

Quantitative Ability Exercise 1A

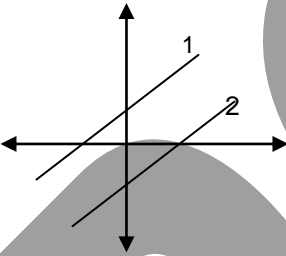
1. Selling an article at $\frac{2}{3}$ rd its Marked Price leads to a loss of 20%. If the MP is Rs 120, what is the Cost Price of the article?
a.80 b.125 c.100 d.120 e. none of these
2. Babu, Govind and Ramu have to push a cart-load to a shop 10km away. When both Babu and Govind push the cart, it moves at the speed of 5km/hr while Govind and Ramu can push it at 6km/hr. Govind alone can push it at the speed of 3kms/hr. How long will it take to reach their destination if all 3 push it together?
a. 1hr 15 mins b. 2hrs c. 1 hr
d. 1.5hrs e. none of these.
3. A, B and C start a venture together. B and C invest Rs 4000 and Rs 3000 respectively while A invests Rs 1000 initially and after 6 months withdraws his capital and decides to work as a working partner with 30% stake in the profits. If A gets Rs.1040 at the end of the year, what was the total profit?
a.1200 b.3600 c.2400 d.4800 e.3000
4. $1728 - 3 * 35 * 12 = ?$
a. 628 b. 468 c. 768 d. 568 e. none of these
5. A tree is standing 200mts away from cliff. The angle of elevation to the top of the cliff from the top of the tree is 30° while that from the bottom of the tree is 45° . What is the height of the tree?
a. $200(\sqrt{3}-1)/\sqrt{3}$ b. $200\sqrt{3}(\sqrt{3}-1)$ c. $200\sqrt{3}/(\sqrt{3}-1)$ d. 200m e. none of these
6. Ketan Parikh bought a certain number of shares for Rs. 27,400. When the market price of each share increased by Rs13 each, he sold them to make a profit of Rs2400. What was the market price at which Ketan bought the shares if the brokerage is $\frac{1}{2}$ % in each transaction?
a. Rs150 b. Rs 137 c. Rs 140 d. Rs130 e. Rs 133
7. A,B,C and D are 4 brothers standing in a row (not necessarily in that order) such that the difference between the ages of two neighbouring brothers is constant. A and B are twins while C is younger than A but older than D. If A is not standing at either of the extremes then B must be standing at
a. The first position b. at either extremes c. Next to A
d. none of these e. Cannot be determined
8. A thirsty crow stops by a spherical pot containing water. But unfortunately the water level in the pot is too low. The smart crow puts in 576 round pebbles in the pot and the water level rises upto the top thus bringing the water into the reach of the crow. If the radius of each pebble is 1cm and the pot was initially $\frac{2}{3}$ rds full, what is the radius of the pot?
a. 12 b. $12(3/2)^{1/3}$ c. $12/(3)^{1/3}$ d. 576 e. None of these
9. How many kgs of sugar costing Rs18 a kg should be mixed with 24kgs of sugar costing Rs 20 per kg so as to get sugar costing Rs18.50 per kg?
a. 8 b. 16 c. 24 d. 72 e. 75
10. Two trains of same length moving in opposite directions have their speeds in the ratio 2:3. They take 10 seconds to cross each other. The faster train takes 25 seconds to cross a stationary train 500 meters long. What is the length of either train?
a. 500 Mts. b. 250 Mts. c. 750 Mts.
d. 400Mts. e. cannot be determined
11. A shopkeeper sells a carpet at 15% profit and a shawl at 15% loss. If the SP of both the carpet and the shawl was the same, how much percent loss or profit did he make in the overall transaction?
a. 2% loss b. 2.25% profit c. 2% profit d. 2.25% loss e. none of these

12. Decrease of 20% in the SP increases the sale by 50% but decreases the profit to 0%. What was the initial profit percentage?
a.10% b.12% c.25% d.30% e.none of these
13. In year 2000, following is the break-up of a certain group of 58 students who at least appeared for one of the entrance examination of various institutes viz. BIM, IIFT and CET.

CET	BIM only	IIFT	CET & BIM	IIFT only
30	10	23	0	8

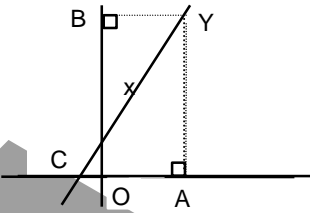

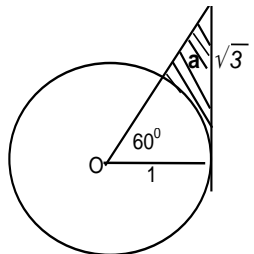
- What is the difference in the number of students who appeared only for CET and for CET as well as IIFT?
a. 10 b. 15 c. 20
d. 25 e. cannot be determined
14. A cone of radius 14 cm and height 15cm is cut in a plane parallel to its base. If the area of the circle at the intersection is 154sqcm then what is the height from the base at which the cone is cut?
a. 10cm b. 5 cm c.15cm
d. 7.5cm e. cannot be determined.
15. 5 men working for 12 hours a day can complete a work in 30 days. How much time would 15 men take to do $\frac{1}{2}$ the work if they work for 12 hours a day ?
a. 5days b. 4 days c. 10days d. 15 days e. 7.5 days
16. $x^6 \cdot y^5 z^{11} \div x^7 y^3 z^2 * z^2 y^{-3}$ for $z = 2$, $x = 8$ and $y = 16$ is.....?
a. 4 b. 8 c. 16 d. 1 e. 32
17. What is the angle between the hands of the clock at 8:24 p.m.?
a. 100 b. 107 c. 106
d. 108 e. cannot be determined
18. Two sample CAT papers containing equal number of questions were to be prepared by Marlie and Bouncerdee. Marlie had tough and simple question in the ratio of 19 : 6. Bouncerdee had tough and simple question in the ratio of 47 : 3. Later it was decided that the two papers should be merged. What is the percentage of tough questions in the final paper?
a. 87 b. 85 c. 59 d. 67 e. none of these
19. A person earns $\frac{1}{3}^{\text{rd}}$ of his total income from his salary while $\frac{1}{5}^{\text{th}}$ of the rest by working for an office on week-ends. He earns $\frac{1}{2}$ of the remaining from royalty payment as the author of a best seller he had written some time back and the remaining amount from investments in stocks. If he earns Rs 1200 by working on the week-ends, what is the interest he gets from the investments?
a. 2400 b. 1200 c. 3300
d. 2000 e. cannot be determined
20. The ratio of the speeds of two trains is $\frac{3}{2}$. The distance between them is 1000 meters and length of each train is 100 meters. What is the ratio of the time required for them to pass each other completely when they are moving in the same direction to the time required when they are moving in opposite directions?
a. 2:3 b. 3:2 c. 5:1
d. 1:5 e. can not be determined





Quantitative Ability Exercise 1B

1. The ratio of I class, II class & III class passengers on a station to travel in an express train is $1/21:1/7:1/3$. If the total no. of passengers is 385, the number of I, II & III class passengers is respectively,
 a. 35, 105, 245 b. 105, 35, 245 c. 245, 35, 105 d. 35, 245, 105
2. What is the number whose square is equal to the sum of the squares of 4683 and 4460.
 a. 6467 b. 5442 c. 1170 d. 7863
3. A, B, C, D, E held a shooting competition, whoever hits the target wins the trip to the US. They all shot successively only once, in the given order. What is the chance of C winning the trip ?
 a. $4/31$ b. $1/8$ c. $3/10$ d. $3/5$
4. In the preparation of a tea mixture, 1 kg of it goes waste out of every 100 kgs. In what ratio the two kinds of tea of rates Rs. 24 and Rs. 18 per Kg, respectively, be mixed so that the cost of the mixture may come down to be Rs. 20 per kg.
 a. 4:6 b. 3:7 c. 2:9 d. 11:13
5. At what time between 3 o'clock and 4 o'clock the minutes hand is 4 minutes behind the hour hand?
 a. 15 min. past 3 b. 27 min. past 3 c. 12 min. past 3 d. 6 min. past 3
6. The relation between $F_1(x)$ and $F_2(x)$ is

 a. $F_1(x) = -F_2(-x)$ b. $F_1(x) = F_2(-x)$ c. Both a and b d. None of the above
7. Mid-term(s) in the expansion of $(x/2 - 4/x)^7$ is/are
 a. ${}^7C_3(4x)$ & ${}^7C_3(32/x)$ b. ${}^7C_3(4x)$ & ${}^7C_4(32/x)$ c. ${}^7C_3(4x)$ & ${}^7C_4(32x)$ d. ${}^7C_3(4x)$
8. A man can row three quarters of a kilometer against the current in $11\frac{1}{4}$ minutes and returns in $7\frac{1}{2}$ minutes. Find the speed of man in still water.
 a. 4.2 kmph b. 5 kmph c. 5.5 kmph d. 6 kmph
9. Area of the right angled triangle ABC is 6 units. Two of its vertices are (-2,-2) and (1,-2). Which one of the following can not be the third vertex?
 a. (-2,-6) b. (1,-6) c. (-2,4) d. (1,2)
10. If 1, ω , ω^2 are three cube roots of unity, then $(1 - \omega + \omega^2)(1 - \omega^2 + \omega^4)(1 - \omega^4 + \omega^8) \dots$ to n factors equals
 a. Zero b. 1 c. 2^n d. $2^n - 1$
11. A man invests Rs. 6200 partly in 5% stock at Rs. 132 and partly in 4% stock at Rs. 99. If the dividend is the same from each stock, find the value of the each investment.
 a. Rs. 3200 in 5%, Rs. 3000 in 4% b. Rs. 3000 in 5%, Rs. 3200 in 4%
 c. Rs. 3100 in both d. Data insufficient to say
12. Sum to infinity for $1^2 + \frac{2^2}{2!} + \frac{3^2}{(2!)^2} + \frac{4^2}{(2!)^3} + \frac{5^2}{(2!)^4} + \dots$
 a. 12 b. 24 c. $27/2$ d. None of these.

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26. The sides of the triangular piece of ground measure 15547, 17647, 3521 feet respectively. Find the length of the largest hurdle that can be used to fence it exactly without bending or cutting a hurdle.
- a. 6 m b. 6.5 m c. 7 m d. 7.5 m
27. If x satisfies the inequality $x-1 + x-2 + x-3 \leq 6$
- a. $0 \leq x \leq 4.5$ b. $x \leq 0$ or $x \geq 4$ c. $0 \leq x \leq 4$ d. none of these
28. A sum of money amounts to Rs.880 in 2 years at 5% p.a. simple interest. What will be the amount if the interest were compounded annually?
- a. Rs. 881 b. Rs. 882 c. Rs. 883 d. Rs. 884
29. A man, who looked like a tourist, came to Ram's bicycle shop one day and bought a bicycle from him for Rs.350. The cost price of the bicycle was Rs.300. So Ram was happy that he had made a profit of Rs. 50 on the sale. However, at the time of settling the bill, the tourist offered to pay in travelers cheques as he had no cash money with him. Ram hesitated. He had no arrangement with the banks to encash travelers cheques. But he remembered that the shopkeeper next door has such a provision, and so he took the cheques to his friend next door and got cash from him.
- The travelers cheques were all of Rs.100 each and so he had taken four cheques from the tourist totaling to Rs.400. On encashing them Ram paid back the tourist the balance of Rs. 50. The tourist happily climbed the bicycle and pedalled away whistling a tune.
- However, the next morning Ram's neighbour, who had taken the travelers cheques to the bank called on him and returned the cheques which had proved valueless and demanded the refund of his money. Ram quietly refunded the money to his neighbour and tried to trace the tourist who had given him the worthless cheques and taken away his bicycle. But the tourist could not be found.
- How much did Ram lose altogether in this unfortunate transaction?
- a. Rs. 350 b. Rs. 250 c. Rs. 450 d. Rs. 400
30. A bus number had a certain peculiarity about it. The number plate showed the bus number was a perfect square and also if the plate was turned upside down, the number would still be perfect square. The bus company had only five hundred buses numbered from 1 to 500. What was the number?
- a. 169 b. 36 c. 196 d. cannot say
31. If $g_1, g_2, \dots, g_{2n+1}$ are in GP and $g_{n+1} = 50$, then $g_1 \cdot g_{2n+1}$ is
- a. 200 b. 250 c. 2500 d. 1250
32. A man has a job which requires him to work 8 straight days and rest on the ninth day. If he started work on a Monday, the 12th time he rests will be on what day of the week?
- a. Sunday b. Wednesday c. Tuesday d. Friday
33. The sum of n terms of an A.P. is $an + bn^2$ where a, b are real numbers. Then common difference of A.P. is
- a. $2a$ b. $2b$ c. $a+b$ d. $a-b$
34. Three containers P, Q, and R have volumes p, q , and r respectively; and container P is full of water while the other two are empty. If from container P water is poured into container Q which becomes $\frac{1}{3}$ rd full, and into container R which becomes half full, how much water is left in container P?
- a. $p - q/2 - r/3$ b. $(6p-2q-3r)/6$ c. $(5p-3q-2r)/6$ d. $(p-q-r)/6$
35. Five balls of different colours are to be placed in three boxes of different sizes. Each box can hold all five balls. The number of ways in which we can place the balls in the boxes so that no box remains empty is
- a. 132 b. 155 c. 143 d. 150

36. If $r - 1$, r , and $r + 1$ are sides of a triangle; then r cannot be
 a. greater than 3
 b. less than or equal to 3
 c. less than 4
 d. less than or equal to 2
37. The number of ways in which 10 candidates A_1, A_2, \dots, A_{10} can be ranked so that A_1 is always above A_2 is
 a. $10!/2$
 b. $^{10}C_2 \cdot 8!$
 c. $^{10}C_2 \cdot 9!$
 d. a. & b.
38. In the adjacent diagram, line passing through $X(1,4)$ cuts an intercept of -1 on X-axis. If $A \equiv (4,0)$. What are the co-ordinates of B.
 a. $(0, 21/2)$
 b. $(0,10)$
 c. $(10,0)$
 d. $(0,8)$
- 
39. If $A_n = \{x \mid x \text{ is a multiple of } n; \text{ where } n \in \mathbb{N}\}$ Then which of the following is correct?
 a. $A_3 \subseteq A_{15}$
 b. $A_3 \subseteq A_5$
 c. $A_3 \cup A_5 = A_{15}$
 d. $A_3 \cap A_5 = A_{15}$
40. A regular working day is 8 hours and regular week is 5 working days. A man is paid Rs. 2.40 per regular hour and Rs. 3.20 per hour overtime. If he earns Rs. 432 in 4 weeks, what is the total number of hours he works?
 a. 180
 b. 175
 c. 160
 d. 195
41. There are three picture nails on a wall and seven different pictures. In how many different ways can pictures be hung on all nails?
 a. 210
 b. 420
 c. 105
 d. 120
42. How many diagonals does a decagon have?
 a. 25
 b. 45
 c. 35
 d. 55
43. The value of a for which quadratic equation $3x^2 + 2(a^2 + 1)x + (a^2 - 3a + 2) = 0$ possesses roots of opposite sign lies in
 a. $(-\infty, 1)$
 b. $(-\infty, 0)$
 c. $(1, 2)$
 d. $(3/2, 2)$
44. By drawing straight lines through the given rectangle a number of different regions can be formed. Which number of regions cannot be formed using 4 lines?
- 
- a. 7
 b. 11
 c. 9
 d. 12
45. The value of $|\log_{10} e + \log_e 10|$ is
 a. 1
 b. 2
 c. less than 2
 d. greater than 2
46. A cow is tied to a pole in the middle of a rectangular field, whose dimension is 60×40 , with a 14-foot rope. If the cow eats 100 square feet of a grass a day, for how many days will the cow have enough to eat?
 a. 2
 b. 18
 c. 24
 d. 6
47. Find the area of the portion marked 'a' of the figure below, where O is center of the circle.
- 
- a. $\sqrt{3} + \pi$
 b. $(3\sqrt{3} - \pi)/6$
 c. $\sqrt{3} - \frac{1}{6}\pi$
 d. $\sqrt{3}\pi$

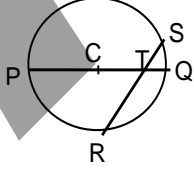
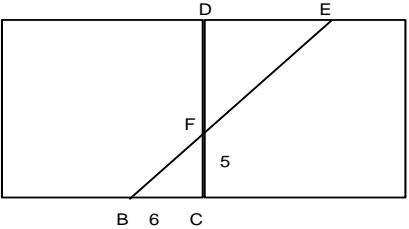
48. If $a \# b = [ab/(a^2 - b^2)] + a/b$, for which values of a and b is $a \# b$ meaningless?
 a. $a = 0, b = 1$ b. $a = \sqrt{2}, b = \sqrt{3}$ c. $a = 0, b = 2$ d. $a = 4, b = 4$
49. The remainder when 2^{3015} is divided by 17 is,
 a. 1 b. 2 c. 4 d. none of these
50. An ant can crawl in the area marked  at 1 inch per minute, the area marked  at 3 inches per minute, and the area marked  at 5 inches per minute. If $BE = 51$ inches, AC and BD each equals to 29 inches, $CE = 42$ inches and $DF = 37$ inches. How long would it take for an ant to crawl from A to F ?
- Start  Finish
- A B C D E F
- a. 41 minutes b. 47 minutes c. 52 minutes d. 75 minutes

Quantitative Ability Exercise 2A

1. If the price of sugar increases by 20%, one can buy 2kgs less in Rs 50. What is the amount of sugar that could be bought before the price hike?
a.10
b.8
c.16
d.12
e. cannot be determined
2. Selling an article for Rs.5 less results to a drop in profit from 25% to 20%. What is the cost price of the article?
a. Rs150
b. Rs 80
c. Rs100
d. Rs125
e. data insufficient
3. A man earns 6% SI on his deposits in Bank A while he earns 8% simple interest on his deposits in Bank B. If the total interest he earns is Rs 1800 in three years on an investment of Rs 9000, what is the amount invested at 6%?
a.3000
b.6000
c. 4000
d.4500
e.2400
4. A man bought stock worth Rs.40,000 at initial public offer and sold it later at a market price of Rs234 per share. He invests the amount thus obtained in 400 shares at 8% with market price of Rs. 200 per share. If he pays brokerage of 2% per transaction, what is the money that he is left with?
a.12,000
b.13,600
c.12,800
d.16,000
e.none of these
5. Zhansilal invests Rs15,000 in green stock and 12,000 in blue stock. At the end of the year, he earns Rs. 1,200 on the first stock and 12% on the second. What is the return on the total investment?
a.12.5%
b.8.77%
c.12.33%
d.9.77%
e.10%
6. What is the conversion of 24 in base 8 to base 2?
a. 10100
b. 10010
c. 11000
d. 10110
e. none of these
7. Two cones with same base radius are attached base to base. The distance from vertex of one cone to that of other is 12cm. If the radius of the cones is 7cm, the total volume of the shape thus formed is?
a. 616 cm^3 .
b. 1858 cm^3 .
c. 890 cm^3 .
d. 1728 cm^3
e. cannot be determined
8. Two identical trains A and B running in opposite directions at same speed take 2 minutes to cross each other completely. The number of bogies of A are increased from 12 to 16. How much more time would they now require to cross each other?
a. 40s
b. 50s
c. 60s
d. 20s
e. 30s
9. $F(G(x)) = x^2 - 4$ while $G(x) = x(x-1)$, where $x \in \mathbb{R}$. What is $F(12)$?
a. 5
b. 12
c. 10
d. does not have unique value
e. none of these
10. If a shopkeeper incurs 10% loss by selling an article costing him Rs.50 after giving a discount of 20%, what will be the selling price of the article?
a. 40
b. 56.25
c. 45
d. 47.25
e. none of these
11. A has $\frac{4}{5}$ th of the number of berries that B has. If A sells the berries at $\frac{2}{3}$ rd the price per kg at which B sells, and B has 20% profit, what is the profit or loss percentage of A?
a. 10% profit
b. 20% loss
c. 20% profit
d. 10% loss
e. neither profit nor loss
12. If $\log_5 64 = x$ then $\log_5 8 = \dots$?
a. $x/2$
b. $x^{1/2}$
c. 1
d. $\frac{1}{2}$
e. 2

13. A regular six pointed star is formed by joining six rhombuses with side 4cm. The area of the star will be....
 a. $52\sqrt{3}$ b. $45\sqrt{2}$ c. 48
 d. $48\sqrt{3}$ e. cannot be determined
14. Different types of chocolates were distributed among 45 children. 25 of them got dairy milks, 30 got 5 star and 15 got candies. If 5 children got no chocolate and 20 of them got two chocolates, how many got all three?
 a. 5 b. 10 c. 4 d. 6 e. None of these
15. What is the distance of the point P(3,5) from the line given by the equation: $4x - 3y + 1 = 0$?
 a. 0 b. $2\sqrt{2}$ c. $4\sqrt{3}$ d. 2.6 e. None of these
16. How many times are the minute hand and the hour hand at right angle in a week ?
 a. 156 b. 312 c. 168 d. 161 e. none of these
17. Which is greater (i) 18^{8888} (ii) 5^{17776}
 a. i b. ii c. are equal
 d. the numbers are not defined e. none of these
18. Rs.4000 invested at the rate of 12% per annum for 3 years is equivalent to what principle invested at 0.5% per month for 4 years?
 a. 5500 b. 4500 c. 5000 d. 6000 e. none of these
19. A man running at 12kmph is pursued by a dog running at 16kmph. If the distance between the man and the dog is 300meters when the dog started running, how much time will it take for the dog to overtake the man?
 a. 5minutes b. 4.5min c. 3mins d. 6mins e. 250secs
20. A quality of rice costing Rs 5 / kg is mixed with 88 kg of another quality rice costing Rs 968. Ghelaram sells a mixture of these two qualities. He charges Rs 2197 for 169 kg of the mixture. What is the ratio in which he has mixed the two?
 a. 1 : 2 b. 2 : 3 c. 4 : 5
 d. Indeterminable e. none of these

Quantitative Ability Exercise 2B

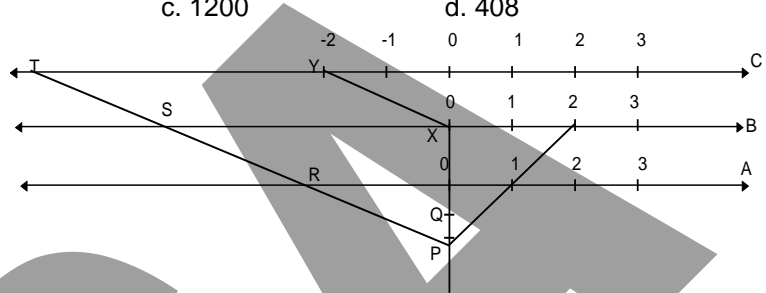
1. There are two similar triangles. The lengths of the sides of one of them are 2 cm, 3 cm and 4 cm. The perimeter of the second triangle is 81 cm. Find the lengths of the corresponding sides of the other triangle.
a. 18, 36, 27 b. 18, 27, 36 c. 27, 18, 36 d. 36, 27, 18
 2. A five digit no. is formed with digits 1 to 9. The no. has the same digits on all the odd positions. A distinct digit is repeated on all the even positions. The sum of the two digits is 10. Find the number if the product of all the five digits in the number has to be maximum.
a. 91919 b. 73737 c. 64646 d. 82828
 3. Vankatlal takes money from the employees co operative society at lower rate of interest and saves in a scheme, which gives him a compound interest of 20 %, compounded annually. Find the least number of complete years after which his sum will be more than doubled.
a. 2 years b. 4 years c. 6 years d. 8 years.
 4. In an examination 20% candidates fail in English, 25% in Mathematics and 10% in both. If 2600 candidates pass in both the subjects, find the total number of the candidates appearing in the examination.
a. 3000 b. 3500 c. 4000 d. 4500
 5. How many numbers divisible by 8 are there between 900 and 1700 ?
a. 95 b. 100 c. 105 d. 110
 6. The chord RS of length 8 cm, of a circle with center C, cuts it's one of the diameter PQ, in a point T such that CT = TQ, If RT = 6, then the diameter of the circle is
a. 14 cm b. 8 cm c. 16 cm d. None of these
- 
7. A man purchased 40 fruits; Apples and oranges for Rs. 17. Had he purchased as many oranges as apples and as many apples as oranges, he would have paid Rs. 15. Find the cost of one pair of an apple and an orange.
a. 70 paise b. 60 paise c. 80 paise d. 1 rupee
 8. A person has to make a journey of 72 kms. He rides a cycle at 12 kms/hr. After going a certain distance, the cycle is punctured and he walks the remaining distance at $4\frac{1}{2}$ kms/hr. Find when the cycle is punctured if the total time for the journey is $8\frac{1}{2}$ hrs.
a. 50 kms b. 52 kms c. 54 kms d. 56 kms
 9. The diagram below shows two squares, each of whose sides equals 20. If BC = 6 and CF = 5 then what is the length of DE?
a. 12 b. 15 c. 18 d. 19
- 
10. A man invests Rs.2400 partly in 3% stock at 75 and partly in 4% stock at 96. If the total income from both is Rs.97.50, find the sum invested in each.
a. Rs. 1500 in 3%, Rs. 900 in 4% b. Rs. 900 in 3%, Rs. 1500 in 4%
c. Rs. 1200 in each. d. Rs. 2000 in 3%, Rs. 400 in 4%
 11. How many three digit odd nos. can be formed from the digits: 2, 0, 3, 5?
a. 24 b. 4 c. 12 d. 6
 12. How many roots are possible for the equation: $\log_2 x^2 + \log_x 2 = 3$?
a. 3 b. 2 c. 1 d. None

13. The average speed of a train including stoppages was 27 kms/hr and excluding stoppages was 41kms/hr. How many minutes did the train stop per hour.
a. 20.5 min b. 15 min c. 18.5 min d. 20 min
14. $a + b = 2c$ such that $a, b, c \in \mathbb{N}$ and c is a constant. Then which of the following is true?
I) $b!c!$ is least possible among the three: $a!b!$, $b!c!$, $c!a!$
II) $b!c!$ is greatest possible among the three: $a!b!$, $b!c!$, $c!a!$
III) $a!b!$, $b!c!$, $c!a!$ are all distinct.
a. I and III b. II and III c. III only d. None of these
15. Fomanchu received a coded message: CHANGTANGSANG, which he has to decipher by forming a single word. He knows the correct position of all the A's. Find the chance that he is able to decode the message correctly.
a. $3/10$ b. $36/10!$ c. $\frac{1}{2}$ d. $1/13!$
16. Two pipes P & Q would fill a cistern in 24 and 32 minutes respectively, both pipes being opened. Find when the first pipe must be turned off so that the cistern may be just filled in 16 minutes?
a. 10 minutes b. 12 minutes c. 14 minutes d. 16 minutes
17. Greatest value of $y = (x + 1)^{1/3} - (x - 1)^{1/3}$ on $[0, 1]$ is,
a. 1 b. 2 c. 3 d. $2^{1/3}$
18. If m is any three digit number and n is any number obtained with any type of permutations of the digits of m , then $m - n$ is always divisible by
a. 2 b. 3 c. 6 d. 9
19. A litre of water weighs a kilogram and a liter of another liquid weighs 1.350 kilograms. A mixture of two weighs 1.250 kg/litre. The volume of water and the liquid in a litre of mixture is,
a. $2/7, 5/7$ b. $5/7, 2/7$ c. $\frac{3}{4}, \frac{1}{4}$ d. $\frac{1}{4}, \frac{3}{4}$
20. If $f(x)$ is a polynomial satisfying $f(x) \cdot f(1/x) = f(x) + f(1/x)$ and $f(3) = 28$, then $f(4)$ is given by
a. 63 b. 65 c. 67 d. can not determined
21. A man being accused of having stolen certain valuable jewels and trying to run away with them, was caught by a smart policeman who overtook him.
In the cross examination, the lawyer of the accused asked the police officer how he could catch up with the accused who had already taken twenty seven steps ahead of him when he started to run after him. 'Yes Sir', the officer replied, he takes 8 steps to 5 steps of mine.
'But then officer', interrogated the lawyer, 'how did you ever catch him if that was the case'
'That easy' explained the officer, 'I have got a longer stride. Two steps of mine are equal to five of his. So the number of steps I required were fewer than his and this brought me to the spot where I captured him'. A member of the jury who was quick at calculations said that the police officer is giving a true confession. Can you find out how many steps did he take to catch up with the thief.
a. 28 b. 35 c. 40 d. 30
22. The equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ will have
a. one real value of x b. two real value of x c. no real value of x d. none of these
23. If four whole numbers taken at random are multiplied together, then the probability that the last digit in the product is 1, 3, 7, or 9 is
a. $4/25$ b. $4/10$ c. $2/5$ d. $16/625$
24. If $a^2 > a^3 > a^4$ then which of the following represents all possible values of a
a. $a < 0$ b. $-1 < a < 0$ c. $a < 1$ d. $0 < a < 1$
25. Supposing a clock pendulum takes 7 seconds to strike 7, how long will the same clock take to strike 10 ?
a. 10 seconds b. 9.5 seconds c. 10.5 sec d. 11 seconds.

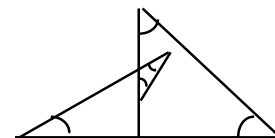
26. If $0 < a, b, c < 1$ and $a + b + c = 1$ then
 a. $\frac{((1-a)/a)((1-b)/c)((1-c)/c)}{8} \geq 8$
 b. $\frac{((1-a)/a)((1-b)/c)((1-c)/c)}{8} \geq 6$
 c. $\frac{((1-a)/a)((1-b)/c)((1-c)/c)}{8} < 8$
 d. none of these
27. The value of the expression $\left[\frac{\sqrt{2}+1}{2(\sqrt{2}-1)} - \frac{\sqrt{2}-1}{2(\sqrt{2}+1)} \right]^{\frac{1}{3}}$
 a. $(\sqrt{2}+1)/(\sqrt{2}-1)$
 b. $\sqrt{2}$
 c. $\sqrt{2}/(\sqrt{2}+3)$
 d. $\sqrt{2}/(\sqrt{2}+1)$
28. If $S_9 = 1+22+333+4444+\dots+999999999$, then $S_9 - S_8$ is
 a. 10^9
 b. 10^9-1
 c. 10^9+1
 d. 10^8-1
29. In a chessboard total number of rectangles will be,
 a. 1296
 b. 204
 c. 1200
 d. 408

Directions : Qns.30-34 are based on following figure.

The three number lines are parallel and are equally spaced. A fixed point P pairs each point on line A to a point on line B by drawing a line through P and the point on line A. The points on line B are paired with points on line C by drawing lines parallel to line XY.



30. If a represents the value of a point on line A what would be the value of the corresponding point on line B?
 a. $a + 2$
 b. $a + 1$
 c. $a \times 2$
 d. $a \times 0$
31. If b represents the value of a point on line B, what would be the value of the corresponding point on line C?
 a. $b + 2$
 b. $b - 2$
 c. $-2b$
 d. $2b - 1$
32. If PT is parallel to XY, what is the value at point T?
 a. -2
 b. -4
 c. $-5\frac{1}{2}$
 d. -6
33. With reference in Qn. 32, What is the sum of the values at the points R and T?
 a. -10
 b. $7\frac{1}{2}$
 c. $-7\frac{1}{2}$
 d. -8
34. If the distance from Q to line A is half the distance from P to line A and Q also pairs points on line A to those on line B, then the value of the point on line B that pairs with the point on line A whose value is a is
 a. $4a$
 b. $3a$
 c. a
 d. $2a$
35. Thirty days of September, April, June and November. Some months are of thirty one days. A month is chosen at random. Then it's probability of having exactly three days less than maximum of 31 is
 a. $15/16$
 b. 1
 c. $3/48$
 d. None of these .
36. If the average of m numbers is a, and when x is added to the m numbers, the average of the m+1 numbers is b, then x is equal to which of the following?
 a. $ma + b$
 b. $m(a + b)$
 c. $2ma - mb$
 d. $(b - a)m + b$
37. All the five angles marked in the given figure are equal, then each of them equals to
 a. 30°
 b. 45°
 c. 36°
 d. Insufficient data



39. A bag contains 10 blue marbles, 10 green marbles, and 5 red marbles. The marbles are removed one by one in a dark room, where their color cannot be seen. What percent of the marbles must be removed to insure that at least two of each color have been taken out?
a. 88 b. 24 c. 72 d. 100
- 40.
- | | | | | | |
|-----------------|-----|-----|-----|-----|-----|
| Height (inches) | 48 | 54 | 60 | 66 | 72 |
| Weight (pounds) | 100 | 120 | 140 | 160 | 180 |
- Using the table shown above, what would you expect to be the weight of a person who is 75 inches tall?
a. 185 b. 190 c. 200 d. 205
41. A school has S students. Q students serve on squads while T students are on teams. B students are on both a team and a squad. How many students are not on a squad nor on a team?
a. $S + Q + T + B$ b. $S - Q - T - B$ c. $S - Q - T + B$ d. $S + Q + T - B$
42. A five digit number $x_1x_2x_3x_4x_5$ is such that x_3 is the greatest digit and the digits from x_3 on either side are in decreasing order. Total number of such numbers is
a. ${}^9C_5 \cdot {}^4C_2$ b. ${}^9C_4 \cdot {}^3C_2$ c. ${}^9C_5 \cdot {}^4C_2 + {}^9C_4 \cdot {}^3C_2$ d. none of these
43. M, N, O are consecutive integers. Which of the following is true?
a. $M + N + O$ is always even. b. $M + N + O$ is always odd.
c. $M + 2N + O$ is always even. d. $M + 2N + O$ is always odd.
44. If α, β are the roots of the quadratic equation $6x^2 - 6x + 1 = 0$ then $\frac{1}{2}(a + b\alpha + c\alpha^2 + d\alpha^3) + \frac{1}{2}(a + b\beta + c\beta^2 + \beta^3) =$
a. $a + b/2 + c/3 + d/4$ b. $a/4 + b/3 + c/2 + d$
c. $a + b + c + d$ d. $a/2 + b/3 + c/4 + d$
45. Nitesh writes letters to four of his friends. He asks each of them to copy the letter and mail to four different persons with the request that they continue the chain similarly. Assuming that the chain is not broken, and that it costs 25 paise to mail one letter, what will be the total amount spent on postage (in rupees) till the 8th set of letters is mailed?
a. 17640 b. 21845 c. 12880 d. none of these
46. The intersection of two cubes cannot be
a. cube b. triangle c. a rectangle d. None of these.
47. A rainy day occurs one in every 10 days. Half of the rainy days produce rainbows. What percent of all the days do not rainbows?
a. 95% b. 10% c. 50% d. 5%
48. Anil has 3 books and Sunil has 6 books. If they exchange the books in such a way that Anil will always have three books with him and Sunil will have 6. The number of ways that they can exchange the books in, is,
a. 81 b. 82 c. 83 d. 84
49. A student walks from his house at a speed of $2\frac{1}{2}$ kms/hr and reaches his school 6 minutes late. The next day he increases his speed by 1 km/hr and reaches his school 6 minutes early. How far is the school from his house.
a. $1\frac{1}{2}$ Kms b. $1\frac{1}{4}$ Kms c. 2 kms d. $1\frac{3}{4}$ Kms
50. If $\log^2 x - 5 \log x + 6 = 0$, then the value(s) of x could be
a. 2 b. e^2 c. e^3 d. e^2 and e^3 both.

Quantitative Ability Exercise 3A

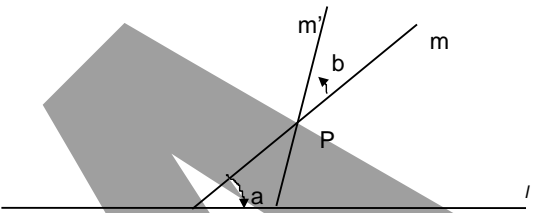
1. There are 550 chocolates which have to be distributed among 25 children such that the first child gets as much more than the second as the second gets more than the third and the third gets more than the fourth and so on. How many chocolates will the 10th child get if each child gets at least 9 chocolates?
a. 10
b. 25
c. 34
d. 11
e. cannot be determined
2. 70 students in a class have to choose at least one of the three subjects Hindi, English and Sanskrit. A subject may not be taught unless there are at least 10 students opting for it. If 40 students take English and 20 students opt for English and Hindi alone and 5 opt for Sanskrit and English alone, what is the maximum number that can opt for both Sanskrit and Hindi?
a. 30
b. 45
c. 15
d. 25
e. cannot be determined.
3. AB is the longest chord in a circle. C is a point on the circumference such that length(minor arc AC) = 2 x length(minor arc BC) and height of triangle ABC on AB is 4. Thus the area of the circle will be.
a. $64\pi/3$
b. 16π
c. $12\pi/5$
d. 4π
e. cannot be determined
4. A person invests Rs24,000 in a 5% stock with market price Rs124. If the dividend of 5% is paid every six months, what will be his income after 4 years, brokerage while buying or selling being 1%?
a. Rs3840
b. Rs7680
c. Rs.3080
d. Rs.6600
e. none of these
5. Tap A fills a tank in 20 minutes while C empties in at $1/3^{\text{rd}}$ the rate at which A fills it. At 12:00noon, A and C are simultaneously turned on and when the tank is half full, A is turned off. At what time will the tank be empty?
a. 12:35pm
b. 12:45pm
c. 12:30pm
d. 12:55pm
e. none of these
6. When A walks at 4km per hour from his house to office, he reaches 6 minutes late and if he walks at 5km per hour, he reaches 3 minutes late. What is the distance between his house and office?
a. 1km
b. 2km
c. 3km
d. 0.5km
e. cannot be determined
7. Some amount of money is distributed equally among 24 men. When the same amount is distributed among 40 men, what is the new amount that each person gets as a percentage of the old amount?
a. 50%
b. 60%
c. 75%
d. 64%
e. 72%
8. A quality of rice costing Rs 5 / kg is mixed with 90 kg of another quality rice costing Rs 720. A shopkeeper sells a mixture of these two qualities at Rs 6.66 / kg. What is the ratio in which he has mixed the two?
a. 4 : 5
b. 1 : 2
c. 3 : 4
d. 5 : 6
e. none of these
9. How much % profit can be earned by selling an article at $\frac{1}{2}$ its Marked Price with the Marked Price being 3 times of the CP?
a. 33.33%
b. 25%
c. 50%
d. 37.5%
e. insufficient data.
10. 3 Men working at 8 hours a day can paint a closed room made up of 4 walls, each of height, width and thickness 12, 24 and $\frac{1}{2}$ feet respectively, in one day. How many days would be required to paint two rooms of the same dimensions if 4 men work 6 hours a day?

- a. 1 day
d. 2 days
- b. 3 days
e. none of these.
- c. $2\frac{1}{2}$ days
11. 5 times a number is 4 more than its square. What is the number?
a. 1
d. both a and c
- b. -1
e. none of these
- c. 4
12. What is the volume of a cone with same height but one-third the base radius of a cylinder of volume 81 cubic units?
a. 81
d. 9
- b. 273
e. insufficient data
- c. 3
13. A line with equation $3x - 2y = C$ cuts another line $x + y = D$ at (2,3). What are the values of C and D?
a. 2 and 5
b. 0 and 5
c. 2 and 3
d. 0 and 3
e. 1 and 4
14. The ratio of the base of a right angled triangle to its height is $1:\sqrt{3}$. What are the other two angles of the triangle?
a. 30,60
d. 60,90
- b. 45,45
e. cannot be determined
- c. 56,34
15. Carl Lewis runs at a speed 25% more than that of Ben Johnson. If, Ben Johnson runs at 8 kmph, how much can Carl Lewis give Ben Johnson in a race of 3000m race so that he still wins by 4 seconds?
a. 580 m
b. 590 m
c. 600 m
d. 480 m
e. 595 m
16. At a candle factory, the workers are paid Rs. 20 per day plus an amount proportional to the number of candles they make everyday. Sadashiv gets Rs.5 more than Lakshman while the number of candles made by them is in the ratio 2:1. Then Laxman's daily pay is...
a. 25
d. 40
- b. 30
e. cannot be determined
- c. 20
17. A and B invest money in a business in the ratio 4:3 for 6 months and 8 months respectively. If the return on investment is 15% and A gets Rs 2700, what was the investment?
a. 24000
d. 48000
- b. 12000
e. insufficient data.
- c. 36000
18. A person travels 50km with a speed of 20km per hour and twice the distance at 25km per hour. What was the average speed of the journey?
a. 23.5kmph
b. 24kmph
c. 23kmph
d. 27.5kmph
e. 28kmph
19. If $\log_x 288 = 2$ then $\log_x 12\sqrt{2} = ?$
a. $\frac{2}{3}$
b. $\frac{3}{2}$
c. 2
d. 3
e. 1
20. Four lines intersect at the origin and the angle between any two adjacent lines is constant. Two points are marked on each of the lines with equal distance from the origin and then are joined. The interior angle of the polygon thus formed will be....
a. 60°
d. 135°
- b. 120°
e. insufficient data
- c. 180°

Quantitative Ability Exercise 3B

1. Roots of $3x^4 - 10x^3 + 4x^2 - 3x - 6 = 0$ are
 a. 3, 2/3, 1, 1 b. -3, -2/3, $(-1 \pm \sqrt{-3})/2$ c. 3, -2/3, -1, 0 d. none of these

 2. How would Rs.121.55 as wages be divided amongst a man, a woman and a boy, if the man worked for 16 days, the woman for 14 days and the boy for 10 days, the amount of their work done per day being $1/3 : 1/4 : 1/5$.
 a. Rs. 59.84, Rs. 39.27, Rs. 22.44 b. Rs. 39.27, Rs. 59.84, Rs. 22.44
 c. Rs. 59.84, Rs. 22.44, Rs. 39.27 d. Rs. 39.27, Rs. 22.44, Rs. 59.84

 3. The angle between lines l and m measures a degrees. If line m is rotated b degrees counterclockwise about point P to line m' , what is the angle in degrees between lines l and m' .
 a. $180 - (a+b)$ b. $a - b$
 c. $90 + a - b$ d. $a + b$
- 
4. What is the maximum value of x/y if $(x+y)^2 = 9$ and $(y+3)^2 = 25$?
 a. $3/2$ b. 1 c. $5/8$ d. None of these.

 5. Which of the following is/are true?
 I. Sum of n AM's between A and B is equal to n times the single AM between A and B.
 II. Product of n GM's between A and B is equal to n th power of the single GM between A and B.
 III. AM, GM, HM are in AP.
 IV. $AM > GM > HM$
 a. All b. Only II and III c. I, II and IV d. I, II and III

 6. Two trains start at same time one from wolverpur and second from planchestpur running in opposite directions with uniform speed. They can complete their journey in 42 minutes and 56 minutes respectively. They will meet after
 a. 21 min b. 22 min c. 24 min d. 28 min.

 7. Ramesh travels 600 kms to reach home, partly by train and the rest by car. He takes 8 hrs if he travels 120 kms by train and the rest by car. But he would take 20 minutes more, if he were to travel 200 kms by train and the rest by car. The respective speeds of train and the car are,
 a. 60 kmph, 80 kmph b. 80 kmph, 60 kmph c. 40 kmph, 45 kmph d. 45 kmph, 40 kmph

 8. Professor Bal has designed a lift which always carries two children don't smoke. Besides, it allows as many times non-smoking adults as the no. of smoking adults. The weight(in Koni) on lift is assumed to be equal to the weight of all the persons on the lift. The safety limit unto which the lift can work is 134 Koni. The maximum no. of non-smoking persons the lift can accommodate is
 a. 121 b. 169 c. 123 d. 146

 9. A person holds Rs. 30,000, $3\frac{1}{2}\%$ of stock. He sells $2/3$ of his stock at 98 and the remaining at 99. He then invests the proceedings in 5% state loan at Rs. 118. Find the amount of loan he now holds and the alternation in his income.
 a. Rs. 30,000 and Rs. 500 increase in income. b. Rs. 25,000 and Rs.200 increase in income
 c. Rs. 45,000 and Rs. 200 increase in income. d. Rs. 20,000 and Rs.400 increase in income

 10. A man purchased a horse and a carriage. If he sells the horse at 10% loss and carriage at 20% profit, he never gains or loses. But if sells the horse at 5% gain and carriage at 5% loss, he gains Rs. 10 in all. Find the cost of the horse.
 a. Rs. 450 b. Rs. 500 c. Rs. 300 d. Rs. 400

Directions : Questions 11 and 12 are based on the following notations.

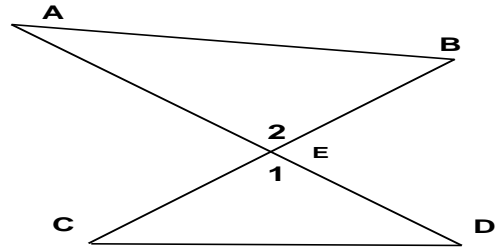
If \int stands for addition, \rfloor stands for subtraction, $|$ stands for division, \backslash stands for multiplication,

$\sqrt{}$ stands for equal to and \leftarrow stands for greater than

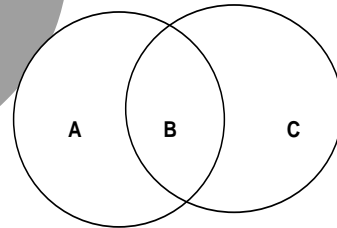
11. Which of the following is true
 a. $10 \rfloor 2 \rfloor 4 \rfloor 2 \sqrt{5} \rfloor 2 \rfloor 6 \rfloor 4$
 c. $10 \rfloor 2 \rfloor 4 \rfloor 2 \sqrt{1} \rfloor 8 \rfloor 6 \rfloor 9$
 b. $4 \rfloor 2 \rfloor 10 \sqrt{5} \rfloor 9 \rfloor 3 \rfloor 5$
 d. $4 \rfloor 2 \rfloor 10 \leftarrow 5 \rfloor 9 \rfloor 3 \rfloor 5$
12. Value of the expression $15 \rfloor 3 \rfloor 2 \rfloor 2 \rfloor 6 \rfloor 2$ is x then
 a. $x \sqrt{3}$
 b. $x \leftarrow 11$
 c. $x \sqrt{9}$
 d. None of these
13. The C.I. of a sum of money in 3 years at the rate of 5% per annum is Rs.1261. What is the simple interest of the same sum of money in the same number of years but at 4% per annum of simple interest?
 a. 960
 b. 900
 c. 840
 d. 800
14. Rs.1261.50 is divided between a brother and sister who are respectively 12 and 10 years old, in such a way that if their portions are invested at 5% p.a. compounded interest, they shall receive equal amounts on reaching 21 years of age. The brother and sister respectively get Rs.,
 a. 661.50, 600
 b. 600, 661.50
 c. 630.75 each
 d. None of these
15. 50% like Dharam, 25% like Hema, 30% like Sunny. All those who don't like any of these like Bobby. All those who like Hema like both Dharam and Sunny. All those who like Sunny like Dharam as well. Number of people who like Sunny and not Hema is what percent of people who like Bobby ?
 a. 0
 b. 5
 c. 10
 d. 50
16. The Middle number of the three numbers which are in the ratio 5 : 2 : 3 and sum of whose squares is 1862 is
 a. 11
 b. 12
 c. 13
 d. 14
17. Reena and Neena are partners investing Rs.700 and Rs.1200 respectively. Reena is a working partner and gets Rs.250 p.m. as working allowance. The shares of Reena and Neena respectively, in a profit of Rs.8700 after one year are,
 a. Rs. 5100, Rs. 3600
 b. Rs. 3600, Rs. 5100
 c. Rs. 3500, Rs. 5200
 d. Rs. 5200, Rs. 3500
18. Last time I visited a friend's farm near Bangalore he gave me a bag containing 1000 peanuts. From this I took out 230 peanuts for myself and gave away the bag with the remainder of peanuts to three little brothers who live in my neighborhood and told them to distribute the nuts among themselves in proportion to their ages which together amounted to $17 \frac{1}{2}$ years. Tinku, Rinku and Jojo, the three brothers, divided the nuts in the following manner: As often as Tinku took four Rinku took three and as often as Tinku took six Jojo took seven. With this data can you find out what were the respective ages of the boys ?
 a. 7, $4\frac{1}{2}$, 6
 b. 6, $4\frac{1}{2}$, 7
 c. $4\frac{1}{2}$, 6, 7
 d. $4\frac{1}{2}$, 7, 6
19. A cistern contains 50 kg of milk, 5 kg of milk is taken out of it and replaced by water. Then again 5 kg of mixture is taken out and replaced by water. The proportion of milk and water in the resulting mixture is,
 a. 19 : 81
 b. 81 : 19
 c. 80 : 20
 d. 20 : 80
20. There are three switches: BULB, FAN, MULT.
 Pushing BULB or FAN switch puts on the respective appliance.
 Pushing the same switch twice puts off the appliance, while pushing the same switch thrice puts on the alternate appliance.
 Pushing MULT odd no. of times puts off the appliance that's on while pushing it even number of times makes the bulb blink for a while.

- Find the probability that none of the appliances are on, if the switches are pushed 1,2,3 times(not in this order). Each switch is operated only once.
- a. $\frac{2}{3}$ b. $\frac{49}{97}$ c. $\frac{4}{7}$ d. $\frac{7}{12}$
21. Find the minimum value of $bcx + cay + abz$, when $xyz = abc$
- a. abc b. $2abc$ c. $3abc$ d. $6abc$
22. By selling 200 chikkies, a seller gains the selling price of 40 chikkies. The gain of seller is
- a. 20% b. 25% c. $18\frac{2}{5}\%$ d. 30%
23. If f be greatest integer function and g be the modulus function, then $(gof)(-\frac{1}{3}) - (fog)(-\frac{1}{3})$, will be equal to
- a. 0 b. 1 c. $-\frac{1}{3}$ d. $-\frac{2}{3}$
24. A monkey ascends a greased pole 15 meters high, ascending 5 meters in 1st minutes and slipping down 2 meters in another minute repeating his process. In what time, shall he reach the top?
- a. 10 minutes b. 9 minutes c. $8\frac{3}{5}$ minutes d. 6 minutes
25. For what values of the parameter m , is the inequality $|(x^2+mx+1)/(x^2+x+1)| < 3$ satisfied for all real values of x ?
- a. $m < -11$ or $m > 7$ b. $m < -11$ or $m > 5$ c. $m < -1$ or $m > 7$ d. $m < -1$ or $m > 5$
26. Let y_1, y_2, y_3 and y_4 be respectively the words "follow", "thumb", "flow" and "origin" and let $A = \{a, b, f, g, h, i, l, m, n, o, t, u, w\}$. Define $W_j = \{x \mid x \text{ is letter in the word } y_j\}$. Then $W_1 \cap W_3 \cup (W_2 \cap W_4) =$
- a. $\{l, o, w, f\}$ b. \emptyset c. A d. $\{a, g, j, n, l, o, w, f\}$
27. The number of ways in which 8 books can be arranged on a shelf so that two particular books shall never come together is,
- a. $8!$ b. $7!$ c. $8! - 7!$ d. $8! - 2 \times 7!$
28. Let $n (>1)$ be a positive integer. Then the largest integer m such that (n^m+1) divides $(1+n+n^2+\dots+n^{127})$ is
- a. 127 b. 63 c. 64 d. 32
29. An orange seller sold $\frac{1}{2}$ an orange more than half his oranges to the first customer. To the second customer he sold $\frac{1}{2}$ an orange more than half of the remainder and to the third and the last customer he sold $\frac{1}{2}$ an orange more than half he now had, leaving him none. Can you tell the number of oranges he originally had, if he never had to cut an orange ?
- a. 5 b. 7 c. 9 d. 11
30. If $x < 1$ & $y < 1$ then,
- a. $x+y > 1+xy$ b. $x+y < 1+xy$ c. both a & b d. none of these
31. An empty cistern has three taps A,B and C. A and B can fill it in 3 and 4 hours respectively and C can empty it in one hour. If the taps A,B,C are opened at 1 p.m., 2 p.m. & 3 p.m. respectively, The cistern will be emptied at
- a. 5.00 pm b. 4.30 pm c. 4.20 pm d. 5.12 pm
32. The $(n+1)$ th term of a GP is 3. The product of the first $(2n+1)$ term is
- a. 3^n b. 3^{n+1} c. 3^{2n+1} d. none of these
33. There are n different books and p copies of each in a library. The number of ways in one or more than one book can be selected is,
- a. $p^n + 1$ b. $(p+1)^n - 1$ c. $(p+1)^n - p$ d. p^n

34. In the diagram, if AD meets BC at E, which of the following is always true?
- angle A + angle D = angle B + angle C
 - angle A + angle B = angle D + angle C
 - angle 1 + angle 2 = 90°
 - angle A is supplementary to angle C



35. The sum of five whole numbers is 146. If m is the largest of the five numbers, what is the smallest value that m can have?
- 30
 - 35
 - 28
 - 27
36. If the ratio of m to n and the ratio of p to q are both equal to $1/6$, find the ratio of m+p to n+q.
- $5/6$
 - $1/12$
 - $1/3$
 - $1/6$
37. In Yaku Taku game of the cards, 52 cards are equally divided in four players. The player who deals the cards, he takes his 13 cards first and distributes the remaining cards by giving one card at a time to each of the remaining in clockwise direction. Then the probability that the dealer gets 13 cards of the same suit is
- $1/52! \times 39!$
 - $4/52! \times 39!$
 - $52 \times 12! \times 39! / 52!$
 - None of these.
38. The probability of India winning a test match against Pakistan is $1/2$. Assuming independence from match to match the probability that in a 5 match series India's second win occurs at third test is
- $1/8$
 - $1/4$
 - $1/2$
 - $2/3$
39. If both the roots of the equation $x^2 - 6ax + 2 - 2a + 9a^2 = 0$ exceed 3, then
- $a > 12$
 - $a < 10$
 - $a > 11/9$
 - $a > 1/9$
40. In the diagram, two circles pass through each other's center if the radius of each circle is 1, what is the perimeter of the region marked B?
- $(4/3)\pi$
 - $(3/2)\pi$
 - 4π
 - $(8/3)\pi$



41. If $a > b > c > d$, which of the following statements must be true?
- $a - b > c - d$
 - $a + b > c + d$
 - $a - d > c - d$
- I only
 - II only
 - I and II only
 - II and III only

Directions : Questions 42 to 45 are based on the following construction:

Divide the unit square into nine equal squares by means of two pairs of lines parallel to the sides. Remove the central square. Treat the remaining squares in the same way. Then

42. Area left after two steps is equal to
- $64/81$
 - $46/54$
 - $8^2 / 9^2 - 17$
 - None of these
43. Number of squares left after three steps are
- 8^2
 - $8^3 - 3$
 - 8^3
 - $8^3 - 65$
44. Length of the small square after three steps is
- $1/27$
 - $1/9$
 - $1/9^3$
 - None of these.
45. If n is very large, then the sum of the areas of removed squares after n steps is
- 0
 - 1
 - approaches 0
 - approaches 1

46. A man arranged to pay off his loan of Rs. 3600 by 40 annual installments, which form an arithmetic progression. If he could pay $\frac{2}{3}$ of his loan in the first 30 installments, his first and second installments are,
a. Rs. 50, Rs. 52 b. Rs. 51, Rs. 53 c. Rs. 52, Rs. 54 d. Rs. 53, Rs. 55
47. How many four digit numbers greater than 5000 can be formed with the digits 2, 4, 5, 9 if no digit is repeated ?
a. 64 b. 24 c. 12 d. 256
48. Find the least number by which if we divide 4851, it becomes a perfect square.
a. 3 b. 7 c. 11 d. 15
49. Mangoes cost Rs.20 more per kg than oranges. If 15 kg of oranges cost just as 10 kg of Mangoes, how much do Mangoes cost per kg?
a. Rs.60 b. Rs.50 c. Rs.40 d. Rs.25
50. Two cars start together in the same direction from the same place. The first goes with uniform speed of 10 km/hr. The second goes at a speed of 8 km/hr in the first hour and increases the speed by $\frac{1}{2}$ km, each succeeding hour. In how many hours will the second car overtake the first if both cars go non-stop?
a. 7 b. 8 c. 9 d. 10

Quantitative Ability Exercise 4A

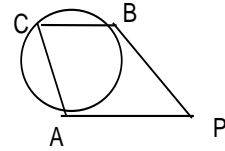
1. If 10 litres of water is removed from a container containing only water and replaced with wine, the ratio of water to wine becomes 5:2. How much water was there originally?
a. 35 b. 25 c. 15 d. 20 e. none of these
2. A mixture of 60 litres Black label and soda contains 20% soda. How much soda should be added so that the mixture contains 40% soda?
a. 10 b. 20 c. 25
d. 30 e. cannot be determined
3. Johnny has accumulated a lot of marbles. He offers his friend Satish 25 of marbles in return of doing his mathematics homework. Satish agrees under one condition that if square of the number of marks that Johnny gets for the home-work exceeds the no of marbles that he gets then he should be given more marbles equal to the 4 times of the excess. Finally Satish got 69 marbles. How much did Johnny score in the homework?
a. 6 b. 5 c. 7
d. 8 e. can't be determined
4. A train 200m long running at speed 60kmph takes two minutes to overtake a car. What is the speed of the car?
a. 50km/hr b. 56km/hr c. 52km/hr d. 54km/hr e. 60km/hr
5. What is the profit percentage if a discount of 12% is given over the price that is marked 25% above the cost price?
a. 11% b. 13% c. 10% d. 12.5% e. none of these
6. A, B and C invest Rs 3000, 2,500 and Rs 4000 for 8, 10 and 12 months respectively. If the total profit at the end of the year was 9,700. What is the share of B in the profit?
a. 3,600 b. 4,800 c. 2,500 d. 2,400 e. none of these
7. Two metals A and B are mixed in the ratio 2:3 to form an alloy costing Rs.13 per gm. If A costs Rs.10 per gm, what is the cost of B per gm?
a. Rs.14 b. Rs.10 c. Rs.12
d. Rs.15 e. can't be determined
8. What is the next term in the following series?
5, 8, 17, 32, 53, ...?
a. 67 b. 80 c. 74 d. 64 e. 82
9. Considering that women do twice the work that men do, in double the time and that 5 men and 3 women do a certain work in 9 days when they work 8 hours a day. How many days will be required to complete double the work by 7 men and 9 women if they work 6 hours a day?
a. 10 $\frac{2}{3}$ days b. 11.5 days c. 13 days
d. 12 days e. insufficient data.
10. Out of every 5 people in Kolkata, 3 travel by train and 3 by bus, where each person uses at least one of the given modes of commuting. If 120,000 people use both bus and train, what is the population of the city?
a. 720,000 b. 600,000 c. 60,00,000
d. 480,000 e. can't be determined
11. 1,750 soldiers are made to stand in a certain number of rows each row containing equal no of soldiers. If the ratio of the number of rows to the number of columns is 10 : 7, how many rows are there?
a. 70 b. 35 c. 50
d. 100 e. cannot be determined

12. Three identical solid cones made of a metal are melted and cast into two identical cylinders with base radius equal to that of the cones. The ratio of the height of the cones to that of the cylinders is....
 a. 1:2
 b. 2:1
 c. 1:3
 d. 2:5
 e. cannot be determined
13. What is \log_2 to the base 1024?
 a. 1/10
 b. 10
 c. 9
 d. 1/9
 e. none of these
14. What is the angle between the hands of the clock at 2:18 p.m.?
 a. 198
 b. 145
 c. 39
 d. 140
 e. none of these
15. A line with y-intercept 0 passes through the point $(5\frac{2}{3}, 11\frac{1}{3})$. P is a point on the line with x co-ordinate $3\frac{1}{2}$. What will be the y co-ordinate of P?
 a. 7
 b. $8\frac{1}{2}$
 c. 8
 d. $7\frac{1}{2}$
 e. none of these
16. A man divides his property among his 2 sons and 3 daughter in the ratios, 2.3: 2.5: 3.2: 4.7: 2.6. The third daughter receives Rs 52,00. What is the difference between the money received by the daughter with the maximum benefit and the son with lowest benefit?
 a. 2000
 b. 3200
 c. 4800
 d. 12000
 e. none of these
17. Two identical trains travelling with speeds 50 and 60 km per hr start from two stations A and B respectively at 12:00 noon and meet at a station M at 2:00pm. What is distance of station M from A?
 a. 95kms
 b. 90kms
 c. 100kms
 d. 120kms
 e. 125kms
18. The vertices of triangle ABC are (2,3), (4,3) and (3,0). What is area of the triangle obtained by joining the midpoints of the sides of ABC?
 a. 1 sq. unit
 b. 0.75 sq. units
 c. 1.25 sq. units
 d. $\sqrt{5}$ sq. units
 e. insufficient data.
19. If 27 in a certain base is written as 1000 then how will 42 be written?
 a. 1102
 b. 2100
 c. 1010
 d. 1120
 e. 1210
20. There are two pipes A and B, which fill a cistern in 20 min and 30 min respectively. C empties it in 10 minutes. If all the pipes are turned on simultaneously when the cistern is full, when will it become empty?
 a. 1hr
 b. 1.5hr
 c. 2hrs
 d. 75min
 e. Can't be determined

Quantitative Ability Exercise 4B

1. If both the roots of $121px^2 + (2p-q)x - 36q + 24 = 0$ are zero, then $p + q = ?$
 a. 2
 b. 1
 c. $2/3$
 d. Cannot be determined.

2. PA and PB are tangents to the circle at A and B respectively and the chord BC is parallel to tangent PA. If AC = 6 cm, and length of the tangent AP is 9 cm then the length of the chord BC is
 a. 6 cm
 b. 4 cm.
 c. 9 cm
 d. None of these.

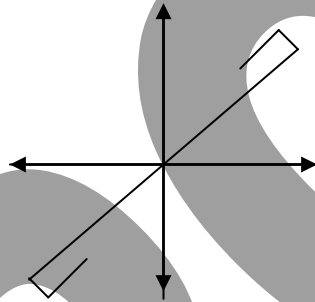


3. If $a^2 + b^2 + c^2 = 1$, then $ab + bc + ca$ is
 a. Greater than $-1/2$
 b. Lesser than $-1/2$
 c. Equal to $1/2$
 d. Either b. or c.
4. An examination is held in English and Arithmetic. 72% of the candidates pass in English and 67% in Arithmetic. If 19% fail in both the subjects and 638 candidates pass in both the subjects, The number of candidates who appeared in the examination is,
 a. 1000
 b. 1100
 c. 1200
 d. 1300

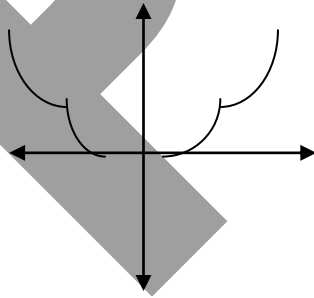
For questions 5 - 6, mark

- a. if $f(x) = f(-x)$
 b. if $f(x) = -f(-x)$
 c. if $f(x)$ is not a function
 d. None of these

5.

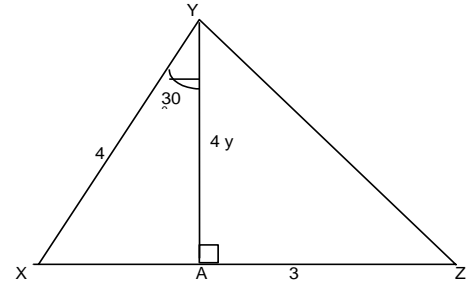


6.



7. In a certain year, the income-tax for taxable value over Rs.25,000 but not exceeding Rs.30,000 is computed according to the following rule:
 Total income-tax = Tax + Surcharge
 Surcharge = 15% of the Tax
 Tax = Rs.3200 + 30% of the amount by which the taxable income exceeds Rs.25,000.
 The total income-tax on a taxable income of Rs.27,400 would be,
 a. Rs. 4502
 b. Rs. 4504
 c. Rs. 4506
 d. Rs. 4508

8. Find the area of a triangle XYZ shown in the adjacent figure.
- a. 16 b. $20y$
c. $5\sqrt{2}y^2$ d. $10y$



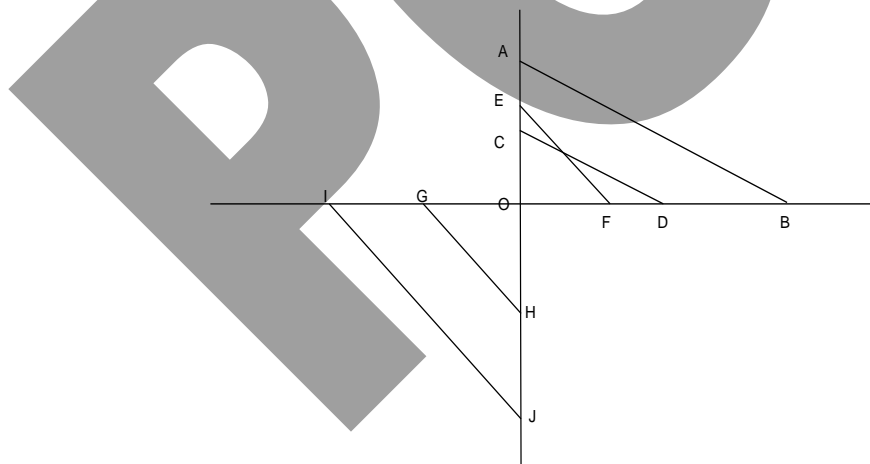
9. A lamp lighter has to light 100 gas lamps. To go from one lamp post to the next he takes 60 seconds. Each lamp burns 10 cubic feet of gas per hour. If he lights the first lamp at 6 p.m. then the gas burnt when he lights the last lamp is
- a. 31262.5 ft^3 b. 1000 ft^3 c. 825 ft^3 d. 762.5 ft^3
10. A vehicle covered a distance $AB = 40 \text{ kms}$ as follows: the first 10 kms at 5 kms per hour, the next 10 kms at 10 kms/hour, the subsequent 10 kms at 20 kms per hour and the last 10 kms at 30 kms per hour. The return journey BA was performed at a uniform rate which was $\frac{23}{24} s$, where s is the average speed of the vehicle for its journey from A to B. Determine the average speed for its to and fro journey.
- a. 10 kmph b. 10.2 kmph c. 10.4 kmph d. 10.6 kmph
11. The number of triangles formed with 10 straight lines in a plane, of which no two are parallel and no three are concurrent is,
- a. 100 b. 110 c. 120 d. 130
12. If three consecutive terms in the expansion of $(x^2 + 1/x^3)^n$ are in G.P. then the value of n is
- a. 1 b. -1 c. Any value d. No value
13. Rs.564 were to be divided in A, B and C in the ratio of 3:4:5 but by mistake this sum of money was divided in the ratio of $\frac{1}{3} : \frac{1}{4} : \frac{1}{5}$. Due to this mistake, find the loss or profit of each.
- a. A : profit Rs. 99, B : loss Rs. 8, C : profit Rs.91
b. A : loss Rs. 99, B : loss Rs.8 C : profit Rs. 91
c. A : profit Rs. 99 B : loss Rs. 8 C : loss Rs. 91
d. A : loss Rs. 99 B : profit Rs. 8 C : loss Rs. 91
14. Divide Rs.3320 into two parts such that the interest on one for three and a half years at 5 % is double that of the other at 3% for 4 years.
- a. Rs. 1400, Rs. 1920 b. Rs. 1920, Rs. 1400 c. Rs. 1650 each d. none of these
15. A dishonest milk man professes to sell his milk at cost price, but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is,
- a. 5% b. 10% c. 15% d. 20%
16. If $a, b, c \in \mathbb{R}$ and $a > 0$, then the least value of the expression $ax^2 + bx + c$ where $x \in \mathbb{R}$ is
- a. $(4ac - b^2)/4a$ b. $(4bc - a^2)/4b$ c. $(4ab - c^2)/4c$ d. $(4ac - c^2)/4c$
17. Find the least number which when doubled will be exactly divisible by 68,102,117 and 78.
- a. 3974 b. 3976 c. 3978 d. 3980
18. A cistern can be filled by 3 pipes in 30,40 and 60 minutes respectively, and emptied by an escape pipe in half an hour. The three taps are turned on at noon, but the escape pipe is at the same time accidentally left open and not closed for a quarter of an hour. At what time will the cistern be full?
- a. 12:10 pm b. 12:15 pm c. 12:20 pm d. 12:30 pm
19. A coin is tossed 6 times. If A be the event that fourth toss results in a tail then, probability of A is
- a. $1/(16)$ b. $1/8$ c. $\frac{1}{2}$ d. $\frac{2}{3}$

20. A began business with Rs.6500. After 4 months B joined with him a certain capital. At the end of the year the profits were divided in the ratio of 5:2. How much did B invest?
 a. Rs. 3800 b. Rs. 3900 c. Rs. 4000 d. Rs. 4100
21. 125 gallons of a mixture of wine and water contains 20% water. How much water must be added to it to make the water 25% of the new mixture?
 a. 8 gallons b. $8\frac{1}{3}$ gallons c. $8\frac{2}{3}$ gallons d. $8\frac{3}{4}$ gallons
22. Let $f(x) = \sin x$; $g(x) = \ln|x|$ if the ranges of the composite function fog and gof are R_1 & R_2 respectively , then
 a. $R_1 = \{U : -1 \leq U < 1\}$ $R_2 = \{V : -\infty < V < 0\}$
 b. $R_1 = \{U : -\infty < U \leq 0\}$ $R_2 = \{V : -1 \leq V \leq 1\}$
 c. $R_1 = \{U : -1 < U < -1\}$ $R_2 = \{V : -\infty < V < 0\}$
 d. $R_1 = \{U : -1 \leq U \leq 1\}$ $R_2 = \{V : -\infty < V \leq 0\}$
23. For the equation $|x|^2 + |x| - 6 = 0$
 a. there is only one root b. sum of roots is 0
 c. the product of roots is -4 d. b & c
24. The number of students in three rooms is 138. The ratio of the number of students in 1st and 2nd room is 3:4. The ratio of the no. of students in 2nd & 3rd room is 7:5. The number of students in the 1st, 2nd & 3rd room respectively is,
 a. 56, 40, 42 b. 42, 56, 40 c. 40, 56, 42 d. 56, 40, 42
25. The sum of the series $1 + 3 - 5 + 7 - 9 + 11 - 13 + 15 - 17 + \dots$ up to $3n$ terms is
 a. $2n(3n - 1)$ b. $3n^2 - 4n$ c. $4n^2 - 6n$ d. $n(6n - 8)/3$
26. For a real number x , $[x]$ denotes the integral part of x . The value of $[1/2] + [1/2 + 1/100] + [1/2 + 2/100] + \dots + [1/2 + 99/100]$ is
 a. 49 b. 50 c. 48 d. 51
27. Let $a > 0$, $b > 0$, $c > 0$, then both the root of the equation $ax^2 + bx + c = 0$ ----
 a. are real and negative b. have negative real part
 c. are rational numbers d. none of these
28. Both the triangles are equilateral triangles, which are inscribed and circumscribed about a circle. Then, the ratio of areas of the triangles is
 a. $1/3$ b. $2/5$
 c. 4 d. $5/2$
29. The sum of the series $1^2 - 2^2 + 3^2 - 4^2 + \dots + 199^2 - 200^2$ is
 a. - 21000 b. 21000 c. -20100 d. 20100
30. Sunil bought 100 wine glasses. He collected through his servant, offering him for delivery 3 paise for every glass delivered safely and threatened to forfeit 9 paise for every glass he broke. On settlement the servant received Rs.2.40. How many glasses did he break?
 a. 3 b. 4 c. 5 d. 6
31. If x is very large, then $2x/(1+x)$ is
 a. close to 0 b. arbitrarily large
 c. close to 2 d. greater than 2
32. Cost of cleaning a tall chimney of height 100 ft is 6 paisa for first foot and the cost of each foot after that is x paisa more than that of the preceding foot. If total cost of cleaning the chimney is Rs. 204, then the value of x is
 a. 2 b. 3 c. 4 d. 5
33. A teacher wants to demonstrate an experiment to 20 students. If he can show the experiment to a group of 4 students only, in how many ways can he make the group for the experiment ?
 a. 4845 b. 4850 c. 4855 d. 4860



34. 65 % of children in a sports club play foot ball, 70 % play volley ball and 75 % play basket ball. What is the smallest percentage of children playing all the three games.
a. 15 % b. 10 % c. 25 % d. 65 %
35. The straight lines l_1, l_2, l_3 are parallel and lie in the same plane. A total number of m points on l_1 ; n points on l_2 ; k points on l_3 , the maximum number of triangles formed with vertices at these points are
a. ${}^{m+n+k}C_3$ b. ${}^{m+n+k}C_3 - {}^mC_3 - {}^nC_3 - {}^kC_3$ c. ${}^mC_3 + {}^nC_3 + {}^kC_3$ d. none of these
36. What is the smallest possible value of xy if $2x - 4 \geq 6$ and $8 - y \leq 5$?
a. 30 b. 150 c. 15 d. 52
37. Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with these three vertices is equilateral, equals
a. $1/2$ b. $1/5$ c. $1/10$ d. $1/20$
38. The condition that the equation, $(1/x) + (1/(x+b)) = (1/m) + (1/(m+b))$ has real roots that are equal in magnitude but opposite sign is
a. $b^3 = 3m^3$ b. $b = m$ c. $b^2 = 2m^2$ d. none of these
39. Anand has a sister who is half his age. When Anand's age double, what will be the ratio of his age to his sister's age?
a. $4/3$ b. 2 c. $2^{1/2}$ d. $6/5$
40. A man invests a certain sum of money at 6 % S.I. and another at 7 % S.I. His income from interest after two years was Rs. 354. One fourth of the first sum is equal to one fifth of the second sum. Then the total sum invested is
a. 1200 b. 2400 c. 2500 d. 2700

Directions : For Qns.41-44 refer to the following diagram in which the two reference lines are co-ordinate axis



41. If we know that $OF = OG$ then which of the following statement is true?
a. $OE = OH$ b. $OI = OD$ c. $EF = CD$ d. $OA = OB$
42. Given OB is equal 5 units, CD equal 3 units, and AB equal 8 units, find BD .
a. 3 b. $4^{4/5}$ c. $5^{1/5}$ d. $3^{1/8}$
43. Triangles OCD and OGH are congruent. Furthermore, GH is 2 units long, OA is 3 units long, and OG is unit long. Find the length of AB .
a. $4^{2/3}$ b. 8 c. 5 d. 6
44. How many pairs of similar triangles are there in the diagram?
a. 1 b. 2 c. 3 d. 4

45. For which value of m is it impossible to have a triangle with sides m , $m + 2$, $m + 3$?
a. 1 b. $1\frac{1}{2}$ c. 3 d. π
46. What is the value of the following expression ?
 $\log(9/14) - \log(15/16) + \log(35/24)$
a. 0 b. 1 c. 2 d. 3
47. How many automobile license plates can be made if the inscription on each contains one letter of English alphabet followed by three different digits from 1, 2, 3, 4, 5 ?
a. 1550 b. 1560 c. 1570 d. 1580
48. A man saves a certain amount every year, which exceeds the amount saved by him in the preceding year by half the amount of the preceding year. If he had saved Rs. 6650 in 6 years, the amount saved by him during the first year would be ,
a. Rs. 300 b. Rs. 320 c. Rs. 340 d. Rs. 360
49. In a cricket match, 11 players made an average score of 197 runs. If the captain's score of runs is 47, find the average of runs scored by other players.
a. 200 d. 206 c. 212 d. 218
50. If r , s , and t are consecutive odd integers with $r < s < t$, which of the following must be true?
a. $rs = t$ b. $r + t = 2t - s$ c. $r + s = t + 2$ d. $r + t = 2s$

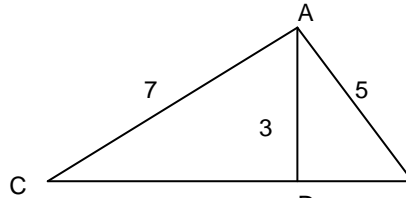
Quantitative Ability Exercise 5A

1. There are some ants that are walking down a trail of sugar crystals. $\frac{1}{3}$ rd of them are lured by a dead cockroach and half of the remaining are too tired to move ahead. Among those that continue the sugar trail, 19 stop to drink water and thus only $\frac{1}{6}$ th of the total reach their destination. What is the number of ants that are tired?
a. 6
b. 114
c. 25
d. 38
e. cannot be determined
2. A,B,C and D are participating in a 4x100 relay race in that order. A and B run at the speed of 36km/hr and 30km/hr respectively while C ran his 100m in 12seconds. D ran at the speed of 10m/s. If the other 3 teams took 45, 44, 48 and seconds, who crossed the finish-line first?
a. 1st
b. 2nd
c. 3rd
d. both 1st & 3rd
e. 4th
3. The last digit of a certain number in decimal number system when represented in base 12 as well as in base 8 is 1, while the second-last digits have difference 1. If the number has only 2 digits in base 12 as well as base 8, what is the number?
a. 25
b. 37
c. 49
d. 13
e. cannot be determined.
4. $(12^3 \cdot 25^{3/2} \cdot 16^4 \cdot 3^3) \div (4^2 \cdot 5^{-3} \cdot 8^3 \cdot 45^3 / 24^3) \times x^y = 1$. Which of the following can be the values of x and y?
a. 320, 2
b. 960, 3
c. 160, 5
d. 320, 3
e. none of these
5. 3 cats can kill 3 mice in 3 minutes. How much time would 100 cats take to kill 100 mice?
a. 1minute
b. 2 minutes
c. 3 minutes
d. 100 minutes
e. none of these
6. What is the difference between the compound interest received for 2 years and the simple interest received for 3 years at the rate of 10% pa on a principal of Rs10000?
a. 1800
b. 600
c. 790
d. 690
e. 1210
7. What is the profit earned when selling price of 20 articles is same as cost price of 21?
a. 4.25%
b. 5%
c. 6%
d. 4.76%
e. cannot be determined
8. 5 men work for 20 hours a week to complete a work in 5 weeks. If 3 women are equivalent to 5 men, how many days will 2 women take to finish the same work if they work for 60 hours a week?
a. 5weeks
b. 4 weeks
c. 2.5 weeks
d. 2 weeks
e. insufficient data
9. The 'n'th root of product of n numbers in GP is 2, where n is an odd number. What will be the cube root of the product of the middle three numbers if the common ratio for the GP is $\frac{1}{2}$?
a. 2
b. 4
c. 6
d. insufficient data
e. none of these
10. A money lender borrows some money at a simple interest of 8%pa and lends it at 12%pa compound interest. If he earns Rs 944 after 2 years, what was the principal he borrowed?
a. Rs12,000
b. Rs15,000
c. Rs10,000
d. Rs25,000
e. none of these
11. P is the mid-point of the diagonal of a square with two sides coinciding with the positive axes and another with line $x = 6$. Then P will lie on the line....
a. $y = 3$
b. $x = 3$
c. $x = y$
d. both b and c
e. all a, b and c
12. Among 80 people who go for an expedition in the dessert, 57 are carrying water, 45 are carrying mirrors. According to the instructions of the director of the expedition every group that goes out for investigation must have at least 5 people who have water as well as a mirror. What is the maximum number of groups that can be formed?
a. 4
b. 5
c. 7
d. 22
e. inconsistent data.

13. How many times are the minute hand and the hour hand coincide in a week ?
a. 89 b. 156 c. 154 d. 158 e. None of these
14. The square of the custom duty is proportional to the selling price of the article paid for it after deducting the production cost. The selling price of a lipstick is Rs 202 while that of face cream is Rs. 73. If the production cost for each of them is Rs 2 and Re. 1 respectively and the custom duty for the lipstick is 10, find the custom duty paid on the face cream.
a. 5 b. 6 c. 7
d. 36 e. cannot be determined
15. An article is sold at a loss of 10% and another of $\frac{1}{3}^{\text{rd}}$ that cost price is sold at a profit of 20%. The total loss or profit on the total transaction is:
a. profit 10% b. no profit no loss c. loss 3.33%
d. loss 2.5% e. cannot be determined
16. What is the length of a train that overtakes a man cycling at the speed of 20km/hr in 27 seconds and a lamp-post in 18 seconds?
a. 250m b. 300m c. 350m d. 400m e. 450m
17. A hemisphere of radius $3\frac{1}{2}$ is cut out of a solid cone with base radius 7 and height $4\sqrt{2}$. What is the surface area of the resultant solid?
a. 390.5 b. 512.5 c. 212.3
d. 712 e. none of these.
18. An ant is on the inside wall of a cylindrical glass vessel, 14 cm in diameter, at a distance of 5 cm from the rim. It sees a cube of sugar on the outside wall of the vessel, diametrically opposite to where the ant is, and at the same distance from the rim. What is the shortest distance the ant has to traverse to get to the cube of sugar?
a. $18\sqrt{2}$ b. 24 c. $12\sqrt{3}$ d. 14 e. $14\sqrt{3}$
19. The expenditure of Mr & Mrs Nene is Rs.1,700 and Rs.2,900 and that of Mr. & Mrs. Dixit is 9 : x. If their combined spending of the husbands and that of their wives is in ratio 35 : 57, find the value of x if the expenditure given that the husbands together spend Rs.3,500.
- | | Mr. | Mrs. |
|-------|------|------|
| Nene | 1700 | 2900 |
| Dixit | 9 | X |
| Total | 35 | 57 |
- a. 18 b. 12 c. 28 d. 14 e. none of these
20. Mr. Batliboi invests some amount in gold. After one year he makes a profit of 100% on his investment and invests half of it in shares, where he makes a loss of 50%. If he invests the other half in gold again, what is the profit %age profit that he must make on his gold investment to have an overall profit of 100% on his original amount?
a. 25 b. 50 c. 75 d. 100 e. 200

Quantitative Ability Exercise 5B

1. In the diagram, what is the perimeter of triangle ABC, if AD is perpendicular to BC?
- a. $16 + 2\sqrt{10}$ b. $12 + 6\sqrt{3}$
c. 20 d. 26

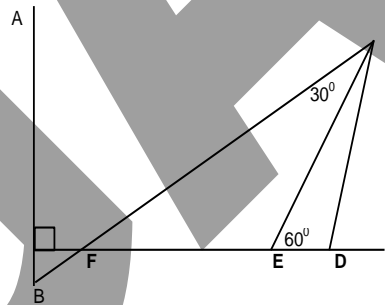


2. A sum was invested at compound interest payable half yearly, in June and December. If the compound interest in December 1995 was Rs. 225 and in June 1996 it was Rs.236.25. Then the annual rate of interest is
- a. 5 % b. 10 % c. 6 % d. 8 %

3. Which of the following conditions is necessary so that $x^2 - xy = 2x - 2y$ will imply that $x = 2$?
- a. $x \neq 0$ b. $y \neq 0$ c. $x > 0$ d. $x \neq y$

4. A car can travel 30 miles per hour going uphill and 60 miles per hour going downhill. What is its average speed, in miles per hour, if it goes 100 miles uphill and then 50 miles downhill?
- a. 40 b. 36 c. $33 \frac{1}{3}$ d. 45

5. In the figure below, AB is perpendicular to ED. What is the measure of angle ABC?
- a. 45° b. 60°
c. 30° d. 55°



6. The times between 7 and 8 O'clock, correct to the nearest minute, when the hands of a clock will form an angle of 84° are
- a. 7.23 and 7.52 b. 7.22 and 7.53 c. 7.23 and 7.53 d. 7.21 and 7.49
7. If third term of a G.P. is 3, then the product of first five terms is
- a. 243 b. 342 c. 234 d. Insufficient data.
8. A tank supplies water to a family for 60 days. Due to a leak in the tank, 5 litres of water waste every day and then the supply last for 10 days less. For how many days less will the supply last if 50 litres of water leak everyday ?
- a. 15 days b. 16 days c. 18 days d. 20 days

Questions 9 - 10 are based on the following data:

In an AP of common difference 3, product of 1st and the last term equals the square of the third term. Also if a GP is formed with the first term and common ratio each half the first term of AP, then 4th term of GP equals the 5th term of AP

9. The no. of terms in AP are
- a. 8 b. 10 c. 11 d. 13
10. The G.P. has common ratio of
- a. 1 b. 2 c. $\frac{1}{2}$ d. Data insufficient

-

(x) = Least integer greater than or equal to x , $[x]$ = Greatest integer less than or equal to x ,
 $|x|$ = absolute value of x , $L_e(a, b, c, \dots)$ = Least of a, b, c, \dots
 $L_o(a, b, c, \dots)$ = Highest of a, b, c, \dots

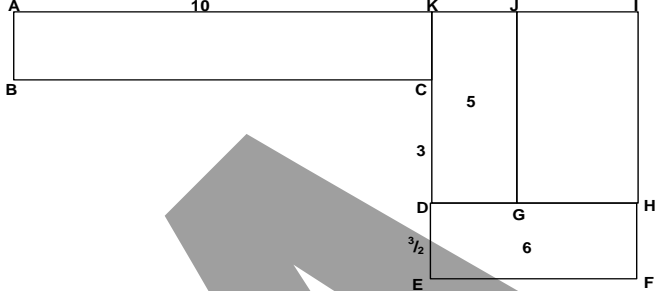
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- $$f(x) = \begin{cases} -2, & x < 0 \\ 0, & x = 0 \\ 2, & x > 0 \end{cases}$$

a. $\{x : x \in \mathbb{R}\}, \{-2, 0, 2\}$
c. $\{0, 2\}, \{x : x \in \mathbb{Z}\}$

- c. $\alpha + \beta = 1$ d. $\alpha^2 = \beta$

21. If x is real, then the least value of the expression $(x^2 - 6x + 5)/(x^2 + 2x + 1)$ is
 a. -1 b. $-1/2$ c. $-1/3$ d. none of these
22. Two trains start at the same time from stations A & B and proceed towards each other at the rate of 16 miles and 21 miles per hour respectively. When they met, it was found that one train had covered 60 miles more than the other. Find the distance between the two stations.
 a. 400 miles b. 444 miles c. 344 miles d. 620 miles
23. The number of integral values of x for which $(5x-1) < (x+1)^2 < 7x-3$ is
 a. 0 b. 1 c. 2 d. 3
24. 75% of the employees of a firm are classed as skilled workers and the rest unskilled. 80% of the former class and 20% of the later are permanent employees. The number of employees of the firm when the temporary employees numbered 63, is
 a. 160 b. 170 c. 180 d. 190
25. A construction company owns a shop and a warehouse. The shop is valued at Rs.23,600 and the warehouse is valued at Rs.9600. The property tax is charged on 60% of the value of the property. If the tax rate is 2.5%, the tax on the shop and the warehouse respectively is,
 a. Rs. 144, Rs. 354 b. Rs. 354, Rs. 144
 c. Rs. 250, Rs. 248 d. Rs. 248, Rs. 250
26. A man purchases 30 cows for Rs.37500. He sells 6 cows at 10% loss. 4 cows die. At what rate should he sell the remaining cows so as to gain a profit of 10% on total investment?
 a. Rs. 1700 b. Rs. 1725 c. Rs. 1750 d. Rs. 1775
27. At an election three districts are to be canvassed by 10, 15 and 20 men respectively. If 45 men volunteer, in how many ways can they be allotted to the different districts ?
 a. $45!/(15! \times 15! \times 15!)$ b. $45!$ c. $45!/(10! \times 15! \times 20!)$ d. none of these
28. A garrison of 2000 men has provisions for 54 days. At the end of 15 days, a reinforcement arrives and it is found that now the provisions will last for 20 days more. What is the strength of reinforcement?
 a. 1700 b. 1800 c. 1900 d. 2000
29. The solution set of the inequality $4^{-x+0.5} - 7(2)^{-x} - 4 < 0$ ($x \in \mathbb{R}$) is
 a. $(-\infty, \infty)$ b. $(-2, \infty)$ c. $(2, \infty)$ d. $(2, 7/2)$
30. In a kilometer race, A can beat B by 40 meters and B can beat C by 50 meters. By how many meters can A beat C in a 500 meter race?
 a. 44 m b. 45 m c. 45 m d. 46 m
31. If x is real and $k = (x^2 - x + 1)/(x^2 + x + 1)$ then
 a. $1/3 \leq k \leq 3$ b. $k \geq 5$ c. $k \leq 0$ d. none of these
32. If $l(OP) = 3$ units, and P, Q, R, and S are equidistance from O, then the area of square PQRS is
 a. 36 b. 18 c. $6\sqrt{21}$ d. $16\sqrt{2}$
33. A man is picked-up by his wife from the station everyday. One day he was left off from the work one hour earlier, so he took an earlier train and arrived at the station 5 pm instead of usual 6 pm. He started walking home. En route he met his wife and got into the car. They drove home and arrived 10 minutes earlier than the usual time. How long did the man walk before he was picked up by his wife.
 a. 55 minutes b. 15 minutes c. 45 minutes d. 50 minutes
34. If the inequality $(mx^2 + 3x + 4)/(x^2 + 2x + 2) < 5$ satisfied for $x \in \mathbb{R}$ then m satisfies the relation –
 a. $m < 71/24$ b. $m > 5$ c. $-5 < m < 5$ d. $0 < m < 5$

35. A can do a piece of work in 36 days, B in 54 days and C in 72 days. All the three began the work together but A left 8 days and B 12 days before the completion of work. How many days in all did C put in till the entire work was finished?
a. 21 days b. 22 days c. 23 days d. 24 days
36. The value of $(0.2)^{\log_{\sqrt{5}}(1/4 + 1/8 + 1/16 + \dots \infty)}$ is
a. 2 b. 4 c. 8 d. 16
37. In the given diagram, AK is 10 units long, CD is 3 units long, DE is $3/2$ units long and ABCK has an area of 20, KJGD has an area of 5, and DHFE has an area of 6. Find the area of IJGH.
a. 10 b. 20
c. 12 d. 15
- 
38. In a baseball season of 53 games, the probability of winning a game by Black throepe is 0.585 and that of Green horn is 0.509. How many games behind the black throepe are the Green horn
a. 3 b. 4 c. 5 d. 6
39. Three men were employed to do a piece of work. They worked for 5, 6 and 7 hours respectively per day and receive the same hourly wages. After 3 days, each starts working for one hour more and receives proportional increase in wages. The work is completed 4 days from that time. The total sum paid to them was Rs. 27.60. How much did each get?
a. Rs. 7.30, Rs. Rs. 9.60, Rs. 10.70 b. Rs. 7.80, Rs. 9.20, Rs. 10.60
c. Rs. 7.40, Rs. Rs. 9.50, Rs. 10.70 d. Rs. 8, Rs. 9, Rs. 10.60
40. A person buys 16 railway tickets for Rs.450. Each first class ticket costs Rs.50 and each second class ticket costs Rs.15. What will another lot of 16 tickets in which the present number of the first and second class tickets are interchanged cost?
a. Rs. 585 b. Rs. 590 c. Rs. 595 d. Rs. 600
41. Ten persons, amongst whom are A,B, and C, are to speak at a function. The number of ways in which it can be done if A wants to speak before B, and B wants to speak before C is
a. ${}^{10}C_3 \cdot 7!$ b. ${}^{10}P_3 \cdot 7!$ c. $10!/3!$ d. both a. & c..
42. A train 100 meters long meets a man going in opposite direction at the rate of 10 kms/hr and passes him in 7.2 seconds. At what rate is the train going on?
a. 40 kmph b. 45 kmph c. 50 kmph d. 55 kmph
43. A bought radio and spent Rs.110 on its repairs. He then sold it to B at 20% profit. B sold it to C at a loss of 10 percent. C sold it for Rs.1188 at a profit of 10 percent. The amount at which A bought the radio is,
a. Rs. 850 b. Rs. 870 c. Rs. 890 d. Rs. 910
44. A man had some eggs. Out of them 4% were thrown away as they had become rotten; 80% of the remaining eggs were sold and now he was left with only 96 eggs. The number of eggs he had in the beginning was,
a. 450 b. 600 c. 550 d. 500
45. An unbiased die is tossed until a number greater than 4 appears. The probability that an even number of tossed needed is
a. $1/2$ b. $2/5$ c. $1/5$ d. $2/3$

46. A cistern can be filled separately by two pipes A & B in 45 minutes and 36 minutes respectively. The tap C at the bottom can empty the cistern in 30 minutes. If the tap C is opened 7 minutes after the two pipes A and B are opened, find when will the cistern be filled?
a. 48 minutes b. 46 minutes c. 44minutes d. 39 minutes
47. Solve the equation for x, $x + \log(1+2^x) = x\log 5 + \log 6$
a. 0 b. 1 c. 2 d. -1
48. The area of the region bounded by $y = |x-1|$ and $y = 1$ is
a. 2 b. 1 c. $\frac{1}{2}$ d. none of these
49. A sequence is such that the difference between successive terms form an A.P. Then it's n^{th} term is given by
a. $(n^2 + n + 2) / 2$ b. $(n^2 + 2n + 2) / 4$ c. $n(n - 1)$ d. All of these
50. It is a small town railway station and there are 25 stations on that line. At each of the 25 stations the passengers can get tickets for any of the other 24 stations. How many different kinds of tickets do you think the booking clerk has to keep?
a. 600 b. 625 c. 300 d. 150

Quantitative Ability Exercise 6A

1. A and B walk from their homes to their college daily. A's house is a km farther from the college than B's house. If A walks at a speed $\frac{3}{2}$ times that of B and takes the same time as that of A to reach the college, then the distance from A's house to the college is....

a.2km b.3km c.4km
d.5km e.insufficient data
2. A person gets Rs 60 more as interest on a sum if he invests it at simple interest for 3 more years. If the rate of interest is 10%, what is the sum invested?

a.200 b.2000 c.300 d.3000 e.none of these
3. A pipe when turned on for 20 minutes fills $\frac{1}{3}^{\text{rd}}$ of tank A. When turned on for 40 minutes, it will fill what fraction of a tank B which has capacity twice that of tank A?

a. $\frac{1}{2}$ b. $\frac{2}{3}$ c. $\frac{1}{3}$ d. $\frac{3}{2}$ e.none of these
4. A lends Rs.2000 to B at a rate of 12% per annum on the condition that if B does not repay it in 1 year, a simple interest of 15% will be charged on the remaining principle for the remaining period. If the total interest that B pays is Rs.255 in two years, how much did he pay back in the first year?

a.1000 b.1200 c.1250 d.1500 e.1600
5. The ratio of ages of A and B two years back was 2:3. 3 years hence, the ratio will be 3:4. What are the ages of A and B?

a.12, 17 b.15,10 c.15,20 d.12,15 e.10,15
6. A man buys a new car at a 10% discount on the market value. He then sells it at a value which is 25% lower than the market value. What is his loss percent?

a.15% b.16.66% c.12% d.insufficient data e.none of these
7. 5 bees can clean a certain number of cells in a bee-hive in 3 minutes. If twice the number of bees are added, they can clean 30 more cells in the same time. How many cells can 5 bees clean in 3 minutes?

a. 5 b. 12 c. 16
d. 15 e. none of these
8. Find the number of pairs of natural numbers with LCM as 56.

a. 3 b. 4 c.10
d. 11 e. can't be determined
9. There are 5 consecutive natural numbers with LCM as 60. The product of the first two numbers is equal to the 5th number. What is the sum of the 5 numbers?

a. 0 b. 19 c. 20
d. 15 e. can't be determined
10. How much water should be mixed with 12 litres of milk costing Rs.16 per liter so that on selling at cost price, there will be 33.33% profit?

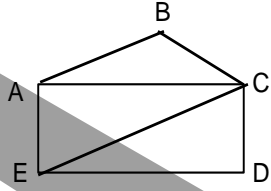
a. 1 b. 4 c. 3
d. 6 e. none of these
11. Nikhil buys a certain number of eggs and marks them at a price that will fetch him 20% profit. But a smart customer cheats him off Rs21 and Nikhil loses 10% in the transaction. What was the cost price of the eggs?

a.Rs.50 b.Rs.60 c.Rs.70
d.Rs.80 e. none of these.
12. What is the angle in degrees between the hands of the clock at 9:18 p.m.?

a. 191 b. 171 c. 71 d. 76 e.none of these

13. Mario sells milk in the vicinity of Florence. He gets milk at 50 lira a litre and after mixing water sells it at 40 lira a litre. If he still makes a profit of 14.28%, what is the ratio in which he mixes water with milk?
a. 17:5 b. 7:3 c. 7:5 d. 3:7 e. none of these
14. The weight of person is partly proportional to the amount of daily intake of calories and partly proportional to his age. A person aged 36yrs weighs 61kgs when his intake is 2500calories everyday while a person aged 60 years weighs 70kgs when he takes in 1000 calories per day. How much would a person of age 24 yrs weigh when his calorie intake is 3000 per day?
a. 64 b. 70 c. 54
d. 78 e. none of these
15. A man is walking on a railway platform that is 200m long. An express train passes through the station at 60kmph and overtakes the man in 20 seconds while completely passes the platform in 30 seconds. What is the speed at which the man is walking on the platform?
a. 10kmph b. 5kmph c. 6kmph d. 4kmph e. none of these
16. Two of the vertices of an equilateral triangle are given by (4,0) and (8,0). The third vertex lies on the line $y = x/\sqrt{3}$. The third vertex is...
a. (6, $-\sqrt{3}$) b. (-6, $\sqrt{3}$) c. (6, $\sqrt{3}$)
d. both a and c e. none of these
17. If thrice of A is equal to twice of B and 7 times B is equal to 9 times C then the ratio between A and C is
a. 2/3 b. 4/7 c. 9/5
d. 6/7 e. cannot be determined
18. There are 0.5 million cars in Bangalore distributed over 0.20 million households. In as many as 0.1 million households, both husband and wife own a car and in 0.02 million of these, the eldest son or daughter owns a car. There are 0.1 million households owning a total of at least 3 cars and 0.02 million do not own a car at all. What is the maximum number of households who own exactly three cars?
a. 0.15 million b. 0.1 million c. 0.05 million d. 0.12 million e. none of these
19. A and B invest into a business in the ratio 5:6. B gets Rs12000 for managing the business, which leaves A with Rs25,000 share of the profit. What is the total profit?
a. 75,000 b. 67,000 c. 87,000 d. 88,000 e. none of these
20. If 25 is written as 100 in some number system, how will 24 be written as?
a. 99 b. 96 c. 44
d. 24 e. none of these

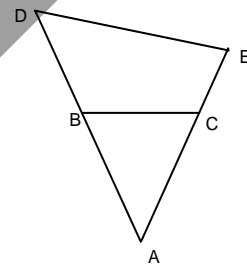
Quantitative Ability Exercise 6B

1. Ghumakkad has options of going to Agra, Gwalior, Ranchi and Yerwadi with any of his girl-friends: Deewani, Pagaly and Vikshipta. In how many ways he can plan his trip, if only one of his girl-friends may come to Yerwadi?
a. 11 b. 4 c. 7 d. 10
 2. The range of values of x for which both $x + 3 > 8x/(x-3)$ and $x^2 - 4 < 0$ are satisfied.
a. $-2 < x < 2$ b. $-2 < x < -1$ c. $9 > x > 2$ d. None of these
 3. ABCE is an isosceles trapezoid and ACDE is a rectangle. AB = 10 and EC = 20. Then, AE is
a. $5\sqrt{2}$ b. 10
c. $5\sqrt{3}$ d. $5(\sqrt{2} + \sqrt{3})$
- 
4. Machinery costing Rs.27400 is installed in a factory. The annual depreciation of the machinery is calculated at 5% of its value at the beginning of the year. The value of the machinery at the end of 4 years is,
a. Rs. 22000 b. Rs. 22310 c. Rs. 22317.47 d. Rs. 22345.40
 5. An eight faced die was marked with numbers: 1 through 8. Due to rough handling, one of the nos. got obliterated. Two nos. were examined and found to be odd. What is the probability that the effaced no. is even?
a. $1/2$ b. $2/3$ c. $3/4$ d. None of these.
 6. Seventy five men were employed to lay down a railway line in 3 months. Due to certain emergent conditions, the work was to be finished in 18 days. How many men should be employed to complete the lay down of the railway track in the desired time?
a. 325 b. 350 c. 375 d. 400
 7. A garrison of 1500 men has provisions for 48 days. At the end of 13 days, a reinforcement arrives and it is found that now the provisions would last for 25 days more. What is the reinforcement?
a. 575 b. 600 c. 625 d. 650
 8. A and B each walks 24 kms. the sum of their speeds is 7 kms/hr and the sum of the time taken is 14 hrs. The speeds of A & B respectively are,
a. 2 kmph, 5 kmph b. 1 kmph, 6 kmph
c. 5 kmph, 2 kmph d. 4 kmph, 3 kmph
 9. When reflected in a horizontal line, **BAD** becomes **BVD**. How many three letter words can be formed (with or without meaning) that remains unchanged by reflection in a horizontal line.
a. zero b. 84 c. 729 d. None of these.
 10. A and B run a 1760 m race ending in a dead heat. At first A runs 20 p.c. faster than B. B then quickens his pace, and for the remainder of the race runs 20 p.c. faster than A. How many metres does B run before he quickens his pace?
a. 750 b. 800 c. 850 d. 900
 11. What is the fifth number m of the form $3n/5$, where $m \in \mathbb{N}$ and n can be any integer?
a. 3 b. 6 c. 9 d. 15
 12. Which of the following is true ?
(I) For an identity function, Range Union Domain = Range
(II) No. of elements in Range of a constant value function equals no. of elements in Domain.

(III) There exist two sub-sets of range of a constant value function.

- a. I and III b. I and II c. II and III d. I only

13. If the roots of $3x^2 - (8 + 2m)x + 3 = 0$ are reciprocal, then find 'n' so that $x^2 - nx + m^2 = 0$ may have equal roots.
a. 1 b. 2 c. -2 d. both b and c
14. A loan of Rs.12820 is repaid by three annual payments; the first payment being half of the second and one third of the third. If the compound interest is calculated annually at rate of 10 %, then the three payments are,
a. Rs. 2662, Rs. 5324, Rs. 7986 b. Rs. 2600, Rs. 5300, Rs. 8000
c. Rs. 2700, Rs. 5400, Rs. 7900 d. Rs. 2700, Rs. 5400, Rs. 8100
15. Two varieties of oil are mixed in the ratio of 4:3 to produce first quality and if they are mixed as 2:3, second quality is obtained. How many kilos of the first quality should be mixed with 10 kilos of the second quality for having the two varieties in the ratio of 5:4?
a. 96 b. 97 c. 98 d. 99
16. I buy a Fan on the condition that I shall pay Rs.500 now, Rs.425 after one year and the Rs.289 after two years. What would be the cash value of the Fan, compound interest being calculated at $6\frac{1}{4}$ per cent per annum ?
a. Rs. 1100 b. Rs. 1150 c. Rs. 1156 d. Rs. 1160
17. If a,b,c,d are four positive real numbers , then minimum value of expression $(a+b+c)/d + (b+c+d)/a + (c+d+a)/b + (d+b+a)/c$
a. 7 b. 6 c. 8 d. none of these
18. Three taps can fill a cistern separately in 10 minutes, 15 minutes and 18 minutes respectively. The cistern being empty, all three taps are kept open and after 3 minutes, the third tap is closed, in how many more minutes will the cistern be full ?
a. 1.25 minutes b. 1.50 minutes
c. 1.75 minutes d. 2.00 minutes
19. A man wishes to have a few books in his library arranged on shelves each containing the same number of volumes. He tried 6 in each shelf, then 8 in each and afterwards 12 in each, but had always 3 volumes left. On trying 17 in each shelf, he had none left. What is the smallest number of books in his library?
a. 34 b. 51 c. 68 d. 85
20. If we know that $x > y$ then which of the following need not be true?
a. $-x < -y$ b. $x + 2 > y + 1$ c. $x/3 > y/3$ d. $x^2 > y^2$
21. A natural number x is chosen at random from the first 100 natural numbers. then the probability that $x + \frac{100}{x} > 50$ is
a. 1/2 b. 11/20 c. 53/100 d. None of these.
22. The number of solutions of $\log_4(x - 1) = \log_2(x - 3)$ is
a. 3 b. 1 c. 2 d. 0
23. There are two mixtures of wine and water, the quantities of wine in them being 0.25 and 0.75 of the mixtures. If 2 gallons of first be mixed with 3 gallons of the second, what will be the ratio of wine to water in new mixture?
a. 9 : 11 b. 2 : 3 c. 3 : 2 d. 11 : 9
24. If $2x = a + a^{-1}$ and $2y = b + b^{-1}$, then value of $4xy + [(x^2-1)(y^2-1)]^{1/2}$
a. $\frac{1}{2}(ab^2 + ab^{-2})$ b. $\frac{1}{2}[ab + (ab)^{-1}]$ c. $(ab + ab^{-1})$ d. none of these

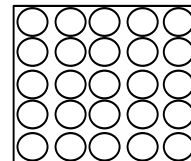


Directions : Questions 25 and 26 are based on the following information

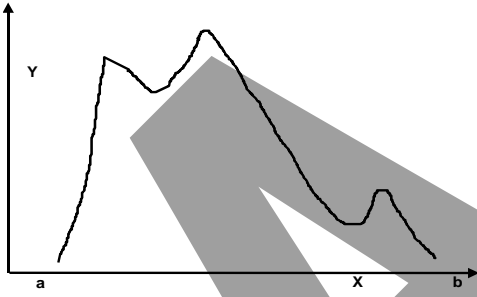
$(a, b, c, \dots) = \text{Greatest Common Divisor of } a, b, c, \dots$

$\phi(n) = \text{Total number of natural numbers less than } n \text{ and relatively prime to } n$. Two numbers are said to be relatively prime if their GCD is 1

25. The value of $\phi(p)$, where p is any prime number is
 - a. 1
 - b. less than or equal to p
 - c. greater than p
 - d. $p - 1$
26. If one of a, b, c, d is a prime number then the value of (a, b, c, d)
 - a. always 1
 - b. Greater than 1
 - c. a prime number or 1
 - d. None of these
27. The smallest integer x for which the inequality $(x-5)/(x^2+5x-14) > 0$ is satisfied is given by
 - a. -6
 - b. -5
 - c. -4
 - d. -3
28. The equation $\sqrt{x+1} - \sqrt{x-1} = \sqrt{4x-1}$ has
 - a. no solution
 - b. one solution
 - c. two solution
 - d. more than one solution
29. Two pipes can fill a cistern separately in 24 minutes and 40 minutes respectively and waste pipe can drain off 30 gallons per min. If all the three pipes are opened, the cistern gets filled in 1 hour. The capacity of the cistern in gallons is,
 - a. 550
 - b. 600
 - c. 650
 - d. 700
30. If a, b, c are any real numbers then
 - a. $\max(a, b) < \max(a, b, c)$
 - b. $\min(a, b) < \min(a, b, c)$
 - c. $\min(a, b) = (\frac{1}{2})(a+b - a-b)$
 - d. none of these
31. The sum of $1 + 2.2 + 3.2^2 + 4.2^3 + \dots + 100.2^{99}$ is
 - a. $100.2^{100} - 1$
 - b. $99.2^{99} - 1$
 - c. $99.2^{100} + 1$
 - d. $100.2^{100} + 1$
32. Container A of volume a , is half full. Container B, of volume b , is one third full. Container C, of volume c , is empty. If all the water in the containers is divided equally among the containers, what part of container C will be full?
 - a. $(3a+2b)/18c$
 - b. $(a+4b)/6c$
 - c. $(2a+b)/24c$
 - d. $(a+b)/3c$
33. A square oven tray 2 meters on a side filled with n^2 circular cherry pies. What is the total area of pie crusts on top of the pies?
 - a. π
 - b. $\pi / 2$
 - c. 2π
 - d. $2\pi n$
34. There are 20 persons among who are two brothers. The number of ways in which we can arrange them around a circle so that there is exactly one person between the two brothers is
 - a. $2 \cdot 17!$
 - b. $2 \cdot 18!$
 - c. $17!$
 - d. $18!$
35. A box contains 24 identical balls of which 12 are white and 12 are black. The balls are drawn at random from the box one at a time with replacement. The probability that a white ball is drawn for the 4th time on the 7th draw is
 - a. $5/64$
 - b. $27/32$
 - c. $5/32$
 - d. $\frac{1}{2}$
36. If x and y are positive integers, then what is the smallest value of $x + y$ such that $2x + 5y$ is divisible by 16?
 - a. 7
 - b. 3
 - c. 10
 - d. 5
37. In a school there are 14 teachers, a P.T. instructor, and five captains of different games. In how many ways can a game committee be formed consisting of the P.T. instructor, two other teachers and two of the captains.
 - a. 700
 - b. 800
 - c. 910
 - d. 1000
38. A circular disc of area $9/\pi$ square feet rolls 120 feet. How many revolutions does it make?
 - a. 14
 - b. 16
 - c. 18
 - d. 20



39. What real values of n will satisfy the following equation?

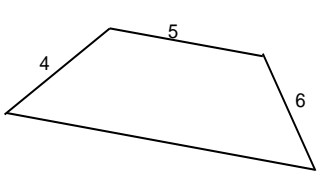
$$\frac{[(n + 1/n)^2 - (n - 1/n)^2]}{(1/n - 1)} = 4n/(1-n)$$
 a. all real values
 b. no real value
 c. all real values greater than 1
 d. all real values except 0 and 1.
40. A, B and C hold a pasture in common for which they pay Rs.64 per month. They put 70, 50 and 40 sheep respectively. A sells $1/7$ of his flock to C after 4 months and after 3 months more C sells $2/5$ of his flock to B. The rent that A, B & C should respectively pay after one year is, in Rs.
 a. 304,280, 184
 b. 280, 304, 184
 c. 184, 304, 280
 d. 280, 184, 304
41. The adjacent figure shows the graph of a relation between x and y . For each value of x between a and b there is (are)
 a. at least one value of y
 b. exactly one value of y
 c. at least 2 values of y
 d. exactly 2 values of y
- 
42. A man pays in all Rs.1100 as income tax, which was charged at 5%, and 10% special surcharge on the amount of income tax. Find his gross income if he is allowed a deduction of 20 %.
 a. 20,000
 b. 25,000
 c. 30,000
 d. 35,000.
43. The cost of setting type is 1 paisa per five letters. A page of material to be set has 30 lines per page, each line having 61 letters. What is the cost of setting 32 pages?
 a. Rs.107.12
 b. Rs.112.12
 c. Rs.117.12
 d. Rs.121.17
44. Which of the following is the circumference of a circle whose radius is an odd integer?
 a. 4π
 b. 3π
 c. 4
 d. 44.
45. Digit in the units place of $(13)^{13}$ is
 a. 1
 b. 3
 c. 7
 d. 9
46. Shubha works in a post office and she sells stamps. One day a man walked in and kept seventy five paise on the counter and requested, 'Please give me some 2 paise stamps, six times as many as one paise stamps, and for the rest of the amount give me 5 paise stamps.' Shubha thought for a few moments and finally she handed over the exact fulfillment of the order to the man. How many 5 paise stamps did he buy?
 a. 7
 b. 6
 c. 2
 d. 8
47. A alone can reap a certain field in 15 days and B in 12 days. If A begins alone and after a certain interval B joins him, the field is reaped in $7\frac{1}{2}$ days. A and B worked together for _____ days.
 a. 4
 b. 5
 c. 6
 d. 7
48. If n is any integer, which of the following must be true?
 a. $3n + 1$ is odd
 b. $n(n+2)$ is even
 c. $n(3n+3)$ is divisible by 6
 d. $n(n+1)$ is divisible by 3
49. The average score per inning of a batsman for certain innings was 21.75. In the next three innings he scored 28,34 and 37 runs and his average thus increased by 1.125 runs. How many innings did he play ?
 a. 27
 b. 28
 c. 29
 d. 30
50. If $(4+\sqrt{15})^x + (4-\sqrt{15})^x = 62$ then x is
 a. 2
 b. -2
 c. +2 or -2
 d. none of these

Quantitative Ability Exercise 7A

1. The ratio of two numbers is 2:3 which changes to 1:3 when 6 is subtracted from the smaller number. What is the larger number?
a. 12 b. 15 c. 18 d. 21 e. 24
2. The average age of the students in a class is 8. If the age of the teacher is 28 and the average of age increases by 0.5 considering the teacher's age too then the total number of students in the class is:
a. 24 b. 36 c. 48
d. 39 e. can't be determined
3. Bozo invests some amount in the bullion market and four times that amount in real estate. After two years, the bullion prices rise by 20% and the real estate prices rise by 5%. He disinvests everything and puts the amount in stocks, which crash to 40% of the value. If he had invested 20,000 in real estate, what was the total amount he has with him in the end?
a. Rs. 10,000 b. Rs. 10,800 c. Rs. 12,800
d. Rs. 12,000 e. none of these
4. 9 men can do a piece of work in 24 days at the rate of 8 hours per day. How long would it take to finish the same work by 16 men working 12 hours a day?
a. 18 days b. 9 days c. 6 days d. 10 days e. none of these
5. Leon bought two Uzis for some amount. He then sold one to Jackal at a profit of 25% and the second he sold to Carlos at a discount of 20%. If Jackal paid \$450 more than Carlos, what is the price of a single Uzi paid by Leon? (in \$)
a. 800 b. 1000 c. 1200
d. 1300 e. none of these
6. 12 men working for 5 hrs a day finish constructing 4 walls of a room each with dimensions $15 \times 12 \times \frac{1}{2}$ in two days. How long would it take to finish the same work if 5 men work for 6 hours a day?
a. 1 b. 3 c. 2 d. 4 e. 4.5
7. A and B together complete a certain work in 10 days while C takes 15 days to do the same work. How much time would A, B and C need to complete the job if they work together?
a. 6 b. 5 c. 4
d. 3 e. none of these
8. If a cube is placed inside a sphere of radius R such that the 8 corners of the cube just touch the boundary of the sphere, what is the volume of the cube?
a. $2R^2$ b. $\frac{4}{3} \times R^3$ c. $2\sqrt{3}R^3$
d. $\frac{8}{(\sqrt{3})}R^3$ e. insufficient data
9. What should be the difference in the simple interests earned if the rate is doubled and the time is reduced by half for the same principal?
a. 0 b. Rs. 400 c. Rs. 600
d. Rs. 1000 e. insufficient data
10. Rito grows flowers in his horticultural farm. He has taken a bank loan of ten lakh, on which he has to pay an interest of 12%. His running costs are twenty thousand per annum, and the output of his farm is one lakh roses per year, at what rate does he have to sell them apiece to make a net profit of 500% on his running costs after paying the bank interest?
a. 12 b. 16.4 c. 12 d. 12.4 e. 2.4
11. In a 500m race Runman beats Bhagtaram by 100m. In 800m race Bhagtaram beats Padtabhau by 200m. By how much did Runman beat Padtabhau in a race of 1000 m?
a. 300 m b. 500 m c. 400 m
d. 600 m e. insufficient data.

12. The volume of a solid cylinder is exactly equal to the total volume of three smaller cylinders each with radius 3 cm and height 7 cm. What is the height of the larger cylinder if its radius is same as that of the smaller one?
 a. 7 cm b. 10 cm c. 15 cm d. 21 cm e. 24 cm
13. How much water when added to 270ml of 18% nitric acid give an acid of 10% concentration?
 a. 300 ml b. 240 ml c. 216 ml
 d. 144 ml e. insufficient data
14. Bozo takes 3 hours to go from Pune to Mumbai, while Mozo takes 5 hours to go from Mumbai to Pune. If they both start at the same time from opposite ends, how much time will elapse until they meet? (In hours)
 a. $1\frac{7}{8}$ b. $1\frac{1}{8}$ c. $1\frac{5}{6}$
 d. 2 e. none of these
15. If the radii of two spheres are in the ratio 2:3, what should be the ratio of their volumes?
 a. 8:27 b. 4:9 c. 9:4
 d. 27:8 e. none of these
16. In a survey conducted involving 300 people, 150 drank pepsi, 25 drank pepsi as well as coke and double the number of people who drank coke but not pepsi preferred pure water to any of these drinks. How many drank coke?
 a. 75 b. 50 c. 25 d. insufficient data e. none of these
17. Suketu is travelling on his bike, Shogun, from Nashik to Pune, at a speed of 80 km/hr. But, one hour after he starts, he almost bumps into a dog and thence proceeds to complete the remaining part of the journey at 40 km/hr. If his average speed over the entire trip comes to 60 km/hr, what is the distance between Nashik and Pune?
 a. 100 b. 120 c. 140 d. 160 e. 180
18. Pipe A fills a water tank while 3 identical pipes empty it. The rate at which pipe A fills water in the tank is thrice that of the pipe that empty it. The tank is full up to height h. What is the height of the water in the tank after 3 hours 20 minutes if all the pipes are simultaneously opened?
 a. 0 b. $h-1$ c. $h-2$
 d. none of these e. cannot be determined
19. Equal sums of money are deposited in two different banks by Shehnaz Treasurywala, one at CI, compounded annually, and the other at SI, both at 5% pa. If after two years, the difference in the amounts come to Rs 200, what are the amounts deposited with each bank?
 a. 64000 b. 72000 c. 80000 d. 8400 e. 9600
20. There are five nos that are in AP as well as GP with the first term as a. The numbers therefore must have the middle term as....
 a. 0 b. 1 c. a
 d. equal to the common difference e. cannot be determined

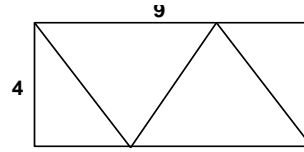
Quantitative Ability Exercise 7B

1. On a windy day, out of every 3 sand dunes formed, only 1 remains. Out of the 5 blown-out sand-dunes, 1 has treasure and only 2 out of 5 sand-dunes formed have lucky coupons. Find the probability that the blown-out sand dune will contain both the things.
a. $\frac{2}{25}$ b. $\frac{4}{75}$ c. $\frac{7}{75}$ d. $\frac{3}{5}$
2. What is 11th term of $\frac{2}{9}, \frac{1}{4}, \frac{2}{7}, \frac{1}{3}, \dots$
a. -2 b. 1 c. $-\frac{3}{13}$ d. None of these.
3. In an examination 70% candidates passed in English and 65% passed in Mathematics. 27% failed in both subjects 248 candidates passed in both the subjects. How many candidates appeared at the examination?
a. 400 b. 450 c. 500 d. 550
4. $A(x)$ is an identity function, $x \in \mathbb{R}$. Value of $A(A(x))$ is
a. x b. x^2 c. 1 d. None of these
5. In an examination A obtained 80% of the minimum marks required to pass the examination. B obtained 10% less than those of A and C $34\frac{4}{19}\%$ less than the marks obtained by A and B together. Does C pass or fail?
a. Passes b. Redundant Condition c. Insufficient Data d. Fails
6. Doubling the perimeter of a triangle, keeping the shape the same, multiplies the area by
a. 2 b. 3 c. 4 d. 8
7. A number of Cats got together and decided to kill between them 999919 mice. Every cat killed an equal number of mice. Each cat killed more mice than there were cats. How many cats do you think there were?
a. 1009 b. 919 c. 991 d. 999
8. A train running between two towns arrives at its destination 10 minutes late when it goes 40 kms per hour and 16 minutes late when it goes 30 kms per hr. The distance between the two towns is,
a. 11 km b. 12 km c. 13 km d. 14 km
9. Two taps can fill a cistern in 30 and 36 minutes respectively. Tap C can empty it at the rate of 50 litres per minute. If all the three tapes are opened simultaneously, the cistern gets filled in 20 minutes. Find the capacity of the cistern in litres.
a. 4500 b. 4700 c. 4800 d. 5000
10. At a game of billiard, A can give B 10 points in 60 and he can give C 15 points in 60. How many points can B give C in a game of 90?
a. 8 b. 9 c. 10 d. 11
11. A month is chosen at random. What is the probability that the chosen month has two days less than maximum of 31?
a. $\frac{45}{48}$ b. $\frac{1}{2}$ c. $\frac{1}{48}$ d. None of these .
12. The perimeter of the figure is
a. a whole number b. less than 30
c. greater than 40 d. 22

13. If $\sqrt{6x^2 - 5x + 11} + \sqrt{6x^2 - 5x - 25} = 12$, $\sqrt{6x^2 - 5x + 11} - \sqrt{6x^2 - 5x - 25} = 36$, then value of $6x^2 - 5x$ is
a. $\frac{181}{4}$ b. 200 c. Many solutions d. No solution

14. A sum of money amounts to Rs.944 in 3 years at simple interest. If the rate of interest be raised by 25% the sum amounts to Rs.980 during the same period. Find the sum and rate of interest.
a. Rs. 700, 6% b. Rs. 700, 4% c. Rs. 800, 4% d. Rs. 800, 6%
15. In a box 42875 tablets are stacked in the form of a cube. Find the number of layers in the box.
a. 25 b. 45 c. 55 d. 35
16. If $(x+y)/z = 1$, then
a. x not equal to z b. z not equal to 1
c. $x + y + z$ not equal to 0 d. x not equal to y
17. The distance moved by a tumtum is given as $8\sqrt{t + t^2}$ (m), where 't' is time in sec. The minimum velocity of the tumtum is
a. 6 b. 1 c. 3 d. No real value
18. A figure is divided into two squares by drawing one straight line. The original figure could have been a(an)
a. trapezoid b. triangle c. square d. octagon
19. A 60 metres long train traveling at a 42 kms/hr crosses a train 84 metres long traveling at 30 kms/hr in the same direction. How long will it take to fully cross it?
a. 42 sec b. 43.2 sec c. 44.2 sec d. 45.2 sec
20. $0 < x < \pi/4$. Then $(\sec 2x - \tan 2x)$ equals
a. $\tan(x - \pi/4)$ b. $\tan(\pi/4 - x)$ c. $\tan(x + \pi/4)$ d. $\tan 2(x + \pi/4)$
21. The average salary per head of all the workers of an institution is Rs.60. The average salary of 12 officers is Rs.400. The average salary per head of the rest is Rs.56. Find total number of workers in the institution.
a. 1030 b. 1032 c. 1034 d. 1036
22. Three equal glasses are filled with mixtures of spirit and water. The ratio of the spirit to water in each glass is as follows: in the first glass as 3:4, in the second glass as 4:5 and in the third glass as 5:6. The contents of the three glasses are emptied into a single vessel. What is the ratio of the spirit to water in the mixture now?
a. 920 : 1159 b. 1159 : 920 c. 11 : 9 d. None on these
23. If a, b and c are three natural numbers such that c is a factor of the product ab and c is coprime to a, then
a. b is a factor of c b. c is a factor of b
c. a is a factor of b d. b is a factor of a
24. A sofa set listed at Rs.800 is sold to retailer at successive discounts of 25% and 15%. The retailer desires a profit of 20% of his cost price after allowing 10% trade discount (on list price) to the customer. At what price should he list the sofa set ?
a. Rs. 670 b. Rs. 680 c. Rs. 690 d. Rs.700
25. A manufacturer sells goods to an agent at profit of 10%. The agent's wholesale price to a shopkeeper is at a profit of 20% and shopkeeper's profit is 25%. Find the manufacturing cost of goods bought from the shop for Rs.41.25.
a. Rs. 20 b. Rs. 21 c. Rs. 25 d. Rs. 30
26. A, B, and C are moving on a highway with the speeds of 50 kms/hr, 40 kms/hr, and 50 kms/hr respectively. A and B are moving in the same direction with B being 30 Kms ahead of A. C is moving towards A and B from the opposite direction, and the distance between A and C is 210Kms. If B and C maintain their speeds, then for all three cars to meet at the same point, by how much should A increase his speed?
a. 30 kms/hr b. 15 kms/hr c. 10 kms/hr d. 5 kms/hr
27. If the three segments inside the rectangle are equal,

then the sum of their length is

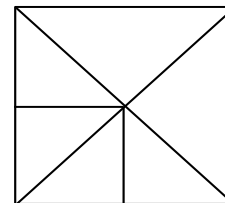
- a. 5 b. 12
c. 18 d. 15



28. Least value of $2\log_{10}x - \log_x(0.01)$, $x > 0$ & $x \neq 1$ is 4, This statement is...
a. True b. False c. Cannot say d. none of these
29. A gardener had a number of shrubs to plant in rows. At first he tried to plant 2 in each row, then 3, then 4, then 5 and then 6 but always, 1 left. On trying 7, he had none left. What is the smallest number of shrubs he could have had?
a. 201 b. 401 c. 501 d. 301
30. 1080 mangoes were distributed among few boys. Every boy was given as many mangoes as the number of boys. But 9 mangoes fell short this way. How many boys were there ?
a. 31 b. 33 c. 35 d. 37
31. Recently, while in London, I decided to walk down the escalator of a tube station. I did some quick calculation in my mind. I found that if I walk down twenty-six steps, I require thirty seconds to reach the bottom. However, if I am able to step down thirty-four stairs I would only require eighteen seconds to get to the bottom. If the time is measured from the moment the top step begins to descend to the time I step off the last step at the bottom, can you tell the height of the stair way in steps?
a. 44 b. 48 c. 46 d. 42
32. Number of positive integral solutions of $x_1 x_2 x_3 = 30$ is
a. 30 b. 27 c. no solution d. infinite solution
33. If a,b,c and d are four unequal quantities and $S = a + b + c + d$, then $(s-a)(s-b)(s-c)(s-d)$ will be,
a. $> 81abcd$ b. $< 81abcd$ c. $> 16abcd$ d. $< 16abcd$
34. If $a/b = c/d$ and $d/c = x/y$. Which of the following is true?
a. $y/a = x/b$ b. $xy = ab$ c. $ac/bd = x/y$ d. $x = c + d - y$
35. A man borrows Rs.25220 which he undertakes to pay back with compound interest at the rate of 5% p.a. in three equal installments at the end of one, two and three years. Find the amount of each installment.
a. Rs 9200 b. Rs. 9261 c. Rs 9300 d. Rs. 9400

36. How many triangles are there in the figure?

- a. 10 b. 11
c. 12 d. 15



37. If a,b,c,d are four positive real numbers, which one of the following holds ?
1. $(bcd)/a + (cda)/b + (dab)/c + (abc)/d \geq ab + bc + cd + da$
2. $a^2 + b^2 + c^2 + d^2 \geq ab + bc + cd + da$
a. only 1 b. only 2 c. both 1 & 2 d. none of these
38. $3/7 - 4/7^2 + 3/7^3 - 4/7^4 + 3/7^5 - 4/7^6 + \dots \infty$
a. 17/48 b. 23/48 c. 35/49 d. none of these
39. If $a < b < 0$ then
a. $a/b < 1$ b. $a + b > -1$ c. $a/b > 1$ d. $ab > 1$

40. The weight of a body, as calculated by the average of 7 different experiments is 53.735 g. The average of the first three experiments is 54.005 g, the fourth experiment was greater than the fifth by .004 g while the average of sixth and the seventh was 0.010 g less than the average of the first three. Find the weight of the body as obtained by the fourth experiment.
a. 53 gm b. 53.072 gm c. 54.072 gm d. 55.072 gm
41. A three man jury has two members each of whom independently has probability 'p' of making the correct decision and a third member tosses a coin for every decision. A one man jury has probability 'p' of making the correct decision. Which jury has the better probability of making the correct decision? If decision in three man jury is taken by majority rule.
a. One man jury. b. Three man jury.
c. Both have same probability. d. Depends on value of 'p'.
42. $1/(1-n)$ is approximately equal to $1 + n$. Then n is probably
a. greater than 2 b. close to 0 c. a whole number d. negative
43. If a, b, c are in AP, then the roots of the equation $ax^2 + 2bx + c = 0$ are
a. real b. imaginary c. equal if $a = c$ d. both a. and c.
44. A question paper is split into two parts- part A and part B. Part A contains 5 questions and part B has 4. Each question in part A has an alternative. A student has to attempt at least one question from each part. Find the number of ways in which the student can attempt the question paper.
a. $3^5 \cdot 2^4$ b. $(3^5 \cdot 2^4) - 1$ c. $(3^5 - 1)(2^4 - 1)$ d. none of these
45. If p and q are the roots of $x^2 + px + q = 0$ then
a. $p = 1$ b. $p = 1$ or 0 c. $p = -2$ d. $p = -2$ or 0
46. A student bought books, note-books and pencils from a stationer. If the ratio of the number of books to the number of note books is the same as the ratio of the number of note books to the number of pencils, find the number of note books if books & pencils are 20 & 5 respectively.
a. 7 b. 8 c. 9 d. 10
47. A box is made by using rectangles of area 24 as the sides. The bottom of the box is a square of area 9. The volume of the box is
a. 216 b. 72 c. 96 d. 33
48. $m + n = 0$, but $1/m + 1/n$ not equal to 0
a. $m = n$ b. $m > 0$ c. $m < 0$ d. $m^2 > n^2$
49. If $a^2 + b^2 + c^2 = 1$, then $bc + ca + ab$ lies in the interval
a. $[-1/2, 3]$ b. $[-1, 2]$ c. $[-1/2, 1]$ d. $[-1, 1/2]$
50. The expressions $y + x^3 + yx$ and $y^3 + y^2 + x$ are equal if
a. $y = 0$ b. $x^2 = 1$ c. $y + x^3 = x + y^3$ d. $x^2 = y^2$

Quantitative Ability Exercise 8A

1. A dam is to be completed in 80 days and 120 men are set to work, each working for 8 hours a day. After 40 days only $\frac{2}{5}$ of the work was completed. How many additional men must be employed so that the work is completed in time, each man now working 9 hrs a day?
a. 35 men
b. 40 men
c. 45 men
d. 50 men
e. none of these
2. A took Rs- 5000 from B and gave it to C for 2 years @ 6% S.I. After two years, A returns B Rs 5400. At what rate did A take money from B and how much does he gain?
a. 5%, 100
b. 4%, 100
c. 4%, 200
d. 3%, 200
e. insufficient data
3. A, B, C started a business. They put Rs.400, 400, 800 respectively at the beginning. After four months B took back Rs 200 and A put Rs 200 more. At the end of the year total profit was Rs 900. What will be the profit share for all the three?
a. 300, 200, 400
b. 250, 200, 450
c. 200, 200, 500
d. 300, 150, 450
e. none of these
4. Milo Minderbender buys eggs from Malta at 7 cents per piece and sells them at 12 cents per piece to a dealer in Bologna. Then he buys eggs at 11 cents per piece from a dealer in Bologna and sells them to his mess at 5 cents apiece. If he owns all the intermediaries mentioned, what is his percentage profit/loss from Malta to his mess?
a. 40 loss
b. 40 profit
c. 28.56 loss
d. 11.11 profit
e. 71 profit
5. If 4 men working 6 hrs a day to make a wall $15m \times 8m \times 6m$ in 4 days. How many more days they will have to work to make a wall of size $20m \times 8m \times 6m$ working 8 hrs a day?
a. 4 days
b. 5 days
c. 6 days
d. none of these
e. can't be determined
6. Two pipes A and B can fill a tank in 12 min and 15 min respectively. Another pipe C can empty the tank in 20 min. If all the three pipes were opened at the same time how much time it will take to fill the tank?
a. 8 min
b. 10 min
c. 12 min
d. 14 min
e. none of these
7. In a circular ground a man starts running from a point on the edge of the ground runs 57m due east, to reach another point on the edge, turns south and runs 76m to another point on the edge. What is the diameter of the ground?
a. 75m
b. 90m
c. 95m
d. 110m
e. can't be determined
8. In a class, 24 students are of age 15 and a few others are of age 17. If the average age of the class is 15.5 yrs, how many students are of age 17?
a. 4
b. 8
c. 24
d. 3
e. none of these
9. John is a wheat dealer who buys from the farmers and exports to the EU. John buys at Rs 14000/- per tonne and sells at Rs 20000/- per tonne. His processing and shipping charges come to 5% of the selling price. What is his final %age profit?
a. 43.2
b. 40.4
c. 33.3
d. 27.3
e. 31.66
10. When are the hands of the clock together between 7 & 8 O' clock?
a. $7:38\frac{4}{11}$
b. $7:38\frac{2}{11}$
c. $7:32\frac{3}{11}$
d. 7:38
e. none of these
11. A square of side 10 cm and a right angle triangle of height 10 & base 10 cm are both placed inside a rectangle of length 20 cm and width 10 cm. What fraction of the area of the rectangle remains uncovered?

Quantitative Ability Exercise 8B

1. $G(x)$ is any function and $F(x)$ is an odd function. Then $F(g(x))$ is
a. Odd, if $G(x)$ is even b. Even, if $G(x)$ is even c. Always odd d. None of these
2. Four letters are randomly chosen from the word MATHEMATICS. What is the probability that the four letters can be used to spell MATH?
a. $\frac{4}{165}$ b. $\frac{1}{330}$ c. $\frac{4}{330}$ d. None of these.
3. The points (2,3) and (2,10) are 2 vertices of a square. Another vertex of the square could be
a. (2,5) b. (10,2) c. (3,3) d. (-5, 3)
4. The no. of real solution(s) of $\cos(\log x) = 3^{2x} + 3^{-2x}$ is/ are
a. zero b. one c. two d. infinite
5. The range of the function $\sin x + \cos x$ is
a. $[-\sqrt{2}, \sqrt{2}]$ b. $[-1, 1]$ c. $[0, 1]$ d. $[-2, 2]$
6. If two poles 20 m. and 80 m. high are 100m. apart. Then the height of the intersection of the lines joining top of each pole to the foot of opposite pole is
a. 12m. b. 14m. c. 16 m. d. 18 m.
7. The no. of different outcomes if three indistinguishable dice are rolled are
a. 108 b. 56 c. 216 d. 215
8. Two men starting from the same place walk at the rate of 4 kms/hr and 6 km/hr respectively. How many kms will they be apart at the end of $3\frac{1}{2}$ hrs if they walk in opposite directions initially for first half an hour and there after they reverse their directions after every one hour.
a. 10 km b. 5 km c. 9 km d. 6 km
9. Let $m \# n = (m + n)/2$. Given $(a \# b) \# c = a \# (b \# c)$. Then
a. $b = 0$ b. $a + b + c = 0$ c. $a - c = 0$ d. $abc = 0$
10. A race course is 880 m long. A and B run a race and A wins by 10 m, C and D run over the same course and C wins by 30 m, B and D run over it and B wins by 20 m. If A and C run over it who would win and by how much?
a. A wins by $\frac{1}{3}$ m b. C wins by $\frac{880}{3741}$ m c. C wins by $\frac{1}{3}$ m d. A wins by $\frac{880}{3741}$ m
11. The coefficients of x in the $(2r + 1)$ th term and $(r - 2)$ th terms in the expansion of $(1 + x)^{15}$ are equal. The r th term is
a. ${}^{15}C_3 x^3$ b. ${}^{15}C_5 x^5$ c. ${}^{15}C_6 x^6$ d. Data Insufficient
12. An officer's pension on retirement from service is equal to half the average salary during last 36 months of his service. His salary from 1-1-1954 is Rs.380 per month with increment of Rs.40 as from 1-10-1954, 1-10-1955 and 1-10-1956. If he retires on 1-1-1957, what pension does he draw?
a. 210 b. 215 c. 220 d. 225
13. The number of the point of intersection of the two curves $y = 2\sin x$ and $y = 5x^2 + 2x + 3$ is
a. 0 b. 1 c. 2 d. ∞
14. A grey hound pursues a hare and takes 5 leaps for every 6 leaps of the hare; but 4 leaps of the hound are equal to 5 of the hare; compare the rates of the hound and hare.
a. 25 : 24 b. 24 : 25 c. 27 : 25 d. 25 : 30
15. The sides of a rectangle are whole numbers, both greater than 2. How many of the following could not be the area of the rectangle: 8, 9, 44, 15, 23?
a. 1 b. 2 c. 3 d. 4

16. Find the greatest value of xyz for positive values of x, y, z subject to the condition $yz + zx + xy = 12$
 a. 64 b. 8 c. 16 d. 32
17. If A can do as much work in 3 days as C in 4 days and B in 5 days as much as C in 6 days, How long will it take B to complete a piece of work which A can finish in 18 weeks?
 a. 18 b. 20 c. 22 d. 24

Directions : Questions 18 and 19 are based on the following notations.

(a, b, c, \dots) = Greatest Common Divisor of a, b, c, \dots

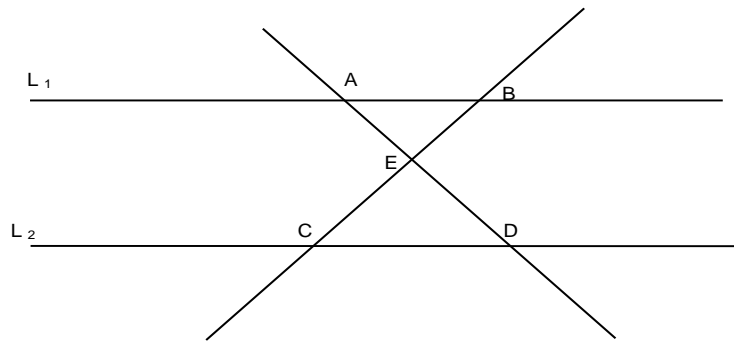
$[a, b, c, \dots]$ = Least Common Multiple of a, b, c, \dots

$\phi(n)$ = Total number of natural numbers less than n and relatively prime to n . Two numbers are said to be relatively prime if their GCD is 1

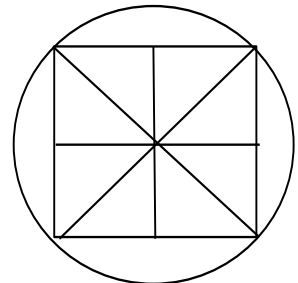
18. Which of the following is / are correct
 (I) There do not exist any real numbers a and b such that $(a, b) = 0$
 (II) Maximum value of (a, b) can be Maximum of a and b
 (III) $(a, b)[a, b] = a \times b$
 a. Only (I) b. Only II c. (I) and (III) d. (I) and (II)
19. If x, y and z are distinct numbers such that $(x, y, z) = y$ and $y = p$ a prime number, then which of the following is more correct
 a. $\phi(y) < \phi(x)$ b. $\phi[x, y, z] = p + 1$ c. $\phi[y, z] = \phi[x, y]$ d. $\phi(y) < \phi(z)$
20. The distance from the origin of a point in two dimensions is given by $D = \sqrt{x^2 + y^2}$. How far from the origin is the point $P = (2.98, 3.97)$?
 a. $4.50 < D < 4.75$ b. $4.75 < D < 5.00$
 c. $5.00 < D < 5.25$ d. $5.25 < D < 5.50$
21. The number of solution of $\sqrt{x+3} + \sqrt{x} = 1$, is
 a. two b. one c. none d. none of these
22. Ten litres are drawn out of a can full of milk and the can refilled with water. After this has been done four times, the resulting mixture contains milk and water in the ratio of 16:65. Find the capacity of the can.
 a. 20 litres b. 25 litres c. 30 litres d. 35 litres
23. A horizontal pipe for carrying flood water has diameter 1 meter. When water in it is 10 cm. deep, what is the breadth of the water surface?
 a. 60 cms b. 70 cm. c. 50 cm. d. 55 cms.
24. The value of $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \dots \cos 92^\circ$ is
 a. 0 b. 1 c. -1 d. none of these
25. Which one of the following holds?
 $1.7^7 > 1.3.5.7.9 \dots 13$
 $2.2^n > 1 + n\sqrt{2^{n-1}}$
 $3.1/(7+1) + 1/(7+2) + \dots + 1/(2.7) > 1/2$
 a. 1' b. 2 & 3 c. 3 & 1 d. all of these
26. Sum of n terms of following series will be:
 $(2n-1) + 2(2n-3) + 3(2n-5) + \dots$
 a. $1/6 n^2 (n+1) (2n+1)$ b. $1/6 n (n+1) (2n+1)$ c. $1/6 n (n+1) (2n+1)^2$ d. none of these
27. Four dice are rolled. The number of possible out comes in which at least one die shows 3 is
 a. 664 b. 665 c. 671 d. 1352
28. If $(a + 1/a)^2 = 3$, then $a^3 + 1/a^3$ equals
 a. 0 b. $3\sqrt{3}$ c. $10\sqrt{3} / 3$ d. $6\sqrt{3}$

29. If a triangle has sides of 1, $1-c$, and $1-2c$. What are the bounds for c ?
 a. -1, -1/3 b. -1, 1/3 c. -1/3, 1 d. 1/3, 1
30. ' a_n ' is the n th term of a GP. If $\sum a_{2n} = x$ and $\sum a_{2n+1} = y$. Then for $n=\{1,2,\dots,200\}$ the common ratio is a. x/y b. y/x c. $\sqrt{x/y}$ d. $\sqrt{y/x}$
31. A standard-sized cigarette can be rolled out of 6 standard-sized cigarette butts. How many cigarettes can be made and smoked from 36 butts?
 a. 6 b. 7 c. 6.5 d. 7.5
32. Bisectors of the interior angles formed by a transversal and two parallel lines form a
 a. Rectangle b. Square c. Rhombus d. None of these.
33. Two trains running at the rate of 75 km and 60 km an hour respectively on parallel rails in opposite direction, are observed to pass each other in 8 seconds and when they are running in the same direction at the same rates as before, a person sitting in the faster train observes that he passes the other in $31\frac{1}{2}$ seconds. Find the length of the trains.
 a. 168.75 m, 130.25 m b. 160.75 m, 131.25 m c. 168.75 m, 131.25 m d. None of these
34. What can be the maximum population of a country in which no two person have an identical set of teeth? Disregard the shape and size of teeth. Consider only the positioning of teeth in consideration. Also assume that there is no person without a tooth and no person has more than 32 teeth.
 a. $32!$ b. $32!.2$ c. $2^{32} - 1$ d. 2^{32}
35. $(x+1)^2 + (y-1)^2 = 0$. Then $x + y =$
 a. 0 b. 1 c. -1 d. 2
36. With a piece of wire, a boy can make a circle of radius 7 feet. How large an area could he enclose with the same piece of wire if he makes a square instead? (use $\pi = 22/7$)
 a. 49 sq.feet b. 36 sq.feet c. 121 sq.feet d. 44 sq.feet
37. The average of n consecutive whole numbers will always be a whole number if
 a. n is greater than 3 b. n is less than 5
 c. n is the square of a whole number d. n is odd
38. In how many different ways could couples be picked from 8 men and 5 women?
 a. 8 b. 5 c. 13 d. 40
39. Let p, q belongs to $\{1,2,3,4\}$. The number of equations of the form $px^2 + qx + 1 = 0$ having real roots is
 a. 15 b. 9 c. 7 d. 8
40. From a pack of 52 cards, all face cards are removed and four cards are drawn one by one without replacement. Then the probability that they are of same suite and different denomination is . . .
 a. $(9/10)^4$ b. $(9 \times 8 \times 7) / 10^3$ c. $10 \times 9 \times 8 \times 7 / {}^{40}C_4$ d. None of these.
41. The sum of two expressions is denoted by x . Twice the first expression is denoted by y . Then the square of the first minus the square of the second is denoted by
 a. $x(x - y)$ b. $x(x + y)$ c. $x(y - x)$ d. $x^2 - y^2$

42. In the figure, L_1 is parallel to L_2 .
If $AB = CD$, then



- a. ABE is an equilateral triangle
c. $AD = BC$
- b. $AC = BD$
d. $AC = AD$
43. You are given three consecutive natural numbers. Which of the following statements is(are) true?
I. Two of the numbers are even.
II. One of the numbers is divisible by 3.
III. The sum of the numbers is never divisible by 5.
a. I
b. II
c. I and II
d. II and III
44. In what time would A, B, C together do a work, if A alone could do it in 6 hours more, B alone in one hour more and C alone in twice the time?
a. 60 minutes
b. 40 minutes
c. 30 minutes
d. insufficient data
45. Jagadish divided his marbles into 3 equal piles and found he had 2 left over. When he tried to divide them into 5 equal piles, he had 1 left over. If he had more than 15 marbles what was the smallest number he could have?
a. 11
b. 41
c. 56
d. None of these.
46. If $y = x + (1/x)$, then $x^4 + x^3 - 4x^2 + x + 1 = 0$ becomes
a. $x^2(y^2 + y - 2) = 0$
b. $x^2(y^2 + y - 3) = 0$
c. $x^2(y^2 + y - 4) = 0$
d. $x^2(y^2 + y - 6) = 0$
47. I had about Rs. 14.40 in one rupee coins and 20 paise coins when I went out for shopping. When I returned, I found that number of 20 paise and 1 rupee coins are exactly as 1 rupee and 20 paise coins respectively, that I had originally. I came back with one third of what I had started out with. How many one rupee coins did I have initially?
a. 10
b. 12
c. 14
d. 16
48. Probability of not getting a sum of seven in a single throw with pair of dice is
a. $1/6$
b. $2/3$
c. $1/3$
d. $5/6$
49. The four squares in the diagram are congruent, each with sides of length one. What is the area of the circle which encloses them?
a. $\pi/2$
b. π
c. $3\pi/2$
d. 2π
50. We are given four positive numbers a, x, y and z. If $a < x$, $z > x$, $y > z$, then which of the following is false?
a. $a < y$
b. $y > x$
c. $x - a > y - a$
d. $2a < x + y$



Quantitative Ability Exercise 9A

1. A man gave 10% of his money to his wife, 10% of the remaining to his son and 10% of the rest to his daughter. He is now left with a sum of Rs.65,610. How much did his wife get?
a. Rs. 9,500 b. Rs. 8,000 c. Rs. 12,000 d. Rs. 9,000 e. none of these
2. If $a+b=2$ and a, c, b are in harmonic progression then the geometric mean of a and b is given by...
a. $c^{1/2}$ b. 1 c. $ab/2$
d. 2 e. can't be determined.
3. Fullyautomatix is the blacksmith of the village. He buys raw iron at 40 sesertii per pound and fabricates swords that weigh half a pound apiece, which he sells for 50 sesertii each. Now, 16.66% of the raw iron has to be wasted in making the swords, what is his profit when he sells 10 swords? (In sesertii)
a. 260 b. 240 c. 220 d. 180 e. 120
4. 25 men working 8 hours a day can complete a work in 20 days but after 2 days few more men join the team and all of them together finish the remaining $9/10^{\text{th}}$ work 6 days earlier by working 10 hours a day. Find the number of additional men.
a. 6 b. 4 c. 5 d. 12 e. 7
5. In a class there are 89 students who have an average age of 13. Of them, 25 are 12 yr. old and 20 others are of age 14. If the age of every student must be an integer, of the remaining what is the maximum number that can be of age 13 if all of them are aged more than or equal to 12yrs and less than 16 years?
a. 41 b. 35 c. 4
d. 13 e. can't be determined
6. When the price of rice falls by 25% a person can buy 10 kg more for Rs 300. If the price had fallen by 40%, how much more rice could he have bought for the same sum?
a. 25 kg b. 20 kg c. 12 kg d. 18 kg e. 15 kg
7. A merchant has 100 kg of apples. He sells some of them at 10% profit and the remaining at 15% profit. If he gains 12% overall, find how many apples he sold at 15% profit.
a. 60 kg b. 40 kg c. 100 kg d. 25 kg e. 75 kg
8. In a 19878m race Runbhau beats Bhagtaram by 9768m. In 98767m race Bhagtaram beats Padtaman by 4572m. By how many meters did Runbhau beat Padtaman in a race of 78987 m?
a. 7898 mm b. 8909 m c. 40 km
d. 8909 km e. insufficient data.
9. A, B, C move 100kg of grain from one godown to another in one day. A and C move 240 kg in 3 days. How many days will B take to move 100kg?
a. 3 days b. 4 days c. 5 days
d. 6 days e. can't be determined
10. Winespirix is a wine merchant in Alesia. He matures wine in sealed wooden casks of 10 litres each. The price of the wine increases by 20 sesertii per litre for every year of maturing, but at the same time 10% of the wine evaporates every year? If the price of a litre of fresh wine is 100 sesertii, what is the change in his profits if he sells a sealed cask after one year of maturing, rather than selling it fresh? (In sesertii)
a. 64 more b. 64 less c. 80 more
d. 80 less e. indeterminable
11. At a certain bank, compound interest is calculated only at the end of the year. What is the minimum number of years required to double a sum of money invested at 20% C.I.?
a. 4 b. 5 c. 6 d. 7 e. 8

12. Train X overtakes another train Y, which is of the same length, in 40 sec and crosses a platform 100m long in 10 sec. If the speed of train X is 90 km/hr, what is the speed of train Y (in km/hr)?
 a. 56 b. 58 c. 60 d. 63 e. 72
13. A sample of tea with C.P. Rs. 90 per kg is mixed with a tea with C.P. Rs. 80 per kg to make a mixture of 20 kg costing Rs. 1,700. What is the quantity of each?
 a. 8 and 12 kgs b. 5 and 15 kgs c. 15 and 5 kgs
 d. 10 and 10 kgs e. insufficient data
14. ABC is a triangle where A is (-2,1), B(3,1) and C(3,6). What is the type of the triangle?
 a. Obtuse-angled b. Isosceles c. Equilateral d. Scalene e. none of these
15. A man started walking from his home towards east. After 100m, he turned left and walked for another 100m. Again he took a turn in 180° and walked for 200m. Approximately, how far is he from his home now?
 a. 120m b. 140m c. 172m
 d. 200m e. can't be determined
16. What is the total of the two natural numbers with LCM = 36 and GCD = 6, if the numbers are in the ratio 2:3?
 a. 30 b. 10 c. 15
 d. 35 e. can't be determined.
17. The length of the parallel sides of a trapezium are 10 and 15cm respectively. The height is 8 cm. A square with maximum possible area is drawn inside the trapezium. What will be the ratio of the area of the square and the area of the trapezium itself?
 a. 16:20 b. 9:16 c. 16:25 d. 9:25 e. none of these
18. Two numbers bear ratio 3:5. If each of them is increased by 10, their ratio becomes 7:11. Find the larger number.
 a. 80 b. 60 c. 140
 d. 100 e. insufficient data
19. A convoy is moving at a certain speed. The last car suddenly starts moving at double the speed of the convoy to the front and returns to its position in one and half hours. If the convoy is moving at 30 km/hr, how long is the convoy? (in km)
 a. 25 b. 33.75 c. 35.25
 d. 37.45 e. indeterminable
20. A mixture consists of 3 substances with volumes in the ratio 4:5:6. The weight of equal volumes of these substances are in the ratio 7:8:9. What is the ratio of the weight of the three substances in the mixture?
 a. 14:20:27 b. 15:21:28 c. 14:20:25 d. 15:20:27 e. 15:21:27

Quantitative Ability Exercise 9B

1. The numerator of a fraction is multiple of two nos. One of the nos. is greater than other by 2. The greater no. is smaller than the denominator by 1. If the denominator is given as $5+c$ (c is a constant), then the minimum value of the fraction is
a. 2 b. -2 c. $-1/2$ d. $1/2$
2. In how many ways can 7 Englishmen and 7 Americans sit down at a round table, no two Americans being together ?
a. 3628800 b. 3826800 c. 3268800 d. cannot say

3 – 5 are based on following data:

In a locality of 400 people, there are three ways of saying Welcome: Namaste, Wandakam and Hello. No. of people who speak only one of these are 245. Out of every 16 only 1 speak all the three. An equal no. of people (5%) of the locality speak both Wandakam and Hello only, and Namaste and Wandakam only. The difference in the no. of people speaking Hello and Wandakam equals the no. of people speaking none of the words which in turn is twice the no. of people speaking both Namaste and Hello only. People who speak only Wandakam are 50.

3. The no. of people speaking only Hello are
a. 50 b. 70 c. 100 d. 175
4. The no. of people who speak none of the three words
a. 45 b. 32 c. 60 d. 80
5. The no. of people who speak Namaste or Wandakam are
a. 300 b. 240 c. 135 d. None of these
6. A family has several children. Each boy in this family has as many sisters as brothers but each girl has twice as many brothers as sisters. How many brothers and sisters are there?
a. 4 brothers, 3 sisters b. 3 brothers, 4 sisters
c. 4 brothers, 4 sisters d. cannot say
7. The flights from Delhi to Bombay and Delhi to Calcutta take $1\frac{3}{4}$ hours and 2 hour respectively. If the air flight distance from Delhi to Calcutta is 1300 km, and from Delhi to Bombay is 1225 km, find the ratio of average speeds of two flights (Delhi-Bombay : Delhi-Calcutta).
a. $14/13$ b. $13/14$ c. $15/14$ d. $14/15$
8. How many seven digit nos. divisible by 9 can be formed from single digit natural numbers without repetition of the digits?
a. $4 \times 7!$ b. $9! / 2$ c. $7!$ d. $2 \times 9!$
9. The number of diagonals of a polygon having 20 sides is
a. 170 b. 176 c. 190 d. 180
10. If $\sin\alpha$, $\cos\alpha$ are the roots of the equation $ax^2 + bx + c = 0$; (c not equal to 0) then
a. $a^2 - b^2 + 2ac = 0$ b. $(a+c)^2 = b^2 + c^2$
c. $a^2 + b^2 - 2ac = 0$ d. a & b both
11. Three cards are drawn at random from an ordinary pack. Find the probability that they will consist of a king, a queen and an ace.
a. $64/22100$ b. $64/20000$ c. $32/5000$ d. cannot say
12. A ball is rolled at 45° from the corner of a 3 m X 5m room and it continuously rolls of each wall at 45° angle. How far does it travel before reaching a corner at first time?
a. 15 b. $10\sqrt{2}$ c. $13\sqrt{2}$ d. $15\sqrt{2}$
13. A stock yields 5% to an investor. A fall of Rs.5 in its price causes a yield of $5\frac{1}{2}\%$ to it. What was its price ?
a. Rs. 50 b. Rs. 53 c. Rs. 54 d. Rs. 55

14. A car after traveling 45 Kms develops a snag and then proceeds at $\frac{2}{3}$ of its original speed to reach its destination 45 minutes late. Had the problem occur 54 Kms further on, it would have been delayed by only 27 minutes. Find the speed of the car and the distance.
 a. 90 Kmph, 180 kms
 b. 60 Kmph, 100 Kms
 c. 70 Kmph, 90 Kms
 d. 75 Kmph, 150 Kms
15. On the interval $[0,1]$ the function $x^{25}(1-x)^{75}$ takes its maximum value at the point
 a. 0
 b. $\frac{1}{4}$
 c. $\frac{1}{2}$
 d. $\frac{1}{3}$
16. A person bought an article and sold it at 6% profit. Had he bought this article for 4% less and sold for Rs. 1.90 more, his profit would have been 12%. How much did he buy it for?
 a. Rs. 120
 b. Rs. 85
 c. Rs. 155
 d. Rs. 125
17. The equation $\sqrt{x+3} - 4\sqrt{x-1} + \sqrt{x+8} - 6\sqrt{x-1} = 1$
 a. no solution
 b. only one solution
 c. only two solution
 d. more than two solution
18. If $y + \cos 2x = \sin 2x$ has a real solution, then
 a. $-1 \leq y \leq 1$
 b. $-\sqrt{2} \leq y \leq \sqrt{2}$
 c. $-2 \leq y \leq 2$
 d. $-\frac{1}{\sqrt{2}} \leq y \leq \frac{1}{\sqrt{2}}$
19. The intersection of a plane and a sphere can be which of the following?
 I. 2 points
 II. a circle
 III. an ellipse
 a. I only
 b. II only
 c. II and III only
 d. I and III only
20. If a, b, c, d are positive real numbers s.t. $a+b+c+d = x$, then which holds ?
 1. $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d} \geq \frac{16}{x}$
 2. $(x-a)(x-b)(x-c)(x-d) \geq 81abcd$
 3. $(x-a)(x-b)(x-c)(x-d) \leq \frac{81}{256} (x^4)$
 a. 1 & 2
 b. 2 & 3
 c. 3
 d. all of these
21. A, B and C enter into a partnership invest respectively Rs.1100, Rs.1300 and Rs.1700. After few months an additional capital of Rs.500 is needed which is invested by B. After 12 months they closed the business with a profit of Rs.2527. A's share of profit was Rs.627. B invested the additional capital after,
 a. 4 months
 b. 5 months
 c. 6 months
 d. 8 months
22. A mixture of 70 litres of wine and water contains 10 per cent of water. How much water must be added to make water 12.5% of the resulting mixture?
 a. 1 litre
 b. 2 litres
 c. 3 litres
 d. 4 litres
23. What will be the sum of first 24 terms of A.P. a_1, a_2, a_3, \dots , if $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$
 a. 975
 b. 950
 c. 900
 d. none of these
24. What are the times between 3 o'clock and 4 o'clock when the hands of a watch are equi-distance from the figure 3
 a. 15 and 24 minutes past 3
 b. $13\frac{11}{13}$, $16\frac{4}{11}$ minutes past 3
 c. $9\frac{1}{12}$ and $13\frac{11}{7}$ minutes past 3
 d. None of the above.
25. Values of x which satisfies $\left| \frac{10-x}{3} \right| < 2$ are
 a. $4 < x < 16$
 b. $-4 > x > -16$
 c. $4 > x > -16$
 d. $x < 16$.
26. A tradesman marks an article with a price which would give him a profit of 20% on the cost price. If the customer pays cash however, the tradesman makes a deduction of 5% from the marked price. Find the actual profit received from the sale of an article for which the tradesman is paid Rs.28.50.
 a. Rs. 2.50
 b. Rs. 3.50
 c. Rs. 4.50
 d. Rs. 5.50
27. A reservoir is 2 metres long, 1 metre broad and 0.5 metre deep. A flower pot requires 0.5 litre of water. How many such pots can be watered from the reservoir, if one litre of water contains $\frac{1}{1000}$ cu. m. ?
 a. 1000
 b. 2000
 c. 3000
 d. 4000

28. The L.C.M. and H.C.F. of two numbers are 4125 and 25 respectively. One number is 375. Find by how much is the second number less than the first.
a. 100 b. 50 c. 75 d. 25
29. If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ ($abc \neq 0$) is equal to sum of the squares of there reciprocals then a/c , b/a , c/b are in
a. AP b. GP c. HP d. none of these
30. In a certain community, the market value of taxable property was Rs.2,80,00,000. The property was assessed at 45% of the market value. (i) If the community needed a total of Rs.441,000 in taxes, what must be per cent tax rate? (ii) Find the tax on a house whose market value was Rs.52,000.
a. 4%, Rs. 819 b. 3.5%, Rs. 819
c. 5%, Rs. 819 d. 1.575%, Rs. 819
31. 'm' men and 'n' women are to be seated in a row so that no two women sit together. If $m > n$, then the number of ways in which they can be seated are,
a. $m! {}^{m+1}P_n$ b. $m! {}^mP_n$ c. $m! {}^mC_n$ d. none of these
32. If x, y and z are the sides of a triangle satisfying the condition that the sum of the products of two sides is 5, then the sum of the squares of it's sides lies in the interval
a. [5, 7.5] b. [5, 10] c. [10, 15] d. [5, 15]
33. A man standing on a platform notes that a train going in one direction takes 3 seconds to pass him; a train of the same length going in the opposite direction takes 4 seconds. How long did they take to pass each other?
a. 1 second b. 24 seconds c. $3\frac{3}{7}$ seconds d. cannot say
34. If two sides of a triangle are 7 and 8, which of the following cannot be the length of the altitude to the third side ?
a. 8 b. 7 c. 6 d. 4
35. Two clubs, Y and Z, have together x members; Y has y members; and Z has z members. If it is known that some people belong to both clubs, which expression gives the number of people who belong to only one club?
a. $x + y - z$ b. $2(y+z) - 2x$ c. $yz - x$ d. $2x - (y + z)$
36. What are the values of x that will satisfy the condition $1 < 3x - 5 < 10$
a. $2 < x < 5$ b. $x < 2$ or $x > 5$ c. $-2 > x > -5$ d. $\frac{1}{3} < x < 3\frac{1}{3}$
37. Two taps can separately fill a cistern in 20 and 30 minutes respectively. Each of the taps is opened for a minute in turn, but due to a hole in the bottom of the cistern, and discharge of the water through that it takes 3 minutes more to fill the cistern. If the cistern is full of water, find the time taken by the hole to empty it.
a. 3.6 hours b. 3.375 hours c. 3.8 hours d. 3.25 hours

Directions : Qns.38-39 : refer to the definitions of the following two operations.

$a \# b = ab + 1/ab$ and $c \## d = (c+1/c)(d+1/d)$, where a,b,c, and d are non-zero real numbers.

38. Which of the following is equal to $99 \# 1/99$?
a. $20 \# 20$ b. $5 \## \frac{1}{2}$ c. $\frac{1}{2} \# 2$ d. $10 \# 5$
39. Which expression is equivalent to $c \## d$?
a. $c \## (c \# d)$ b. $(c \# d) + (c \# 1/d)$ c. $c \# (c \# d)$ d. $c \# (d \## d)$
40. Oranges cost anywhere from 15 ps. per pound to 30 ps. per pound. What is the greatest number of pound of oranges you can buy with Rs.5?
a. 33 b. 20 c. 16 d. 17
41. How many arrangements can be made with the letters of the word " Independence" ? a.
479001600 b. 79833600 c. 1663200 d. 79833600

42. The equations of a pair of opposite sides of a parallelogram are given by the solutions of the equations $x^2 - 5x + 6 = 0$ and $y^2 - 6y + 5 = 0$. The equations of its diagonals are
a. $x + 4y = 13$ & $y = 4x - 7$
b. $4x + y = 13$ & $4y = x - 7$
c. $4x + y = 13$ & $y = 4x - 7$
d. $y - 4x = 13$ & $y + 4x = 7$
43. In the given figure if AB = 4 cms, and BC = 3 cms, then AE is equal to
a. 2.6
b. 5
c. 2.4
d. can't be determined.
-
44. The speed of motor boat of length 20 metres in water without current is 40 kms/hr. If the motor boat, sailing against a river current of 4 kms/hr crosses a temple on the bank in 10 seconds, find the length of the temple.
a. 70 m
b. 80 m
c. 350 m
d. 200 m
45. The cost of carpeting a room 6 metres long is Rs. 270. Had the room been 0.5 metres less wide, the cost would have been Rs. 240. The width of the room is,
a. 2.3 m
b. 3.5 m
c. 4.5 m
d. None of these
46. A shopkeeper spent Rs.1350 in purchasing wheat. After sometime one-third of it was spoiled which he had to sell at a loss of 10%. Find the percentage of profit at which he should sell the remaining stock of wheat so that he may make profit of 10% on the whole?
a. 25%
b. 20%
c. 10%
d. 15%
47. From the top of a building 60 metres high the angles of depression of the top and bottom of a tower are 30° and 60° respectively. The height of the tower is,
a. 20 m
b. 30 m
c. 40 m
d. 50 m
48. If x, y and z are integers and $\sqrt{xy} = z$, then
a. both x and y must be perfect squares
b. either x is a perfect square or y is a perfect square
c. z cannot be a perfect square
d. z has to be greater than zero.
49. Three identical dice are rolled. The probability that the same number will appear on each of them is
a. $1/6^3$
b. $1/36$
c. $25/36$
d. $20/36$
50. A survey shows that 63 % of the Indians like Hirithik and 76 % like Big B. If $x\%$ of the Indians like both Hirithik and Big B, then
a. $x = 39$
b. $x = 63$
c. $39 \leq x \leq 63$
d. None of these

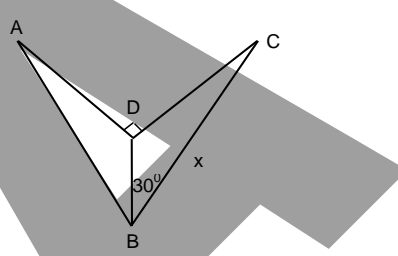
Quantitative Ability Exercise 10A


1. A man can buy 10 kg more rice when the price reduces by 10%. If the price increases by 12.5%, how much less can he buy for Rs. 1,800. What was the original price?
a. 15 kg, Rs.12 b. 10kg, Rs.20 c. 12kg, Rs. 15
d. 9 kg, Rs. 20 e. insufficient data
2. Mr. Batliboi invests some amount in gold. After one year he makes a profit of 100% on his investment and invests half of it in shares, where he makes a loss of 50%. If he invests the other half in gold again, what is the profit %age profit that he must make on his gold investment to have an overall profit of 100% on his original amount?
a. 25 b. 50 c. 75 d. 100 e. 200
3. Two men and 3 women can do a piece of work in 3 days working 8 hrs/day. 3 women and 3 men can do the same work in 2 days when they work for 9 hrs/day. Find out how many men working along with 3 women can complete the same work in 2 days when they all work for 6 hrs/day.
a. Five b. Four c. Eight d. Six e. Nine.
4. A cistern can be filled separately by two pipes A and B in 40 minutes and 30 minutes respectively. A tap C at the bottom can empty the full cistern in 60 minutes. Taps A and B are opened at 3:10pm and tap C is opened 10 minutes later. Find when the cistern will be full.
a. 4:00pm b. 3:40pm c. 3:20pm
d. 3:30pm e. none of these.
5. Some birds are perched on a clothesline. The distance between the 2nd and the 3rd bird is square of the distance between the 1st and the 2nd while that between the 4th and 5th bird is square of distance between the 3rd and 4th bird, and so on. If the distance between the 1st and 10th bird is same as the distance between the 5th and the 14th bird then the distance between the 1st and 3rd bird is....
a. 1 b. 2 c. 3
d. 4 e. can't be determined
6. A man lent some money in the ratio 1:2 at 5% SI and 8% SI respectively. His total income after 2 years was Rs.420. Find the total sum.
a. Rs. 1000. b. Rs. 4500 c. Rs. 3000
d. Rs. 1500 e. none of these
7. What is the angle between the hands of the clock at 10:36 p.m.?
a. 104 b. 98 c. 100
d. 102 e. insufficient data
8. The ratio of milk to water in a mixture is 9:1. Some water is mixed in it and now the new mixture contains 80% milk. If the initial mixture was 2 liters, how much water is mixed?
a. 250 ml b. 300 ml c. 400 ml d. 500 ml e. 350 ml
9. A coconut tree 100f is inclined with the ground at 60°. If vertical sun rays fall on the tree, what will be the length of the shadow of the tree?
a. $100/\sqrt{3}$ ft b. $100\sqrt{3}$ ft c. 50 ft
d. $50\sqrt{3}$ ft e. none of these
10. Three brothers had their ages in the ratio 1:2:4 an year back. Five years hence, their ages will be in the ratio 3:4:6. What are their present ages?
a. 2,3,5 b. 7, 11, 19 c. 3,6,12 d. 4,7,13 e. 12,24,48
11. A man rows 8 km upstream and back in 4 hrs. If the speed of the stream is 25% of the man's speed in still water, what is the speed of the man in still water? (in km/hr)
a. 3.87 b. 4 c. 4.75
d. 4.27 e. indeterminable

12. Suketu is a Colombian drug lord. He buys heroin in Columbia at Rs. 10 lakh per kg and sells it in Mexico at Rs. 20 lakh per kg in consignments of 150 kg. But as the travails of the trade are, every time one third of his consignments are seized by the authorities. If out of his profits he plans to buy a luxury yacht, which costs Rs. 600 crore, how many consignments have to be sent by him?
- a. 12 b. 20 c. 80 d. 120 e. 150
13. On a sum of Rs. 1000, the CI for 2 years is twice the SI for 2 yrs when rate is 11%. Find the rate at which the interest is compounded.
- a. 13.33% b. 21.11% c. 20%
d. 21.333% e. can't be determined
14. Two successive discounts of 10% and 15% respectively on an item of marked price Rs. 1000 will have a SP of....
- a. Rs. 775 b. Rs. 700 c. Rs. 800
d. Rs. 765 e. none of these
15. Length and width of a rectangle is respectively L and W. The width is 65% of the length. If the width is increased by 20%, by what percent will the perimeter increase?
- a. 8.3% b. 7.4% c. 8.6%
d. 7.8% e. none of these.
16. Divide Rs. 23100 into three parts such that the difference between the greatest and the least part is twice that between the 2nd least and the least, and the ratio of the least amount to the greatest is 3:4.
- a. 6000, 7700, 9400 b. 8800, 7700, 6600
c. 9200, 7000, 6900 d. 11100, 8000, 4000 e. none of these
17. A and B individually can complete a work in 3 and 4 days respectively. But when they work together, their rate of work reduces by $\frac{1}{4}$ th and $\frac{1}{3}$ rd respectively. When they work with C, their reduced rate improves by $\frac{1}{3}$ and $\frac{1}{2}$ respectively. How many days would they require to complete the work if all 3 work together and if C takes 12 days to complete the work?
- a. 1.5 b. 2.5 c. 3 d. 2 e. 1
18. A circular 2 feet wide grass walk surrounds a circular pond 100 feet in diameter. What is the area covered by the walk?
- a. 202π b. 204π c. 804π
d. 404π e. none of these.
19. Karim wants to donate some hens to 14 fakirs, cows among 11 Brahmins and some goats to 12 churches. At the market, he finds that with every cow, he is getting a hen free and also a discount on the purchase of one goat. Hence he decides to buy equal number of cows and goats. What is the minimum number of cows or goats that he should buy so that he is left with enough to gift a cow, a hen and a goat to each of his 5 sisters. How many cows does Karim gift to each Brahmin?
- a. 924, 12 b. 924, 80 c. 929, 12
d. 929, 84 e. none of these
20. A, B and C are riding down to Never Never Land. A's speed is half of that of B and three fourths of that of C. If B takes 10 hrs, how much time will C take?
- a. 15 b. 12 c. 18
d. 14 e. indeterminable

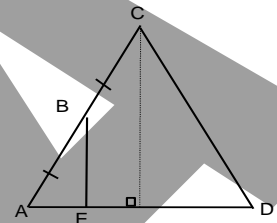
Quantitative Ability Exercise 10B

1. The sixth term from the end in the expansion of $(5x^2/4 - 2x/5)^{11}$
 a. ${}^{11}C_5 x^{16}/80$ b. $-{}^{11}C_5 5x^{17}/128$ c. ${}^{11}C_5 5x^{17}/128$ d. None of these
 2. The range of the values of x for which $\frac{2x^2 + x - 1}{x^2 - 5x + 6} < 0$
 a. $-1 < x < 1/2$ b. $2 < x < 3$ c. Either a. or b. d. Both a. and b.
 3. A, B and C start at the same time from the same point. in the same direction to walk round a circular course of 12 km A, B and C walk respectively at the rate of 3, 7, and 13 km an hour In what time will they come together again?
 a. 6 hours b. 15 hours c. 16 hours d. 21 hours
 4. A certain card game has a special pack. If you deal out evenly to five players there are two cards left undealt. Same is true if you deal to seven players. If the cards are dealt to three players there is one left undealt. Then the number of cards that can not be there in the pack are
 a. 37 b. 142 c. 247 d. 107
 5. A man borrows some money on compound interest and returns it in two years in equal installments. If the rate of interest is 5% and yearly installment is Rs.441, find the principal.
 a. Rs. 820 b. Rs. 800 c. Rs. 830 d. Rs. 835
 6. What is the minimum area of the rectangle needed to completely enclose four circles of which any two of them can intersect atmost at one point and each of area πa^2 ?
 a. $2a^2\pi^2$ b. $16a^2$ c. $4a^2/\pi$ d. $2a\pi$
 7. If $x^4 + 1/x^4 = 727$, then the value of $x^3 - 1/x^3$ is
 a. 0 b. unique c. 625 d. -140
 8. It is possible to fill in the remaining squares in the figure so all the rows and all the columns have the same sum. What would be the entry in the middle square?
 a. 0 b. 5 c. 8 d. 12
- | | | |
|----|----|----|
| 15 | | 10 |
| | | |
| | 25 | |
9. At a party, group of six is to be formed out of ten boys and seven girls, so as to include 50 % of boys and 50 % of girls. Two of the girls refused to join the group. The number of ways in which the group can be formed is
 a. 1200 b. 1800 c. 2400 d. 1600
 10. If petrol costs 30 ps. per gallon or 40 ps. per gallon, how far can a driver who uses equal amounts of the two kinds of petrol drive for Rs.3.50? He gets 15 miles to the gallon on the average.
 a. 100 miles b. 200 miles c. 150 miles d. 35 miles
 11. Two circles with radius 4 cm and 8 cm and centres P and Q are such that $PQ = 15$. transverse common tangents AB and CD meet in E. If A is the point on small circle, then $AE = ?$
 a. 9 b. 3 c. 6 d. 5
 12. A servant was engaged on the condition that he would get Rs.3000 and a bicycle at the end of the year. He worked for eight months. For his work he was given a bicycle and Rs.1700. The cost of the bicycle is (in Rs.)
 a. 600 b. 1200 c. 900 d. 850

13. If x satisfies the inequality $|x-3| + |x-4| + |x-5| \geq 12$, then
 a. $0 \leq x \leq 8$ b. $x \leq 0$ or $x \geq 8$ c. $x \leq -6$ or $x \geq 5$ d. None of these
14. The third term in the expansion of $\frac{\sqrt{1-x/3}}{(2+4x)^2}$ is
 a. $1311x^2/288$ b. $11x^2/3$ c. $11x/3$ d. $1311x/288$
15. Let A be the set of integers $\{1, 11, 21, 31, \dots, 441, 451\}$ and $R \subset A$ such that no two elements of R add up to 452. The maximum possible number of elements in R are
 a. 22 b. 23 c. 24 d. 45
16. While dialing a telephone number, Suyodhan forgot the last two digits, remembering only that they were different. He dials the number at random. If he takes one trial, what is the probability of dialing the correct number.
 a. $1/100$ b. $1/50$ c. $1/45$ d. $1/90$.
17. In the diagram, if triangle ABD and triangle CBD are congruent, what is the length of DC?
 a. $(x\sqrt{3})/4$ b. $2x/5$
 c. $x/3$ d. $x\sqrt{2}/2$
- 
18. The value of a for which the sum of the squares of the roots of the equation $x^2 - (a-2)x - a - 1 = 0$ assume least value is.
 a. 0 b. 1 c. 2 d. 3
19. We are given the following two definitions:
 $r \square s = (r+1)/s$ $r \blacklozenge s = (s+1)/r$ Then $a \square b =$
 a. $a \blacklozenge b$ b. $b \blacklozenge a$ c. $(a-1) \blacklozenge (b-1)$ d. $(a/b) \blacklozenge a$
20. A cistern can be filled by two pipes in 18 and 24 minutes. The third pipe can empty it in 12 minutes. If $1/6$ cistern is already full, in how much time will the cistern be filled?
 a. 1 hour b. 2 hours c. 3 hours d. 4 hours
21. An urn contains 1 rupee coins, 50 paise coins, 25 paise coins and 10 paise coins. The total number of coins in the urn is 840. If their values are in the ratio of 2,3,4 and 6, then find the number of 1 rupee coins.
 a. 16 b. 17 c. 18 d. 20
22. The equation $3^{x-1} + 5^{x-1} = 34$ has
 a. no solution b. one solution
 c. two solution d. more than two solution
23. If the expression $2^{3n+3} - 7n - 8$ is divisible by 49, then n is
 a. a natural number b. any integer c. not possible d. none of these
24. If x satisfies the inequality $|x-2| + |x-4| + |x-6| \geq 12$
 a. $0 \leq x \leq 8$ b. $x \leq 0$ or $x \geq 8$ c. $x \leq -4$ or $x \geq 6$ d. none of these
25. A copper wire 0.5 cm in diameter is evenly wound about a cylinder of length 12 cm. and diameter 10cm, so as to cover the whole surface. The length of wire is
 a. 7.54 m b. 800 cm c. 16 m d. 18 m.
26. If 6 persons spend Rs.750 in 10 weeks on their meals, what would be the expenditure of 18 persons for 12 weeks, assuming that the meals cost the same throughout?
 a. Rs. 2700 b. Rs. 2800 c. Rs. 2900 d. Rs. 3000
27. 2 men and 7 boys complete a work in 14 days. 3 men and 8 boys complete a work in 11 days. In how many days will 4 men and 14 boys complete work?

- a. 5 b. 6 c. 7 d. 8
28. If $a_1, a_2, \dots, a_{2n+1}$ are in AP and $a_{n+1} = 100$, then $a_1 + a_{2n+1}$ is
 a. 200 b. 100 c. 50 d. none of these
29. Line X and line Y in the diagram are parallel. Which of the following equals the area of II divided by the area of I?
 a. 2 b. 1
 c. $\frac{3}{4}$ d. $\frac{1}{5}$
- 
30. A bicycle manufacturer prints in his list a price which would give him a profit of 60% on the cost of manufacture, and then allows for cash payment, a discount of 22% of the list price. What profit percent does he actually make on cash payment?
 a. 23.8% b. 24.8% c. 25.8% d. 26.8%
31. The average age of 10 members of a committee is the same as it was 4 years ago, because an old member has been replaced by a young member. Find how much younger is the new member than the old member.
 a. 35 years b. 37 years c. 36 years d. 40 years
32. Suraj Bhan borrowed Rs.2000 from Ram Kishan at 8% per annum. After 6 years, he cleared the account by giving Rs.2500 and a watch. Find the cost of the watch.
 a. Rs. 450 b. Rs. 460 c. Rs. 470 d. Rs. 480
33. The number of times the digit 3 will be written when listing integers from 1 to 1000 is
 a. 269 b. 300 c. 271 d. 302
34. If A_n is the size of an interior angle of a regular n sided figure, what is $6A_6/5A_5$?
 a. $\frac{2}{3}$ b. 1 c. $\frac{4}{3}$ d. $\frac{5}{3}$
35. A train traveling at the rate of 40 km per hour while inside a tunnel meets another train of half its length traveling at 60 km per hr and crosses it completely in $4\frac{1}{2}$ seconds. Find the length of the tunnel if the first train passes completely through it in 4 minutes $37\frac{1}{2}$ seconds.
 a. 2000 m b. 3000 m c. 4000 m d. 5000 m
36. A bath can be filled by the cold water pipe in 9 minutes and by the hot water pipe in $11\frac{1}{4}$ minutes. A person leaves the bath room after turning on both the pipes simultaneously and return the moment when the bath should be full. Finding, however, that the waste pipe has been open, he now closes it. In $3\frac{3}{4}$ minutes more, the bath is full. In what time would the waste pipe empty it?
 a. 6 minutes b. 7 minutes c. $6\frac{2}{3}$ minutes d. $7\frac{2}{3}$ minutes
37. A lawn mower can cut 10 square yards in one minute. If the mower takes a half an hour to mow a certain lawn, and it costs Rs.3.00 to fertilize the same lawn, how much does fertilizer cost per square yard?
 a. 1 ps. b. 5 ps. c. 3 ps. d. $\frac{1}{3}$ ps.
38. A and B entered in to a partnership. B invested Rs.500 more than A. The capital of A remained in business for 5 months and the capital of B remained in business for 1 month more than the capital of A. If the total profit is Rs.2600 and A gets Rs.600 less than B, find the capital of B.
 a. Rs. 1500 b. Rs. 2000 c. Rs. 2500 d. Rs. 3000
39. The cost price of four qualities of tea are Rs.12, Rs.15, Rs.18 and Rs.21 per kg respectively. If they are mixed in the ratio 4:3:2:1, find the selling price of the mixture per kg in order to make a profit of 10 p.c.
 a. Rs. 16.50 b. Rs. 17.00 c. Rs. 17.50 d. Rs. 18.00

40. A single tennis tournament is held in which 30 men participate. If a player is eliminated as soon as he loses a match, how many matches are required to determine the winner?
a. 29 b. 30 c. 31 d. 32
41. Two equal sums of money are lent out at the same time at 8 percent and 7 percent per year simple interest. The former is recovered 6 months earlier than the later and the amount in each case is Rs.2560. Find the sum and time for which the sums of money are lent out?
a. Rs. 1500, 3.5 years, 4 years b. Rs. 2000, 5 years, 5.5 years
c. Rs. 2000, 3.5 years, 4 years d. Rs. 2000, 4 years, 4.5 years
42. Find the number of ways, in which 16 apples can be distributed among four persons so that each of them gets at least one apple,
a. $16^4 - 1$ b. $2^{16} - 1$ c. ${}^{15}C_3$ d. none of these
43. Any four digit number formed by repeating a two digit number is always divisible by
a. 7 b. 11 c. 101 d. None of these
44. In the diagram, $AC = CD = DA$, $AB = BC$, and BE is the perpendicular to DA . If the length of AE is 1, what is the area of triangle ACD ?
a. $\sqrt{3}$ b. $2\sqrt{3}$
c. $3\sqrt{3}$ d. $4\sqrt{3}$
45. Let α and β be the roots of the equation $x^2 + x + 1 = 0$. The equation whose roots are α^{19}, β^7 is
a. $x^2 - x - 1 = 0$ b. $x^2 - x + 1 = 0$ c. $x^2 + x - 1 = 0$ d. $x^2 + x + 1 = 0$
46. A train going from Pune to Bangalore stops at nine intermediate stations. Six persons enter the train during the journey with six different tickets. How many different sets of tickets they can have?
a. ${}^{45}C_6$ b. 6! c. 9C_6 d. none of these
47. If the lengths of the sides of triangle are 3,5,7 then the largest angle of the triangle is
a. $\pi/2$ b. $5\pi/6$ c. $2\pi/3$ d. $3\pi/4$
48. The digit in the unit place of $(3^3)^{4N} + 1$, where N is any natural number is
a. 1 b. 2 c. 7 d. 9
49. A vessel contains 180 liters of wine, 60 litres are taken out of the vessel every day and equal quantity of water put in. What quantity of wine remains at the end of 3 days?
a. 52 litres b. 52.5 litres c. 54 litres d. 53.3 litres
50. A farmer bought some mules at Rs.50 each, sheep at Rs.40 each, goats at Rs.25 each and pigs at Rs.10 each. The average price of the animals per head worked to Rs. 30. How many goats did he buy?
a. 1 b. 2 c. 3 d. 5



Answers

Exercise 1A

1. c	2. a	3. e	4. b	5. a	6. b	7. e	8. a	9. d	10.b
11.d	12.c	13.c	14.d	15.a	16.c	17.d	18.b	19.a	20.c

Exercise 1B

1. a	2. a	3. b	4. b	5. c	6. a	7.a	8. b	9. c	10.c
11. a	12. a	13. b	14. d	15. c	16. a	17. d	18. c	19. c	20. c
21. d	22. a	23. a	24. c	25. c	26. c	27. c	28. b	29. a	30. c
31. c	32. b	33. b	34. b	35. d	36. d	37. b	38. b	39. d	40. b
41. a	42. c	43. c	44. d	45. d	46. d	47. b	48. d	49. d	50. c

Exercise 2A

1. d	2. c	3. b	4. a	5. d	6. a	7. a	8. a	9. d	10.c
11.b	12.a	13.d	14. a	15.e	16.e	17.b	18.d	19.b	20.d

Exercise 2B

1. b	2. c	3. b	4. c	5. b	6. d	7. c	8. c	9. c	10. a
11. a	12. b	13. a	14. d	15. b	16. b	17. b	18. d	19. a	20. b
21. d	22. c	23. d	24. d	25. c	26. a	27. b	28. b	29. a	30. c
31. b	32. d	33. d	34. b	35. c	36. d	37. c	38. c	39. a	40. b
41. c	42. c	43. c	44. a	45. b	46. d	47. a	48. c	49. d	50. d

Exercise 3A

1. b	2. b	3.a	4.b	5.b	6.a	7. b	8.a	9.c	10.d
11.d	12.c	13.b	14.a	15.b	16.a	17.c	18.c	19.e	20.d

Exercise 3B

1. d	2. a	3. d	4. d	5. c	6. c	7. a	8. c	9. b	10. d
11. b	12. c	13. a	14. a	15. c	16. d	17. a	18. b	19. b	20. a
21. c	22. b	23. b	24. c	25. a	26. a	27. d	28. c	29. b	30. b
31. d	32. c	33. b	34. b	35. a	36. d	37. c	38. b	39. c	40. a
41. d	42. a	43. c	44. a	45. d	46. b	47. c	48. c	49. a	50. c

Exercise 4A

1. a	2. b	3. a	4. d	5. c	6. c	7. d	8. b	9. d	10.b
11.c	12.b	13.a	14.c	15.a	16.c	17.c	18.b	19.d	20.a

Exercise 4B

1. b	2. b	3. a	4. b	5. c	6. a	7. d	8. d	9. c	10. b
11. c	12. b	13. c	14. b	15. d	16. a	17. c	18. c	19. c	20. b
21. b	22. d	23. d	24. b	25. b	26. b	27. b	28. c	29. c	30. c
31. c	32. c	33. a	34. b	35. b	36. c	37. c	38. c	39. a	40. d
41. a	42. d	43. d	44. d	45. a	46. a	47. b	48. b	49. c	50. d

Exercise 5A

1. d	2. d	3. a	4. b	5. c	6. b	7. b	8. c	9. a	10.c
11.e	12.a	13.c	14.b	15.d	16.b	17.a	18.b	19.d	20.b

Exercise 5B

1. a	2. b	3. d	4. b	5. b	6. c	7. a	8. d	9. a	10. b
11. b	12. d	13. b	14. d	15. d	16. a	17.b	18. d	19. b	20. a
21. c	22. b	23. b	24. c	25. b	26. b	27. c	28. c	29. b	30. a
31. a	32. b	33. a	34. a	35. d	36. b	37. d	38. b	39. b	40. b
41.d	42. a	43. c	44. d	45.b	46. b	47. b	48. b	49. d	50. a

Exercise 6A

1. b	2. a	3. c	4. d	5. a	6. b	7. d	8.c	9.c	10.b
11.c	12.b	13.d	14.c	15.c	16.e	17.d	18.b	19.b	20.c

Exercise 6B

1. d	2. b	3. b	4. c	5. b	6. c	7. b	8. d	9. c	10. b
11. d	12. a	13. d	14. a	15. c	16. c	17. d	18. d	19. b	20. d
21. b	22. b	23. d	24. d	25. d	26. c	27. a	28. a	29. b	30. c
31. c	32. a	33. a	34. b	35. c	36. d	37. c	38. d	39. d	40. a
41. b	42. b	43. c	44. d	45. b	46. c	47. c	48. c	49. d	50. c

Exercise 7A

1. c	2. d	3. b	4. b	5. b	6. d	7. a	8. d	9. a	10. d
11. c	12. d	13. c	14. a	15. a	16. d	17. b	18. d	19. c	20. c

Exercise 7B

1. b	2. a	3. a	4. a	5. a	6. c	7. c	8. b	9. a	10. b
11. c	12. b	13. a	14. d	15. d	16. c	17. a	18. a	19. b	20. b
21. b	22. a	23. b	24. b	25. c	26. d	27. d	28. b	29. d	30. b
31. c	32. b	33. a	34. a	35. b	36. c	37. c	38. a	39. c	40. b
41. c	42. b	43. d	44. c	45. b	46. d	47. b	48. a	49. c	50. d

Exercise 8A

1. b	2. c	3. d	4. c	5. d	6. b	7. c	8. b	9. c	10. b
11. c	12. b	13. d	14. c	15. b	16. a	17. a	18. c	19. c	20. b

Exercise 8B

1. b	2. a	3. d	4. a	5. a	6. c	7. b	8. b	9. c	10. b
11. b	12. b	13. a	14. a	15. b	16. b	17. b	18. c	19. c	20. b
21. c	22. c	23. a	24. a	25. d	26. b	27. c	28. a	29. b	30. b
31. b	32. a	33. c	34. c	35. a	36. c	37. d	38. d	39. c	40. d
41. c	42. b	43. b	44. b	45. d	46. d	47. c	48. d	49. d	50. c

Exercise 9A

1. d	2. a	3. a	4. c	5. a	6. b	7. b	8. c	9. c	10. c
11. a	12. d	13. d	14. b	15. b	16. a	17. c	18. d	19. b	20. a

Exercise 9B

1. c	2. a	3. c	4. c	5. b	6. a	7. a	8. a	9. a	10. d
11. a	12. d	13. d	14. a	15. b	16. d	17. d	18. b	19. b	20. d
21. a	22. b	23. c	24. b	25. a	26. b	27. b	28. a	29. c	30. b
31. a	32. d	33. c	34. a	35. d	36. a	37. b	38. c	39. b	40. a
41. c	42. c	43. c	44. b	45. c	46. b	47. c	48. d	49. b	50. c

Exercise 10A

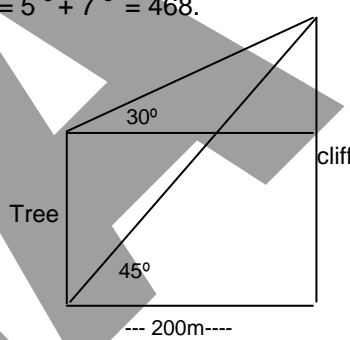
1. b	2. b	3. a	4. d	5. e	6. c	7. d	8. a	9. c	10. d
11. d	12. d	13. c	14. d	15. d	16. b	17. a	18. b	19. d	20. a

Exercise 10B

1. a	2. c	3. a	4. d	5. a	6. b	7. d	8. a	9. a	10. c
11. b	12. c	13. b	14. a	15. b	16. d	17. d	18. b	19. b	20. a
21. d	22. b	23. a	24. b	25. a	26. a	27. c	28. a	29. d	30. b
31. d	32. b	33. b	34. c	35. b	36. c	37. a	38. b	39. a	40. a
41. c	42. c	43. c	44. d	45. d	46. a	47. c	48. b	49. d	50. b

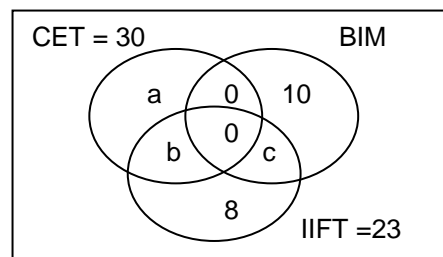
SOLUTIONS

EXERCISE – 1A

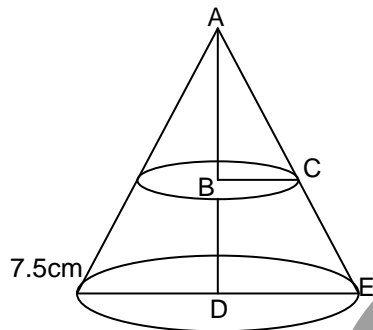
1. Ans. c., If the SP is Rs80, and the loss is 20%, then the CP has to be Rs100.
 2. Ans a..Let b,g and r be the speeds at which Babu, Govind and Ramu can push the cart respectively. So we have $b+g=5$ and $g+r=6$, $g = 3$. Thus $b + g + r = 8$. Thus time taken = 1hr 15 minutes.
 3. Ans e. Out of the total profit, say x, 30% goes to A, as he is the working partner and the remaining 70% is distributed among the three A, B and C in the ratio of their equivalent capitals (the capital investments done for a definite time period) which comes out to be 1:8:6. So, A's share comprises of 30% of x and $\frac{1}{15}$ of 70% of x, which is given as Rs.1040. So, x comes out to be Rs.3000.
 4. Ans. b., The expression can be written as $12^3 - 3 \cdot 5 \cdot 7 \cdot (5 + 7) = 5^3 + 7^3 = 468$.
 5. Ans a.
The height of the cliff will be 200m. The side opposite to the 30° angle will be $200/\sqrt{3}$. Thus the height of the tree will be $200 - 200/\sqrt{3}$.
- 
6. Ans. b.. The amount obtained by Ketan after selling the shares is $\text{Rs}27,400 + \text{Rs}2400 = 29,800$. Let number of shares be x. then brokerage paid by Ketan = $x/2$ every time he buys or sells the shares. Thus he pays a total brokerage of Rsx. Thus $13x - x = 2400$. Therefore $x = 200$. Thus the market price of each share is $27,400/200 = 137$.
 7. The condition given i.e., difference between ages of two neighboring brothers should be constant, cannot be satisfied as per the given information. A and B are twins, C is older than D but younger than A. So, A&B are the eldest, followed by C, followed by D.
Let us assume ages: A&B = 11 years; C = 10 years; D = 9 years.
It is not possible to arrange all four of them in a row in such a manner that the difference in the ages of any two adjacent brothers is constant. We can have some of the arrangements as 11, 11, 10, 9 or 11, 10, 9, 11 or 10, 11, 11, 9 etc., wherein the difference in ages of adjacent brothers varies from 0 to 2. So, the answer cannot be determined. Ans e.
 8. $\frac{2}{3}$ rd of the pot is initially filled with water therefore the total volume of the pebbles is equal to $\frac{1}{3}$ rd of the volume of the pot. Thus if r is the radius of the pot then $\frac{1}{3} \times 4\pi r^3/3 = 576 \times \frac{4}{3}\pi R^3$. Substituting $R = 1$, we get $r = 12$. Ans a..
 9. Using alligation we get the ratio in which the two types of sugars should mixed is 3:1 i.e. 72:24. Thus 72kgs should be mixed. Ans. d.
 10. Let the speeds be 2x and 3x. Thus relative speed is 5x. Since time taken is 10 seconds, the distance travelled i.e. the sum of lengths of both train is 50x. Thus length of each train is 25x. Now while passing the stationary train, the total distance travelled would be $500 + 25x$ in time 25. i.e. $(500 + 25x)/3x = 25$. Simplifying we get $x = 10$. Thus length of either train is 25x i.e. 250meters. Thus Ans.b..
 11. If selling price is same, and percentage profit in first transaction is equal to percentage loss in the second transaction, then, in the overall transaction, there is always a net loss, which is given by $(R/10)^2$, where R is the common loss or gain %. Using this formula, we get the loss in the overall transaction as $(15)^2/100 \% = 2.25\%$. Ans. d.

12. Ans. c., The profit is zero implies CP is same as SP. Thus if initial SP was Rs5, now it is 4 = CP. Thus initial profit is Re1 for Rs4 of CP i.e. 25%.

13. Ans. c.. From the figure, we can see that $a+b+10+c+8 = 58$. So, $a+b+c = 40$. $a+b = 30$, $b+c = 15$. From these equations, we get $c = 10$, $b = 5$ and $a = 25$.
Therefore, [only CET – only (CET + IIFT)]
 $= 25 - 5 = 20$



14.



Since area of circle with BC as radius is 154 sq.cm,
 $\pi(BC)^2 = 154$, so, $BC = 7$ cm
Triangles ABC and ADE are similar triangles.
Therefore, $AB/AD = BC/DE$
As $BC=7$ and DE is 14cm,
 $BC / DE = \frac{1}{2}$, so, AB / AD must also be $\frac{1}{2}$.
So, as $AD=15$, AB must be

Thus Ans. d.

15. Let the work $5 \times 12 \times 30$. Half of that is $5 \times 6 \times 30$.
Thus number of days taken $= 5 \times 6 \times 30 / (15 \times \frac{1}{2} \times 12) = 5$. Ans.a..

16. Using laws of indices, the answer is = 16 i.e. Ans. c.

17. Ans.d.. By formula $\theta = 6 (40 - (11 * 24) / 12) = 108^\circ$

18. Ans.b..

	Simple	Total	
Tough			
Marlie	19	6	25
Multiply by 2.	38	12	50
Bouncerdee	47	3	50
Final Paper	85	15	100

So, % of tough questions in final paper is 85.

19. Ans. a. Suppose the income was 30 then 10 came from this salary, $\frac{1}{5}^{\text{th}}$ of the remaining 20 i.e. 4 came from working at week-ends. $\frac{1}{2}$ of the remaining i.e. $\frac{1}{2}$ of 16 i.e. 8 came from the royalty of his book. The remaining 8 from the investments which is thus twice of the pay of week-end-work. He earns 1200 from weekend-work thus he earns 2400 from investments.

20. The relative speed when they are moving in same direction is 1 on the ratio scale and when they are moving in opposite directions, it is 5. For constant distance, the speed is inversely proportional to time therefore the required ratio is 5:1. Thus answer is (c).

EXERCISE – 1B

1. Ratio of the passengers is $\frac{1}{21} : \frac{1}{7} : \frac{1}{3} :: 1 : 3 : 7$
 $\therefore 11a = 385 \Rightarrow a = 35$, \therefore the number of I, II and III class passengers is 35 : 105 : 245.

2. Since $3^2 = 9$ and $0^2 = 0$, The digit in the unit place of the sum must be 9 therefore the digit in the square root is 3 or 7. The sum of the squares of the digits at thousands place ≥ 32 and $\leq 50 \therefore$ ans. 6467.

3. Favorable case is C wins .The probability of this is $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = 1/8$
4. Let x and y be the number of kgs of sugar of rates Rs 24 and Rs. 18 per kg respectively.
 $\therefore 24x + 18y = 0.99(x + y)20$, $\therefore 24x/y + 18 = 19.8(x/y + 1) \Rightarrow x/y = 3/7$.
5. Let t min past 3 , the minute hand be 4 min. behind the hour hand. Using the formula $t = (12/11)(m + x)$ or $(12/11)(m - x)$, substituting $m = 15$ m.s and $x = 4$ m.s, we get $t = (12/11)(15-4) = 12$ min.
 Ans. is c..
6. The images of graph $F1(x)$ taken once about x-axis, and then about y-axis is same as the graph $F2(x)$.Hence, $F2(x) = -F1(-x)$.
7. The total no. of terms in the expansion of the given binomial is $7 + 1 = 8$ (even).Hence, there'll be two mid-terms: $\frac{(7+1)}{2}$ th term and $\frac{(7+3)}{2}$ th term
 $T_4 = {}^7C_3(x/2)^4(-4/x)^3 = -{}^7C_3 4x$
 $T_5 = {}^7C_4(x/2)^3(-4/x)^4 = {}^7C_3 32/x$
8. Let the speed of the man in still water be m km/hr. and the speed of the current be s km/hr.
 $\therefore \frac{3}{4} = (m-s)(45/4)(1/60)$ and $\frac{3}{4} = (m+s)(15/2)(1/60)$
 $\therefore 15m - 15s = 60$ and $10m + 10s = 60 \Rightarrow m = 5$ km/hr.
9. Distance between two given points is 3 units. Since the area is 6 units it's second side must be 4 units. Hence third vertex can be (1, 2) or (1, - 6) or (-2, 2) or (-2, - 6).
10. $1, \omega, \omega^2$ are three cube roots of unity,
 $\therefore \omega^3 = 1$ and $1 + \omega + \omega^2 = 0$
 $1 - \omega + \omega^2 = -2\omega$
 $1 - \omega^2 + \omega^4 = 1 - \omega^2 + \omega = -2\omega^2$
 $1 - \omega^4 + \omega^8 = 1 - \omega + \omega^2 = -2\omega$ Thus each of the two consecutive terms pair up to give $4\omega^3 = 4$ For n terms we have, $4.4.4.....=4^{n/2} = 2^n$
11. Let he invests Rs x in 5% stock and Rs y in 4% stocks
 \therefore On Rs 132 he earns Rs 5. \therefore On Rs x he can earn Rs $5x / 132$
 Similarly, On Rs y he can earn Rs $4y / 99$
 $\therefore 5x / 132 = 4y / 99 \Rightarrow x / 16 = y / 15 = (x + y) / 31 = 6200 / 31$
 $\therefore x = \text{Rs}3200$ and $y = \text{Rs}3000$
12. Let $S = 1^2 + \frac{2^2}{2!} + \frac{3^2}{(2!)^2} + \frac{4^2}{(2!)^3} + \frac{5^2}{(2!)^4} + \dots$ (1)
 Put $1/(2!) = x$
 $\therefore S = 1 + 4x + 9x^2 + 16x^3 + \dots$ (2)
 Multiply (2) with x
 $\therefore xS = x + 4x^2 + 9x^3 + \dots$ (3)
 Subtracting (3) from (2) we get
 $(1-x)S = 1 + 3x + 5x^2 + 7x^3 + \dots$ (4)
 Multiply (4) with x
 $x(1-x)S = x + 3x^2 + 5x^3 + 7x^4 + \dots$ (5)
 Subtracting (5) from (4) we get
 $(1-x)^2 S = 1 + 2x + 2x^2 + 2x^3 + \dots$
 $= 1 + 2x/(1-x) = (1+x)/(1-x)$
 or $S = (1+x)/(1-x)^3$
 Put $x = 1/(2!)$
 $S = (1 + \frac{1}{2})/(1 - \frac{1}{2})^3$
 $= \frac{3/2}{1/8} = 12$
13. Minimum possible value of any expression inside mode is zero, so we will check for $x = 3, -2$, and $x=5$. At $x = 3$ we will get minimum value , which is 7

14. Given that $mn = 100$. $\therefore m$ and n can be any of the following pairs 25, 4 or 20, 5 or 50, 2 or 100, 1 whose sum is 29 or 25 or 52 or 101 but there are no factors of 100 whose sum can be 50. Hence answer is d.
15. Without leakage it can fill $1/3$ of the tank per hour and with leakage it can fill $2/7$ of the tank per hour \therefore leakage per hour = $(1/3 - 2/7) = 1/21$. \therefore Time taken to drain all the water = 21 hours.
16. In such problem it is easier to take any value for variable then substitute that value. Take $x = 1$
 $f(x) = x/\sqrt{1+x^2} \Rightarrow f(1) = 1/\sqrt{1+1^2} = 1/\sqrt{2}$,
 $f(1/\sqrt{2}) = 1/\sqrt{3}$, $f(1/\sqrt{3}) = 1/2$
 So, $f \circ f \circ f(1) = 1/2$,
 Now substitute $x = 1$ in given answer options, 1st option will be equal to $1/2$
17. Let $a = x/(x-1)$ and $b = x$
 Then $a + b = x/(x-1) + x = (x + x^2 - x)/(x-1) = x^2/(x-1)$
 Thus the given equation becomes $|a| + |b| = |a + b|$
 But this hold if and only if $ab \geq 0$ i.e. if and only if $x^2/(x-1) \geq 0$ i.e. if $x \in \{0\} \cup \{1, \infty\}$
18. Since the face cards are removed there will be 10 cards of each suit. Total number of ways of drawing four cards = ${}^{40}C_4$. Favorable number of cases will be $10 \times 9 \times 8 \times 7$. Hence the required probability is $10 \times 9 \times 8 \times 7 / {}^{40}C_4$
19. Let l and w be the amounts of liquid and water in the mixture.
 $\therefore (1.25)(15)l = 12.5(l + w) \Rightarrow 3(l) = 2(l + w) \therefore w/l = 3/2 - 1 = 1/2$.
20. The $(n+1)$ th term = $(a - n) + i(b - n)$, where $n \in W$
 If the term is real, $(b - n) = 0$, $b = n$
21. A, B and C's work per day is $1/90$, $1/40$ and $1/12$ respectively. Work done per cycle is $1/90 + 1/40 + 1/12 = 43/360$ and to complete the work A, B and C each have to work for 9 days. In 9 days A does $1/10$ th and B does $9/40$ th of the work. \therefore A's share = $1/10 \cdot 240 = \text{Rs. } 24$, B's share = $9/40 \cdot 240 = \text{Rs } 54$. \therefore C's share = Rs 162.
22. Let h and c be the original cost of the horse and cow respectively.
 $\therefore 620 + 260 = 1.1(h + c)$ and $630 + c = 0.9(h + c) \Rightarrow h + c = 800$ and $9h - c = 6300$.
 $\Rightarrow h = 710$ and $c = 90$.
23. Given points are the vertices of a right angled triangle with right angle at (a, a) . It's sides forming the right angle are a and a . $\therefore a^2/2 = 2 \Rightarrow a^2 = 4 \therefore a = \pm 2$.
24. Let the cost price of each article be Rs x , $\therefore (150x + 50) \times 1.38 = 12.5 \times 90 + 10 \times 60 = 1725$.
 $\therefore 150x + 50 = 1250 \Rightarrow x = \text{Rs } 8$.

25.

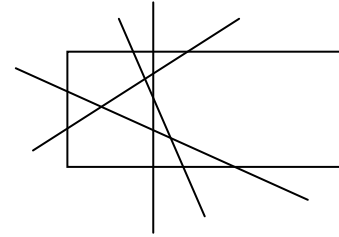
Persons	A	B	C
Investment / Period	Rs 5000 / 4 months	Rs 4500 / 6 months	Rs Nil / 6 months
Investment / Period	Rs 2500 / 8 months	Rs 3000 / 6 months	Rs 7000 / 6 months
Share in the profit	a	b	c

Since the share in the profit is proportional to Principal and period
 $a / (5000 \cdot 4 + 2500 \cdot 8) = b / (4500 \cdot 6 + 3000 \cdot 6) = c / (0 + 7000 \cdot 6)$
 $\Rightarrow a / 40 = b / 45 = c / 42 = (a+b+c) / 127 = 5080 / 127$
 $\therefore a = \text{Rs } 1600$, $b = \text{Rs } 1800$, $c = \text{Rs } 1680$.

26. Length of the largest hurdle = HCF of 15547, 17647, 3521 which is 7.
27. i. If $x \leq 1$ then, $1 - x + 2 - x + 3 - x \leq 6$; $x \geq 0$
 ii. If $1 < x \leq 2$ then, $x - 1 + 2 - x + 3 - x \leq 6$; $x \geq -2$

- iii. If $2 < x \leq 3$ then, $x - 1 + x - 2 + 3 - x \leq 6$; $x \leq 6$
 iv. If $x > 3$ then, $x - 1 + x - 2 + x - 3 \leq 6$; $x \leq 4$
 So, $0 \leq x \leq 4$
28. $A = P [1 + nr / 100]$, $\therefore 880 = P [1 + 2.5 / 100] = 110 / 100 \Rightarrow P = 800$
 S.I. on Rs 800 for one year = Rs.40, and interest on Rs 40 for one year = Rs 2
 \therefore Compound Interest after two years = 82 \therefore Amount = Rs 882.
29. Ram lost a bicycle worth Rs. 300 + Rs 50 given in cash to the tourist. \therefore In all, he lost Rs. 350.
30. The digits which shows some number when turned upside down are 0, 1, 6, 9, and 8. Of the choices 169 and 196 are the perfect squares containing these digits but when turned upside down these shows 691 and 961 of which $961 = 31^2$ is the only perfect square.
31. As product of terms equidistant from the centre is constant, $g_1 \cdot g_{2n+1} = g_2 \cdot g_{2n} = \dots = g_{n+1} \cdot g_{n+1} = g_{n+1}^2 = 2500$
32. Since there are seven days in a week and every eighth day is a rest day. His first and eighth rest days will be on the same day i.e. Tuesday. Ninth on Thursday, Tenth on Sat, 11th on Monday and 12th on Wednesday.
33. At $n = 1$, we get the first term as $a+b$. At $n = 2$, we get the sum of first two terms as $2a+4b$. Hence the common difference = $(2a+4b) - 2(a+b) = 2b$
34. Amount of water left in container $P = p - q / 3 - r / 2 = (6p - 2q - 3r) / 6$
35. Possible arrangements are,
 $1 \quad 1 \quad 3 \Rightarrow {}^5C_1 {}^4C_1 {}^3C_3 \cdot 3 = 60$
 $2 \quad 2 \quad 1 \Rightarrow {}^5C_2 {}^3C_2 {}^1C_1 \cdot 3 = 90$
 So total is 150 ways
36. Since sum of any two sides of a triangle is greater than the third side $\Rightarrow (r-1) + r > r + 1 \Rightarrow r > 2$
37. Out of 10 position select two, no. of ways = ${}^{10}C_2$. In these two positions A1 and A2 can be arranged in one way only. And on remaining, 8 candidates can be arrange in $8!$ ways. So total ways = ${}^{10}C_2 \cdot 8!$
38. Draw ZX parallel to AY
 $\therefore \Delta CZX \sim \Delta CAY \Rightarrow CZ / CA = ZX / AY$
 $\therefore 2/5 = 4/AY \Rightarrow AY = 10 \therefore B \equiv (0, 10)$.
39. By definition $A_3 = \{3, 6, 9, \dots\}$ and $A_5 = \{5, 10, 15, \dots\}$ and $A_{15} = \{15, 30, \dots\}$ clearly $A_3 \cap A_5 = A_{15}$
40. In four weeks his earning by over time = $432 - 160 \times 2.4 = 48$.
 \therefore Number of hours which he worked over time = $48 / 3.2 = 15 \therefore$ Total hours he worked = 175.
41. Required number of arrangements = ${}^7P_3 = 7! / 4! = 210$.
42. Number of diagonals of a polygon of n sides = ${}^nC_2 - n = n(n-3) / 2 = 10 \cdot 7 / 2 = 35$.
43. The equation $3x^2 + 2(a^2 + 1)x + (a^2 - 3a + 2) = 0$ will have two roots of opposite sign if it has real roots and the product of the roots is negative, that is ,
 if $4(a^2 + 1)^2 - 12(a^2 - 3a + 2) \geq 0$ and $(a^2 - 3a + 2) / 3 < 0$
 Both of these conditions are met if
 $a^2 - 3a + 2 < 0$ i.e. if $(a - 1)(a - 2) < 0$ or $1 < a < 2$

44. Since four lines can intersect maximum in six points and the maximum number of divisions are 11 and minimum number of divisions are 5.
(To be understood with the help of the adjacent figure)



45. $\log_{10} e + \log_e 10 = \log e / \log 10 + \log 10 / \log e$. If $\log e / \log 10 = x$, then the given expression can be written as $|x + 1/x| = (\sqrt{x} - 1/\sqrt{x})^2 + 2 \geq 0 + 2 = 2$. Hence the value of the given expression is always greater than 2.
46. Number of days = Field available / 100 = $22 \times 14 \times 14 / (7 \times 100) = 6.16$ days ≈ 6 days.
47. Required area = Area of the triangle - area of the sector = $\frac{\sqrt{3}}{2} - 60 \pi / 360 = (3\sqrt{3} - \pi) / 6$
48. Given expression will be meaningless if $a^2 - b^2 = 0$ or $b = 0 \Rightarrow a = \pm b$ or $b = 0$.
49. $2^{3015} = 2^3 \cdot 2^{3012} = 8(2^4)^{753} = 8(17 - 1)^{753} = 8[17^k - 1]$
9 will be the remainder. Ans.(d).
50. From the given data we get $a+b = 29$ (I). $b + c = 29$(II). $c+d = 42$...(III) and $d + e = 37$...(IV). From (I) and (II) $a = c$ and From III & IV $a - e = 5$. adding I to IV we get $a + e + 2(b+c+d) = 137$
 $\therefore a + e = 35$ and $a - e = 5 \Rightarrow a = 20, b = 9, c = 20, d = 22$ and $e = 15$.
 \therefore Total time = $20 + 9/3 + 20/5 + 22 + 15/5 = 52$ min.

EXERCISE – 2A

- Ans d. Let the initial amount of sugar be x kgs and rate per kg be 5r. Thus $5rx=50$ and $6r(x-2)=50$. Thus solving we get $x=12$.
- Ans. c., Profit drops by 5% which is equivalent to Rs.5. Thus 100% corresponds to Rs100 or the CP is Rs 100.
- Let the investment at 6% be x then at 8% it is $9000-x$. Thus the total interest is given by:
 $6.3.x/100 + 8.3.(9000-x) = 1800$. Solving we get $x = 6000$. Ans. b.
- The man bought 400 shares and when he sold them, he got Rs93,600. The 400 shares cost him Rs. 80,000. The brokerage he paid was $2 \times 800 = 1600$. Thus he is left with Rs 12,000. Ans.a..
- Zhansilal earned 12% on Rs.12,000 invested in blue stock which is Rs 1,440 and thus total earning for the year is Rs.2,640. Thus return on investment is $(2640/27000) \times 100 = 9.77\%$. Thus Ans.d.
- 2 in base 2 is 010 and 4 in base two is 100. Writing them next to one another gives us the binary conversion. Ans.a..
- The total volume of the cones will be given by: $\frac{1}{3}(\pi r^2 h_1 + \pi r^2 h_2) = \frac{1}{3}\pi r^2 (h_1 + h_2)$. Where h_1 and h_2 will be the respective heights which is nothing but the distance between the two vertices of the cones joined base to base which is given to be 12. Thus the volume will be $\frac{1}{3} \pi 7^2 \cdot 12 = 616 \text{ cm}^3$. Thus Ans. a.

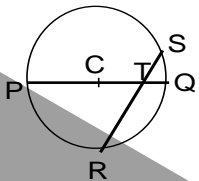
8. Ans. a., The extra time required will be the time required to cross 4 bogies when the trains are running in opposite directions. For 12 bogies, the time is 2 minutes therefore for 4 bogies it will be 40 seconds.
9. We first find x such that $G(x)=12$. I.e. $x(x-1)=12$. I.e. $x = 4$ or $x=-3$. Now $F(12) = F(G(4)) = 12$. Also $F(12) = F(G(-3)) = 5$. Thus answer is d.
10. CP is 50 and loss is 10% i.e. 5. Thus the SP is $50-5=45$. Ans c..
11. Ans. b.. Suppose B sells the berries at Rs30 per kg then A sells it as Rs20 per kg. Since B makes a profit of 20%, the CP of the berries will be Rs25 per kg. Thus A has a loss of Rs5 for every Rs25, thus the loss percentage is 20%.
12. $\log_5 64 = x$ i.e. $5^x = 64 = 8^2$. Thus $5^{x/2} = 8$. Therefore $\log_5 8 = x/2$. Ans. = a.
- 13.
-
- A 6 pointed star can be obtained by joining 6 rhombuses as shown:
Thus one of the angle of the rhombus has to be 60° and therefore its height will be $2\sqrt{3}$. Thus area of the rhombus will be $8\sqrt{3}$.
Thus area of the figure = $6 \times 8\sqrt{3}$.
Ans. d..
14. $U = 45 = X + Y$. $Y=5$. Therefore $X=40$. $S = 25 + 30 + 15 = 70$. Thus Overlap = $S - X = 30$. Overlap = II + 2III. So, $II + 2III = 30$, from which we get that if $II = 20$, then III must be 5. Ans. = a.
15. The perpendicular distance of point (3, 5) from the given line is the magnitude of $[(4 \times 3 - 3 \times 5) + 1] / \sqrt{(4^2 + 3^2)} = 2/5 = 0.4$. So, answer is e..
16. In 12 hours the minute hand and the hour hand are at right angles 22 times. Therefore in a week they will be $22 \times 2 \times 7 = 308$ times at right angle position. Ans e..
17. 177776 can be written as 2×88888 . Hence $5^{177776} = 25^{88888}$. Since the power is same in both the cases. Expression with the greater base will be greater. Ans b.
18. The interest earned on 4000 at 12% for 3 years should be same as the new principle at 0.5% per month i.e. 6% per year for 4 years. Employing the SI formula we get, new principle = 6000. Thus Ans.d..
19. The relative speed is 4kmph. Thus the dog will overtake the man by 4km in one hour. Thus he can overtake 300m in 4.5minutes. Ans b.
20. The two prices are 5 & 11. Mean price is 13. You cannot mix the two quantities, as the mean price does not lie between the prices. Ans d.

EXERCISE – 2B

1. Let the corresponding sides of the other triangle be a , b , and c
 $\therefore a/2 = b/3 = c/4 = (a+b+c) / 9 = 81/9 = 9$ \therefore Required sides are 18. cm ,27 cm and 36 cm.
2. Let the no. be $ababa$
Given $a + b = 10$
And $a^3 b^2$ has to be maximum.
 $\therefore a/3 = b/2$

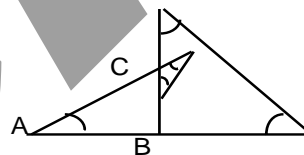
$$\Rightarrow a : b = 3 : 2$$

Hence, the no. is 64646

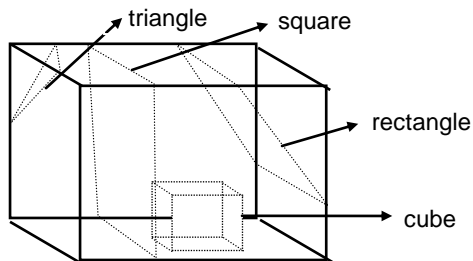
3. $a \times (1 + \frac{20}{100})^T > 2a \therefore (6/5)^T > 2$, which holds if $T = 4$ years.
4. Percentage of the candidates who failed in at least one subject $= n(M \cup E) = n(M) + n(E) - n(M \cap E) = 25 + 20 - 10 = 35 \therefore$ Percentage of the candidates who passed in both the subjects $= 65 \therefore 65x / 100 = 2600 \Rightarrow x = 4000$.
5. Sequence of numbers which are divisible by 8 and lies between 900 and 1700 is $\{904, 912, \dots, 1696\}$ which is an A.P. with first term 904, c.d. = 8 and the last term 1696. If there are n numbers between 900 and 1700 which are divisible by 8. $1696 = 904 + (n-1)8 \Rightarrow n - 1 = 99 \therefore n = 100$.
6. Let radius of the circle be r . $\therefore PT = 3r / 2$ and $TQ = r / 2$
 $\therefore (3r / 2) (r / 2) = 6 \times 2 = 12 \therefore 3r^2 / 4 = 12 \Rightarrow r^2 = 16 \therefore r = \pm 4$. Hence the diameter of the circle is 8 cm. But it is impossible to draw a chord of length 8 cm (other than the diameter) in a circle of diameter 8 cm. The circle must be imaginary.
 
7. Let cost of an apple and an orange be a and b respectively. and x and y be the number of apples and the oranges respectively. $\therefore ax + by = 17 \dots (I)$ and $bx + ay = 15 \dots (II)$. adding (I) & (II) we get $(a + b)(x + y) = 32$ and $x + y = 40 \Rightarrow a + b = \text{Rs } 0.80 = 80$ paise.
8. Let the person rides the bicycle for x km. $\therefore 8.5 = x / 12 + (72 - x) / 4.5 \Rightarrow x = 54$ kms.
9. From the figure it is clear that $\triangle BCF \sim \triangle EDF \Rightarrow BC/ED = CF/DF$ Since side of the square is 20 and $CF = 5 \therefore DF = 15 \therefore 6 / DE = 5 / 15 \Rightarrow DE = 18$.
10. Let he invests Rs. x and Rs. y respectively at 3% and 4% stocks. $\therefore x + y = 2400$ and $3x / 75 + 4y / 96 = 97.5 \Rightarrow 24x + 25y = 97.5 \times 24 \times 25$. Solving these two equations we get $x = \text{Rs. } 1500$ and $y = \text{Rs. } 900$.
11. In these type of problems, the place that is more restricted should be filled first. Unit digit place can be filled in two ways (by 3 or 5 only) while the hundred's place can be filled in three ways (by 2 or 3 or 5). Tenth place can be filled in four ways (all four digits can be used) Therefore starting from the unit's place we can form the nos. in $2 \times 4 \times 3 = 24$ ways.
12. $\log_2 x^2 + \log_x 2 = 3$
 or $2 / \log_x 2 + \log_x 2 = 3$
 or $(\log_x 2)^2 - 3(\log_x 2) + 2 = 0$
 Put $y = \log_x 2$
 $\therefore y^2 - 3y + 2 = 0$
 or $y = 1, 2$
 For $y = 1$, $\log_x 2 = 1$ or $x = 2$
 For $y = 2$, $\log_x 2 = 2$ or $x = \pm \sqrt{2}$
 Since the value of base can't be negative, then there are only two valid values of x : 1 and $\sqrt{2}$.
13. In one hour it will travel 41 km without stoppage and with stop it covers 27 kms. \therefore it stops for the time in which it will travel a distance of 14 km with speed 41 km / hr.
 \therefore time of stoppage $= 14 \times 60 / 40 \text{ min} \approx 20.5 \text{ min}$.
14. The two conditions possible are that either $a \leq c \leq b$ or $b \leq c \leq a$, as c is the arithmetic mean of a and b .
 If $a \leq c \leq b$, then $a!c!$ is the least and $b!c!$ is the greatest. If $b \leq c \leq a$, then $b!c!$ is the least and $a!c!$ is the greatest. So, I and II will not be always true. III is false as a , b and c could be equal numbers. Hence, the answer is (d).

15. There are 13 letters of which Fomanchu knows position of three correctly. This means that now he has to arrange only 10 letters. No. of ways in which these 10 letters can be arranged are $10!/(3! 3!)$.
Out of these there is only one arrangement of correct message. So the chance that he deciphers the message correctly is $\frac{1}{10!/(3! 3!)} = 36/10!$.
16. Let the pipe P be turned off in 't' minutes. $\therefore (1/24)t + 16(1/32) = 1 \Rightarrow t/24 = 1/2 \Rightarrow t = 12$.
 \therefore The first pipe P is to be turned off after 12 minutes.
17. If we put $x = 0$, we will get $y = 2$, so answer option a. and d. ruled out. $y = 3$ is not possible from the given expression.
18. By the properties of the numbers the difference between any number and a number obtained by interchanging its digits is always divisible by 9.
19. Let a be the volume of water in one litre of the mixture. $\therefore a + (1 - a) 1.35 = 1.25 \Rightarrow 10 = 35a \Rightarrow a = 2/7 \therefore b = 5/7$.
20. By observation we can say $f(x) = x^3 + 1$, so $f(4) = 65$
21. Let the policeman took x steps to catch the accused and the distance travelled by him in each step be y. In the same time total number of steps taken by the accused will be $27 + 8x/5$ and the total distance travelled by him will be $(27 + 8x/5) 2y/5$. Equating these two distances we get
 $xy = (27 + 8x/5) 2y/5 \Rightarrow x = 30$.
22. Put $e^{\sin x} = y$; the equation becomes $y - 1/y - 4 = 0$ or $y^2 - 4y - 1 = 0$
 $y = (4 \pm \sqrt{(16 + 4)})/2 = 2 \pm \sqrt{5}$
As $e^{\sin x} > 0$, y cannot be equal to $2 - \sqrt{5}$
 $\therefore y = 2 + \sqrt{5} \Rightarrow \sin x = \log_e(2 + \sqrt{5})$
As $2 + \sqrt{5} > e$, $\log_e(2 + \sqrt{5}) > 1$. That is, $\sin x > 1$, which is not possible.
23. The last digit in the product can be one of the required digits if and only if the last digit of each of the numbers is one of the numbers 1, 3, 7, or 9. \therefore Probability of choosing each of the four numbers is $4/10$. As last digit of required numbers can be chosen in four different ways and total number of ways of choosing a digit at units place is 10. \therefore Required probability = $2/5 \cdot 2/5 = (2/5)^4 = 16/625$
24. Take each answer option and check for values of x in the given range. Only answer option d. satisfies.
25. To strike 7, clock pendulum has to perform six oscillations for which it takes 7 seconds. To strike 10, pendulum has to perform 9 oscillations. For that it will take $9 \cdot 7/6$ seconds. = 10.5 sec.
26. We have $((1-a)/a)((1-b)/c)((1-c)/c) = [1 - (a+b+c) + bc + ca + ab - abc]/abc$
 $= 1/a + 1/b + 1/c - 1$ [as $a+b+c = 1$]
But since $AM \geq HM$
 $1/3(1/a + 1/b + 1/c) \geq 3/(a+b+c) = 3$
we get $1/a + 1/b + 1/c \geq 9$
Thus $((1-a)/a)((1-b)/c)((1-c)/c) \geq 9 - 1 = 8$
27. Given expression is $\{ [(\sqrt{2} + 1)^2 - (\sqrt{2} - 1)^2] / 2(2 - 1) \}^{1/3} = [4\sqrt{2}/2]^{1/3} = [(\sqrt{2})^3]^{1/3} = \sqrt{2}$.
28. $S_9 - S_8 = 999 \dots 9$ (9 times)
 $= 9 + 90 + 900 + \dots + 900000000$
 $= 9(1 + 10 + \dots + 10^8) = 10^9 - 1$

29. In a chessboard, there are 9 horizontal and 9 vertical lines, For a rectangle we need 2 horizontal and 2 vertical lines. Therefore total number of rectangle will be ${}^9C_2 \cdot {}^9C_2 = 1296$
30. Since $\triangle PZA \sim \triangle PXB$, We get $PZ / PX = AZ / AX = 2/1$ (Given) $\therefore PZ = 2 PX \Rightarrow PZ + ZX = 2 PX + ZX = 2 PZ \therefore PZ = ZX = k$ (say). Now $\triangle SPX \sim \triangle RPZ \Rightarrow SX / RZ = PX / PZ = 2$
 $\therefore SX = 2 RZ = 2 \times a$
31. If we take x as origin, then slope of XY = - k/2. Let C \equiv (c, k) be the corresponding point on line C of the point B \equiv (b,0) on line B. \therefore Since BC is parallel to XY; Slope of BC = slope of XY = - k/2
 $b - c = 2 \therefore c = b - 2$.
32. If PT is parallel to XY, then $\triangle MXY \sim \triangle MPT \Rightarrow MY / MT = MX / MP \Rightarrow -2/MT = k / 3k \Rightarrow MT = - 6$
33. With the information in Qn. 32 ; R = - 2, T = - 6 $\therefore R+T = - 8$.
34. Let Q pairs with R' and S' on line A and B respectively then for the same reason in Qn. 30 ;
 $\triangle QR'Z \sim \triangle QS'X \Rightarrow QS' / QR' = QX / QZ \Rightarrow QS'/a = (3k/2) / (k/2) = 3 \Rightarrow QS' = 3a$.
35. Three days less than the maximum of thirty one days means 28 days. Every month having 30 or 31 days also has 28 days. In 4 years, February will have more than 28 days only once. Hence, the sample space is $4 \times 12 = 48$ and there are 3 favorable cases. Required probability is $3/48$.
36. Average of m+1 numbers = $(ma + x) / (m+1) = b \Rightarrow x = b(m+1) - ma = m(b-a) + b$.
37. Let measure of each angle be x. Applying exterior angle theorem, we can see that in triangle ABC, $2x + 2x + x = 180^\circ \Rightarrow x = 36^\circ$
38. Number of different committees = ${}^3C_1 + {}^3C_2 + {}^3C_3 = 3 + 3 + 1 = 7$.
39. We consider the worst case since we must have at least two marbles of each colour, first 21 marbles drawn may be blue, green and one red. Once we draw 22nd marble there has to be at least two marbles of each colour. \therefore Required percentage = $22 \times 100 / 25 = 88\%$.
40. From the table it is clear that increase in the weight is 10 / 3 pounds per inch. \therefore for the growth of 3 inches increase in the weight = 10 pounds. \therefore Total weight = $180 + 10 = 190$ pounds.
41. Total number of the students who are either on squad or on a team = Q + T - B \therefore Number of the students who are neither on a squad nor on team = $S - (Q + T - B) = S - Q - T + B$.
42. The five digit numbers (not containing zero) is ${}^9C_5 \cdot {}^4C_2$ (the greatest of the five digits gets fixed at the central place) and those containing zero ${}^9C_4 \cdot {}^3C_2$ (zero will be the last digit). Hence total number of such numbers = ${}^9C_5 \cdot {}^4C_2 + {}^9C_4 \cdot {}^3C_2$. Ans c.
43. Let M = k -1, N = k and O = k + 1. $\therefore M+N+O = 3k$, which is even or odd depending on whether k is even or odd. Now $M + 2N + O = k-1 + 2k + k+1 = 4k$, which is always even.
44. $\alpha + \beta = 1, \alpha\beta = 1/6$
 $\frac{1}{2}(a + b\alpha + c\alpha^2 + d\alpha^3) + \frac{1}{2}(a + b\beta + c\beta^2 + \beta^3)$
 $= \frac{1}{2}[2a + b(\alpha + \beta) + c(\alpha^2 + \beta^2) + d(\alpha^3 + \beta^3)]$
 $= \frac{1}{2}[2a + b(\alpha + \beta) + c\{(\alpha + \beta)^2 - 2\alpha\beta\} + d\{(\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)\}]$
 $= \frac{1}{2}[2a + b.1 + c\{1 - 2/6\} + d\{1 - 3/6\}]$
 $= a + b/2 + c/3 + d/4$.
45. Total no. of letters = $4 + 4^2 + 4^3 + \dots + 4^8 = 4(4^8 - 1)/(4-1) = 87380$
Total money spend = $25/100 \cdot 87380 = \text{Rs. } 21845$



46.

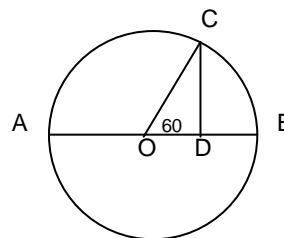


from the figure shown it is clear that the intersection of two cubes can be a triangle, a square, a rectangle and a cube.

47. Only one day per 20 days produces the rainbow. \therefore out of 20 days 19 days can not produce the rainbow. Hence their percentage = $100 \cdot 19 / 20 = 95 \%$.
48. Number of ways in which Anil and Sunil can exchange their books one or two or three at a time is ${}^3C_1 {}^6C_1 + {}^3C_2 {}^6C_2 + {}^3C_3 {}^6C_3 = 18 + 45 + 20 = 83$ ways.
49. Since the distance is same and with different speeds he can save 12 min = $1/5$ hrs.
 $\therefore 2.5t = 3.5(t - 1/5) \Rightarrow t = 7/10 \therefore d = 2.5 \cdot 7/10 = 7/4 \text{ km.} = 1 \frac{3}{4} \text{ km.}$
50. Let $\log x = y$, then the given equation becomes $y^2 - 5y + 6 = 0$. $\therefore y = 2$ or $y = 3$. Hence $\log x = 2$ or $\log x = 3$. $\therefore x = e^2$ or $x = e^3$

EXERCISE – 3A

- The number of chocolates received by each child forms an AP and the common difference has to be at least one. Since each child gets at least 9 chocolates, after distributing 9 chocolates to each child, we are left with 325 chocolates. The no. of chocolates that each child gets after that will again be in AP. Then the maximum common difference can be 1 for the sum of 25 terms of an AP with first term 1 and common difference 1 is $= 25 \cdot 26 / 2 = 325$. Thus the last person gets 10, second last gets 11 and so on, the tenth person will get 25 chocolates. Ans b.
- Since there are 20 students opting for both English and Hindi alone and 5 students take only English and Sanskrit. Thus of the remaining 45 students, all can take Hindi and Sanskrit. Thus in all, maximum 45 students can take Hindi as well as Sanskrit. Thus Ans. is b.
- Since the diameter is the longest chord in a circle, AB is the diameter. The angle subtended by it on the circumference therefore will be 90° . Thus ABC is a right angled triangle with measure arc AB = 180° . Thus measure arc AC = 120° and measure arc CB = 60° . Thus measure angle COD is 60° . CD is height of triangle ABC thus $CD=4$. Therefore $OC = 8/\sqrt{3} = \text{radius}$. Thus area of circle is $64\pi/3$. Thus Ans. a..
- The person pays 1% brokerage therefore the CP of each share is Rs125. Thus he buys 192 shares. The dividend is 5% per share per six months that is Rs.960. Thus the income for 8 terms (4 years) is $960 \times 8 = \text{Rs. } 7680$. Ans.b.
- Let the capacity of the tank be 60 litres. Then A fills in 3 litres per minute while C empties it at 1 litre per minute. When A and C are simultaneously on, water is filled at the rate of 2 litres per minute. Hence half of the tank i.e. 30 litres will be filled after 15 minutes i.e. at 12:15pm. Now C empties at 1litre per minute and hence will take 30 minutes to empty the tank. Ans. b.
- The speeds are in the ratio 4:5 therefore time required will be in ratio 5:4. The difference in time on ratio scale is 1 while actually it is 3min. Thus time required at the speed of 4kmph will be 15 min. In 15 min, at the rate of 4kmph, one can travel 1km. Thus 1km will be the distance. Ans. a..
- Let R_1 and R_2 be the two rates. Then we have: $24R_1 = 40R_2$. Thus $R_2 = 60\%$ of R_1 . Ans. b..
- Alligating we get $d - m = 8 - 6.66$ & $m - c = 6.66 - 5$. Therefore the ratio is 1.34 : 1.66, which is same as 4:5. Ans a.



9. Let the MP be 6 then CP is 2 and SP is 3. Thus gain is 1 over every 2 i.e. 50%.Ans.c..
10. We have the relation $(4.12.24)/(8.3) = (2.4.12.24)/(6.4)T$ Where T is the number of days required. Thus $T = 2$. Ans d.
11. Solving $5x = x^2 + 4$, we get, $x = 4$ or $x = 1$. Thus Ans. d.
12. If r is the radius of the cylinder and h is height, volume is given by $\pi r^2 h = 81$. Thus volume of cone = $(1/3)\pi(r/3)^2 h = \pi r^2 h/27 = 81/27 = 3$ cubic units. Thus Ans c.
13. Since the first line passes through (2,3) substituting we get, $C = 0$. Substituting (2,3) in $x + y = D$, we get $D = 5$. Thus Ans. b.
14. Using Pythagoras Theorem, hypotenuse = 2. So, $\sin \theta = 3/2$, $\theta = 60^\circ$. Ans. a.
15. The ratio of the speeds of Carl Lewis : Ben Johnson :: 5 : 4. The speed of Ben Johnson given is 8 kmph i.e. $20/9$ m/s, therefore that of Carl Lewis is 10 kmph i.e. $25/9$ m/s. Total distance to be traveled is 3000m.
Time taken by Ben Johnson = $3000 \times 9/20 = 1350$ sec.
Time taken by Carl Lewis $3000 \times 9/25 = 1080$ s.
But Carl actually covers the distance 4 seconds before Ben (i.e. in 1346 seconds). So Carl gives Ben
 $1346 - 1080 = 266$ s. i.e. $266 \times 20/9 = 591.11\text{m} \approx 590\text{m}$. Thus Ans. b.
16. Sadashiv gets Rs.5 more than Lakshman and makes twice the no of candle that Lakshman makes. Therefore he gets Rs.10 over and above the daily Rs.20, while Lakshman gets Rs.5 above the Rs.20. Thus Lakshman gets Rs 25 daily. Ans. a.
17. The profits should be divided in the ratio $4 \times 6 : 3 \times 8 = 1:1$. Thus total profit is $2700 \times 2 = 5400$. The return on investment is 15% thus the investment is 36000. Thus Ans c.
18. The total distance travelled is 150km in time 6.5hrs. Thus average speed is 23.08 or ~ 23kmph. Ans c.
19. $x^2 = 288 = 12^2 \cdot 2 = (12\sqrt{2})^2$, thus $x = 12\sqrt{2}$ or $\log_x 12\sqrt{2} = 1$. Thus Ans. = e..
20. A regular octagon is formed. Interior angle of a regular polygon with n sides is given by: $[(n-2) \times 180]/n$. Thus interior angle is 135° . Ans. d.

EXERCISE – 3B

1. In the given equation of degree 4, after making the co-efficient of x^4 equal to 1, we should have the co-efficient of x^3 = sum of all roots. Apply this check for all options and you will see that none of the given combinations form the exact roots. Hence, the answer is (d).
- 2.
- | | Man | Woman | Boy |
|---------------------|------|-------|-------|
| wages | m | w | b |
| Ratio of their work | 16/3 | 14/4 | 10/5. |
- $\therefore 3m/16 = 2w/7 = b/2 = (m+b+w) / (16/3+7/2+2) = 11.22 \therefore m = 59.84, w = 39.27 \text{ \& } b = 22.44$.
3. Exterior angle of a triangle is equal to the sum of it 's remote interior angles. Required angle is a+b.
4. From $(y+3)^2 = 25$ we get $y = 2$ or -8 substituting these values of y in the first equation we get ; at $y = 2$, $x = 1$ or -5 and at $y = -8$, $x = 11$ or 5 . Hence the maximum value of $x/y = \frac{1}{2}$
5. Take any two nos. say 6 and 15
Insert two AM's between them. They are $6 + (15 - 6)/3 = 9$ and $6 + 2.(15 - 6)/3 = 12$
Now, the only AM between 6 and 15 is $(6+15)/2 = 10.5$
Also, Two GM's between 3 and $3/8$ are $3(1/8)^{1/3} = 3/2$ and $3(1/8)^{2/3} = 3/4$

The only GM between 3 and $3/8$ is $3/2\sqrt{2}$

And $(3/2\sqrt{2})^2 = 3/2 \times 3/4$

Both of these rules can be verified for any set of values.

$AM = (a + b)/2$ $GM = \sqrt{ab}$ $HM = 2ab/(a+b)$

$\therefore AM \times HM = GM^2$

Hence, GM is the geometric mean of AM and HM

$AM - GM = (a+b)/2 - \sqrt{ab} = (a + b + 2\sqrt{ab})/2$

$= [(\sqrt{a} - \sqrt{b})/\sqrt{2}]^2$

Thus, $AM > GM$, as $AM - GM$ is positive.

Also, $GM < HM \therefore AM > GM > HM$

Hence, the answer is c.

6. Let the distance between two cities be d. Hence the velocities of the two trains will be respectively $d/42$ and $d/56$. If they meet after time t, then the total distance travelled by both of them $= d = (dt/42 + dt/56)$. Solving this equation we get $t = 24$ minutes.

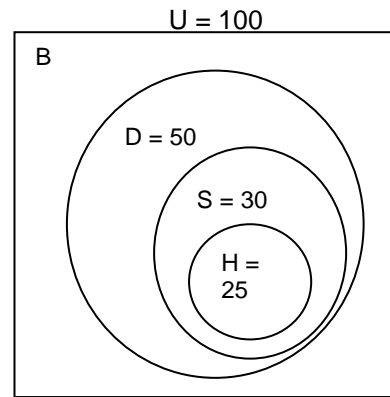
7. Let t and c be the respective velocities of the train and car $\therefore 8 = (120/t + 480/c)$ and $8 \frac{1}{3} = (200/t + 400/t) \Rightarrow 1/t + 4/c = 1/15$ and $1/t + 2/c = 1/24 \Rightarrow 2/c = 1/40 \therefore c = 80 \text{ km/hr.}$
 $\therefore 8 = (120/t + 6) \Rightarrow t = 60 \text{ km/hr.}$

Alternate method: Let us take the case of train, Ramesh takes 20 mins more for $(200 - 120) = 80 \text{ km}$. So for $(600 - 120) = 480 \text{ km}$, he will take 120 mins or 2 hours extra.

Thus to travel 600 km by train he will need $(8 + 2) = 10$ hours. Speed of train $= 600/10 = 60 \text{ km/hr.}$

8. Let the no. of smoking adults be x.
 \therefore The no. of people on the lift is $x^2 + x + 2 \leq 134$
 $(x+12)(x-11) \leq 0$
 So, $-12 \leq x \leq 11$
 Max. value of x is 11. Thus, the max. no. of non-smoking persons on lift is $11^2 + 2 = 123$
9. His initial income $= 300 \times 7/2 = \text{Rs } 1050$
 and amount obtained by selling his stocks $= 200 \times .98 + 100 \times .99 = \text{Rs. } 29,500$. \therefore Number of state loans that he can purchase $= 29,500 / 118 = 250$. \therefore Amount of loan he holds $= \text{Rs. } 25,000$.
 \therefore His present income $= \text{Rs. } 250 \times 5 = \text{Rs. } 1250$. \therefore His income increases by Rs. 200.
10. Let h and c be the price of the horse and the carriage respectively. $\therefore h + c = 0.9h + 1.2c$
 $\therefore h = 2c$, also $h + c + 10 = 1.05h + 0.95c \Rightarrow h = c + 200$. $\therefore c = 200$ and $h = 400$.
11. Replacing the given symbols by usual notations we get from b., $LHS = 4 \div 2 \times 10 = 20$ and $RHS = 5 + 9 \div 3 \times 5 = 5 + 3 \times 5 = 20$.
12. Using the operations of division, multiplication, addition and subtraction in standard order given expression is $10 + 2 - 6 \div 2 = 10 + 2 - 3 = 9$.
13. $P[(1 + \frac{5}{100})^3 - 1] = 1261 \Rightarrow P = 8000$. \therefore S.I. $= (8000 \times 3 \times 4) / 100 = \text{Rs. } 960$.
14. Let sister be given Rs P. \therefore Brother will be given Rs $1261.5 - P$.
 $\therefore (1261.5 - P)(1 + 5/100)^9 = P(1 + 5/100)^{11} \Rightarrow 441P / 400 = 1261.5 - P \therefore P = 600$.
 \therefore Brother's share $= \text{Rs. } 661.5$.

15. From the adjacent venn diagram, it's clear that no. of people who like S and not H are $30 - 25 = 5$.
People who like B are $100 - 50 = 50$.
Therefore, $5/50 \times 100 = 10\%$



16. Let the numbers be $5k$, $2k$, and $3k$ respectively. $\therefore (25 + 4 + 9) k^2 = 1862$. $\therefore k^2 = 49$. $\Rightarrow 2k = 14$.
17. Let r and n be the shares in the profit of Reena and Teena respectively. Actual profit to be divided is $(8750 - 12 \cdot 250) = 5,700$. $\therefore r / 7 = n / 12 = 5700 / 19 = 300$. $\therefore r = 2100$ and $n = 3600$.
 \therefore Reena's total share in the profit = Rs. $(2100 + 3000) =$ Rs. 5100. & Neena's share = Rs. 3600.
18. Let t , r and j respectively be the nuts that Tinku, Rinku and Jojo gets. \therefore their ages are kt , kr and kj respectively. Given that $t / r = 4/3$ and $t / j = 6/7 \Rightarrow t / 12 = r / 9 = j / 14 = 17.5 / 35 = 1/2$. \therefore Their ages will be respectively 6 years, 4.5 years and 7 years.
19. M be the amount of milk in the mixture. $\therefore M = 50 (1 - 1/10)^2 = 50 \cdot 81 / 100 = 81/2$. \therefore Amount of water W in the mixture = $50 - 81/2 = 19/2$. \therefore Required ratio = $M / W = 81 / 19$.
20. The possible no. of ways in which the switches can be operated are ${}^3P_3 = 3! = 6$ ways. Now if, MULT is pushed even no. of times, both BULB and FAN are on. Hence, the favorable condition for the event that all the things are Off is the MULT should be pushed odd no. of times i.e. in $2 \times 2 \times 1 = 4$ ways.
 $\therefore P(\text{All Off}) = 4/6 = 2/3$
21. If $a_1 a_2 a_3 \dots a_n = k$ (constant), the value of $a_1 + a_2 + \dots + a_n$ is least when $a_1 = a_2 = \dots = a_n$
So the least value of $a_1 + a_2 + \dots + a_n$ is $n(k)^{1/n}$
Write $xyz = abc$
 $(bcx)(cay)(abz) = a^3 b^3 c^3 = k(\text{constant})$
Here $n = 3$
Hence minimum value of $bcx + cay + abz = n(k)^{1/n} = 3(a^3 b^3 c^3)^{1/3} = 3abc$
22. Let the S.P. of each article be Re.1. When he sells 200 articles his gain is Rs. 40. Hence the CP is Rs. 160 and profit is Rs. 40. \therefore Profit percent = $(100) (40) / 160 = 25\%$
23. $f(x) = [x]$ and $g(x) = |x|$,
 $(gof)(-1/3) = g(f(-1/3)) = g(-1) = 1$
and $(fog)(-1/3) = f(g(-1/3)) = f(1/3) = 0$
 $(gof)(-1/3) - (fog)(-1/3) = 1 - 0 = 1$
24. Monkey is moving as an average of 3 meter per two minutes at the end of eighth minute it will be 12 meters high and it will take $3/5$ min to reach the top from where it will not slip again.
 \therefore total time to reach the top = $8 \frac{3}{5}$ minutes.
25. The inequality is equivalent to $-3 < (x^2 + mx + 1) / (x^2 + x + 1) < 3$
Since $x^2 + x + 1 = (x + 1/2)^2 + 3/4 > 0$, we have
 $-3(x^2 + x + 1) < x^2 + mx + 1 < 3(x^2 + x + 1)$
 $\therefore 4x^2 + (m + 3)x + 4 > 0 \quad (1)$

$$\text{and } 2x^2 - (m-3)x + 2 > 0 \quad (2)$$

Since the coefficient of x^2 in LHS of (1) = $4 > 0$, the inequality (1) will be valid if

$$(m+3)^2 - 64 > 0, \text{ i.e. if } (m+11)(m-5) > 0 \Rightarrow m < -11 \text{ or } m > 5 \quad (3)$$

Since the coefficient of x^2 in LHS of (2) = $2 > 0$, the inequality (2) will be valid if

$$(m-3)^2 - 16 > 0 \text{ i.e. if } (m+1)(m-7) > 0 \text{ or } m < -1 \text{ or } m > 7 \quad (4)$$

The conditions (3) and (4) will hold simultaneously if $m < -11$ or $m > 7$, hence answer is a.

26. Since $W_1 \cap W_3 = \{f, l, o, w\}$ and $(W_2 \cap W_4) = \emptyset$. Hence $W_1 \cap W_3 \cup (W_2 \cap W_4) = \{f, l, o, w\} \cup \emptyset = \{f, l, o, w\}$
27. 8 books can be arranged on the shelf in 8! different ways. Number of ways in which two particular books are always together = $2 \cdot 7!$ \therefore Required number of ways = $8! - 2 \times 7!$
28. $(1+n+n^2+\dots+n^{127}) = (n^{128} - 1)/(n-1) = (n^{64} - 1)(n^{64} + 1)/(n-1) = (1+n+n^2+\dots+n^{63})(n^{64} + 1)$
Thus the largest integer m such that $n^m + 1$ divides $(1+n+n^2+\dots+n^{127})$ is 64
29. From the given information the number of oranges with the seller must be in the form $2^n - 1$, where n is the number of customers. \therefore Required number of oranges are 1 or 3 or 7 or 15 or 31 depending on the number of customers. Hence the required answer is b.
30. We have $|x+y|^2 - |1+xy|^2 = (x+y)^2 - (1+xy)^2$
 $= (x^2 + y^2 + 2xy) - (1 + 2xy + x^2y^2)$
 $= x^2 + y^2 - 1 - x^2y^2 = (x^2 - 1)(1 - y^2)$
 $= (|x|^2 - 1)(1 - |y|^2) < 0 \quad [\text{as } |x| < 1, |y| < 1]$
31. After 3 pm if all the three taps are kept open for t hours to vacate the cistern. Since the taps A and B can fill the cistern $1/3^{\text{rd}}$ and $1/4^{\text{th}}$ per hour respectively. $1/3 + (1/3 + 1/4) + (1/3 + 1/4 - 1)t = 0$. $\therefore t = 11/5$ hrs. \therefore The cistern will be emptied at 5.12 p.m.
32. $a_1 \cdot a_2 \cdot a_3 \dots a_n \cdot a_{n+1} \dots a_{2n+1}$
 $(a_1 \cdot a_{2n+1}) \cdot (a_2 \cdot a_{2n}) \dots (a_n \cdot a_{n+1}) a_{n+1} = 3^2 \cdot 3^2 \dots 3^2 \cdot 3 = 3^{2n+1}$
33. One book can be selected in p ways and it can not be selected in one way, so total number of ways we can select a book will be $(p+1)$. So total ways to select n books = $(p+1)^n$ ways, but it includes the one way in which we are not selecting any book, therefore total ways in which we can select one or more than one book will be $(p+1)^n - 1$
34. Being opposite angles, angles 1 and 2 are equal. $\therefore A+B+\angle 2 = C+D+\angle 1 \Rightarrow A+B = C+D$.
35. Greatest of the five numbers will be least if remaining four numbers are less than m and as large as possible. $\therefore 4(m-1) + m = 146 \Rightarrow m = 30$.
36. $m/n = p/q = 1/6 \Rightarrow m/n = p/q = (m+p)/(n+q) = 1/6$.
Alternately, verify by substituting random values of m/n and p/q .
37. The dealer may get his 13 cards of same suit in 4 different ways. While total number of ways in which he can get 13 cards = ${}^{52}C_{13} = 52! / 39! \times 13!$
 \therefore Required probability = $4 / [52! / 39! \times 13!] = 4 \times 13! \times 39! / 52! = 52 \times 12! \times 39! / 52!$
38. Let A_1 denote the event that India wins the match.
 Required probability = $P(A_1 A'_2 A_3) + P(A'_1 A_2 A_3)$
 $= P(A_1) P(A'_2) P(A_3) + P(A'_1) P(A_2) P(A_3)$
 $\therefore (1/2)^3 + (1/2)^3 = 1/4$
39. $f(x) = x^2 - 6ax + 2 - 2a + 9a^2 = 0$ will have real roots if $D = 36a^2 - 4(2 - 2a + 9a^2) \geq 0$
 $-8(1 - a) \geq 0$ or $a \geq 1$
 The roots will exceed 3 if sum of roots is greater than 6. Therefore $6a > 6$ or $a > 1$.
 And $f(3) = 9 - 18a + 2 - 2a + 9a^2 > 0$
 $\Rightarrow (9a - 11)(a - 1) > 0 \Rightarrow a < 1$ or $a > 11/9$

40. Since the circles passes through each other' s center the intercepted arcs make an angle of 120° at the center of the circle. \therefore Required perimeter = $2 \cdot (120 / 360) \cdot 2\pi = 4\pi/3$.
41. Given that $a > b$, $b > c$, and $c > d \Rightarrow a > c$, $a > d$ and $b > d \Rightarrow a + b > c + d$.
Also $a > c \Rightarrow a - d > c - d$. Also $a > b > c > d \Rightarrow a - b > 0$ and $c - d > 0$ which needn't say $a - b > c - d$.

Step	Side of small square	Area removed	Area left	Squares left
1	$1/3$	$1/9$	$8/9$	8
2	$(1/3)^2$	$(1/9)^2$	$(8/9)^2$	$(8)^2$
3	$(1/3)^3$	$(1/9)^3$	$(8/9)^3$	$(8)^3$

42. From the above table area left after two steps = $64/81$
43. Number of squares left after three steps = 8^3
44. Length of the small square after three steps = $(1/3)^3 = 1/27$
45. Since area removed is an infinite G.P. with first term = common ratio = $1/9$, Sum of the areas of the removed squares = $[(1/9) / (1 - 1/9)] = 8/9$ closest answer is it approaches to 1.
46. Let his first instalment be a and the second instalment be $a + d$. $\therefore S_{40} = 3600 = 40 \{2a + 39d\}$ and $S_{30} = 2400 = 15 \{2a + 29d\}$. Solving these two equations we get $a = 51$ and $d = 2$. \therefore His first instalment is Rs 51 and the second instalment is Rs 53.
47. Since the required number is to be greater than 5000, the digit at thousand 's place can be chosen from 5 or 9 only in two different ways. Since no digit is repeated in the number remaining places can be filled in 3, 2 and 1 different ways respectively. \therefore By principle of multiplication total number of required four digit numbers = $2 \times 3 \times 2 \times 1 = 12$.
48. $4851 = 3 \cdot 3 \cdot 7 \cdot 7 \cdot 11$. \therefore Required number = 11.
49. Let cost of mangoes = Rs m per kg. $\therefore 10m = 15(m - 20) \Rightarrow m = \text{Rs. } 60$ per kg.
50. Distances covered by second car are 8, 8.5, 9, 9.5.....
Total distance covered in n hrs = $n/2(2.8 + (n - 1)0.5)$ and total distance covered by first car = $10n$, equate these two distances and find the value of n . We get $n = 9$ hrs

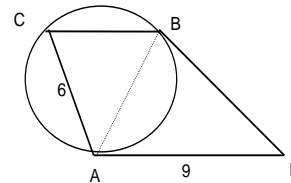
EXERCISE – 4A

- Wine to water ratio is 5:2 and wine is 10 litres therefore water should be 25 litres. Total initial volume of water therefore must be 35 litres. Ans.a.
- Ans. b.. Alligating we get $d - m = 100 - 40$ & $m - c = 40 - 20$. Therefore the ratio is 3 : 1. Therefore 20 litres of soda should be added.
- Ans.a.. Let the number of marks that Johnny gets be x . Then we get the equation:
 $4(x^2 - 25) + 25 = 69$
 $4x^2 = 144$.. So, $x^2 = 36$. Thus $x = 6$.
- The relative speed is $200/120\text{m/s}$ or $200/120 \times 18/5 \text{ km/h} = 6\text{kmph}$. Thus Speed of car must be $60 - 6 = 54\text{km/hr}$. Ans d.
- For CP = Rs.100, MP is Rs125 and 12% discount amounts to Rs15. Thus SP is 110 or profit % is 10%. Ans c.
- The profit should be divided in the ratio 24:25:48. Thus B should receive Rs 2500. Ansc.
- If 2 gms of A worth Rs.20 are mixed with 3 gms of B, the total weight would be 5gms with total cost Rs.65. Thus cost of B= 45 for 3 gms. Thus cost of B per gm = $45/3 = 15$. Ans d..

8. The relation is $3n^2+5$ with $n = 0,1,2,\dots$. Thus the next term is for $n = 5$, 80. Ans. b.
9. Women do twice the work in double the time means that men and women do equal amount of work. Thus we have $2(8.9.8)=(16.6.d)$ where d is the no of days. Thus we have $d = 12$. Ans. d.
10. Since 3 parts of out of five travel by bus and 3 by train, 1 out of every five travels by both. Thus the population of the city is $120,000 \times 5 = 600,000$. Ans. b.
11. Let the no of rows be $10k$. Then no of columns is $7k$. Thus the total no of soldiers $= 70k^2 = 1750$. Therefore $k^2=25$ or $k = 5$. Thus no of rows $= 50$. Ans. c.
12. If r is radius and h is height for the cones, their total volume will be $3 \times (1/3)\pi r^2 h = \pi r^2 h$. Let height of the cylinders be h' , their total volume would be $2\sqrt{r^2 h'} = \sqrt{r^2 h}$. Thus $h : h' = 2:1$. Ans. b.
13. $1024 = 2^{10}$. Thus, $2 = 1024^{1/10}$. Thus $\log_{1024} 2 = 1/10$. Ans is a..
14. Ans.c., By formula $\theta = 6 (10 - (11 \cdot 18) / 12) = 39^\circ$
15. Since y-intercept is zero, the line passes through origin. Since $(5\frac{2}{3}, 11\frac{1}{3})$ lies on the line, the equation of the line is $y = 2x$. This if $x = 3\frac{1}{2}$, $y = 7$. Ans. a.
16. Ans.c., On the ratio scale the daughter received 2.6 while actual value is 5,200 thus the factor of multiplication is 2000. The difference on ratio scale is 2.4 thus actual difference is 4800.
17. Ans.c., The trains meet after travelling for 2hrs. The train from A has speed 50km/hr. Thus the distance is 100kms.
18. The vertices of the new triangle will be: (3, 3), (3.5,1.5), (2.5,1.5). Thus the sides are: 1, $\sqrt{(2.5)}$ and $\sqrt{(2.5)}$. Using hero's formula, we get the area as 0.75 sq. units. Ans.b..
19. Note that 27 is being converted to base 3, Thus 42 will be written as 1120. Ans.d..
20. Ans.a.. Let the capacity of the tank be 60litres. Then A fills it at the rate of 3lits per min, B at 2lits per min and C empties it at 6litres per minute. Thus when all pipes are turned on, the effectively, 1litre water flows out of the cistern per minute. Thus it will take 60 minutes to drain 60litres of water.

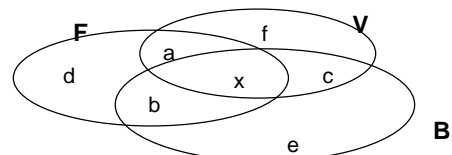
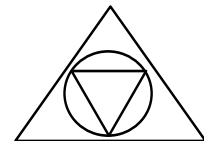
EXERCISE – 4B

1. If both the roots of $ax^2 + bx + c = 0$ are zero, then $c = 0$ and $b = 0$
So, $-36p + 24 = 0$, or, $q = 2/3$
And $2p - q = 0$, or $p = q/2 = 1/3$
So, $p + q = 2/3 + 1/3 = 1$
2. From the figure it is clear that $AP = BP = 9$ and $AC = AB = 6$. and $\triangle PAB \sim \triangle ABC$
 $\therefore AP/BA = BP/CA = AB/BC \Rightarrow BC = 36/9 = 4$ cm.
3. $2(ab + bc + ca) = (a + b + c)^2 - (a^2 + b^2 + c^2)$
 $= (a + b + c)^2 - 1$
 > -1 (because square of a no. is always positive)
4. Since 19 % failed in both the subjects, percentage of students who passed at least in one subject is 81% $\therefore E \cup A = E + A - (E \cap A) \Rightarrow 81 = 72 + 67 - x \therefore x = 58$. \therefore percentage of students who passed in both the subjects $= 58 \therefore$ Required number of the students $= 638 \cdot 100 / 58 = 1100$.



5. Draw a vertical line through the given graph. The line intersects it at two different points, that mean that there exists two values of y for one value of x . Hence, this is not a function.
6. The function is symmetrical about y -axis. Hence, even.
7. Tax = $3200 + (27,400 - 25,000) \cdot 30/100$ = Rs. 3920. Surcharge = $3920 \times 15 / 100 = 588$
 \therefore Total tax payable = Rs (3920 + 588) = Rs 4508.
8. Since length of a side opposite to 30° angle of a right angle triangle is half the hypotenuse, we get $AX = 2$ units. $\therefore ZX = 5$, and area of the triangle = $(1/2) \times 5 \times 4y = 10y$.
9. Each lamp burns 10 cubic feet of gas per hour. i.e. $1/6$ cubic feet of gas per minute. He takes one minute to go from one lamp post to the other. When he lights the last lamp post, first lamp post will burn for 99 minutes, second for 98 minutes, . . . , and 99^{th} for one minute.
 \therefore Total gas burnt = $1/6 [1+2+3+ \dots +99] = 99 \times 100 / (2 \times 6) = 825$ cubic feet.
10. Total time taken to travel from A to B = $23/6$ hours. \therefore the average speed = $s = 40 / (23/6) = 240/23$ \therefore Speed from B to A = 10 km/hr.
 \therefore Average speed of one complete rotation = Total distance travelled / Total time taken
 $= 80 / (47/6) = 10.2$ km/hr.
11. Since any two lines are not parallel and any three of them are not concurrent, any three lines will form a triangle, \therefore Required number of triangles = ${}^{10}C_3 = 120$.
12. Let the coefficients of the consecutive terms be ${}^nC_{r-1}, {}^nC_r, {}^nC_{r+1}$
 As the terms are in G.P.
 $({}^nC_r)^2 = {}^nC_{r-1} \times {}^nC_{r+1}$
 $\Rightarrow [n! / (r!(n-r)!)]^2 = (n! / [(r-1)!(r+1)!(n-r+1)!(n-r-1)!])$
 $\Rightarrow r(n-r) = (r+1)(n-r+1)$
 $\Rightarrow nr - r^2 = nr - r^2 + r + n - r + 1$
 $\Rightarrow n = -1$
13. Since total loss and total profit must be equal, only third alternative holds good.
 Alternatively : Let a, b, c and x, y, z be the shares of A, B, C respectively when they are divided in the ratio 3:4:5 and $1/3 : 1/4 : 1/5$ $\therefore a/3 = b/4 = c/5 = (a+b+c) / 12 = 47 \Rightarrow a = 141, b = 188$ and $c = 235$. Also in second case $x / (1/3) = y / (1/4) = z / (1/5) \Rightarrow x / 20 = y / 15 = z / 12 = 564 / 47$ $\therefore x = 240, y = 180$ and $z = 144$. \therefore A will be in the profit of Rs.99, B will be in a loss of Rs.8 and C will be in a loss of Rs.91.
14. $P \cdot 7/2 \cdot 5 / 100 = (3320 - P) \cdot 3 \cdot 4 / 100 \Rightarrow P = 1920$. \therefore Interest on Rs 1920 at 5% is double the interest on Rs1400 at 4%.
15. Since he gains 25 % by selling at the cost price, he has to mix 25 % of water in the milk.
 \therefore Amount of water in 1.25 lit of mixture = 0.25. \therefore Percentage of water in the mixture = $100 \cdot 0.25 / 1.25 = 20\%$
16. $ax^2 + bx + c = a[x^2 + (b/a)x + c/a]$
 $= a[x^2 + (b/a)x + b^2/4a^2 + c/a - b^2/4a^2]$
 $= a[(x + b/2a)^2 + (4ac - b^2)/4a^2] = a(x + b/2a)^2 + (4ac - b^2)/4a$
 As $x \in \mathbb{R}$ and $a > 0$, we see that for all $x \in \mathbb{R}$
 $ax^2 + bx + c \geq (4ac - b^2)/4a$
 The least value of $ax^2 + bx + c$ is $(4ac - b^2)/4a$ for $x = -b/2a$
17. Required number = Half the l.c.m. of 68, 102, 117, and 78. = 3978.
18. In first 15 minutes tank will be full by $15(1/30 + 1/40 + 1/60 - 1/30) = 5/8$. If time taken to full the remaining $3/8$ of the tank is t minutes, $\therefore t(1/30 + 1/40 + 1/60) = 3/8 \Rightarrow t = 5$ minutes. \therefore total time taken = 20 minutes. \therefore the cistern will be full by 12.20 p.m.

19. Since at any toss the outcome is either Head or a tail, which is independent of the earlier tosses. Hence the required probability = $\frac{1}{2}$.
20. $5 / (6500 \cdot 12) = 2 / (8b) \Rightarrow b = \text{Rs.} 3900$.
21. Amount of water in 125 gallons of mixture = 25 gallons. If x gallons of water is added to make it 25 % of the new mixture. $(125 + x) \cdot 25 / 100 = 25 + x \Rightarrow x = 25/3$ gallons. = $8\frac{1}{3}$ gallons
22. We have $(f \circ g)(x) = f[g(x)] = f[\ln x] = \sin(\ln x)$
therefore $R_1 = \{U : -1 \leq U \leq 1\}$
also $(g \circ f)(x) = g[f(x)] = g[\sin x] = \ln \sin x$
as $0 \leq \sin x \leq 1$, we get
 $R_2 = \{V : -\infty < V \leq 0\}$
23. $x^2 + x - 6 = 0$ & $x^2 - x - 6 = 0$
 $x = -3, 2$ & $x = 3, -2$
As 3, -3 doesn't satisfy the equation and 2, -2 satisfies it so the answer is d.
24. Let a , b and c be the number of students in first, second and third room respectively. $\therefore a/b = \frac{3}{4}$ and $b/c = \frac{7}{5} \Rightarrow a/21 = b/28 = c/20 = (a+b+c) / 69 = 138 / 69 \therefore a = 42, b = 56$ and $c = 40$.
25. Required sum = $[1+3+5+\dots+(6n-1)] - 2[5+11+17+\dots+(6n-1)]$
Using the formula Sum of an A.P. = $n/2 (a+l)$
Required sum = $(3n/2)(6n) - 2[(n/2)(6n+4)] = 3n^2 - 4n$.
26. We have $[(1/2)+(x/100)] = 0$ if $0 \leq x < 49$
= 1 if $50 \leq x \leq 99$
Thus the given expression is equal to 50
27. $D = b^2 - 4ac$. If $D \geq 0$, then the roots of the equation are given by $x = (-b \pm \sqrt{D})/2a$
As $D = b^2 - 4ac < b^2$ (as $a > 0, c > 0$), it follows that the roots of the equation are negative
In case $D < 0$, then the equation are given by $X = (-b \pm i\sqrt{-D})/2a$ which have negative real parts.
28. Since both the triangles are equilateral triangles. If we rotate the inscribed triangle by 180° we get the figure as shown. The circumscribed triangle is divided into four congruent triangles, and one of them is inscribed triangle.
 $\therefore \text{Area of Circumscribed } \Delta / \text{Area of Inscribed } \Delta = 4/1$
29. Sum = $1^2 + 2^2 + \dots + 200^2 - 2(2^2 + 4^2 + \dots + 200^2)$
= $(200 \cdot 201 \cdot 401)/6 - (8 \cdot 100 \cdot 101 \cdot 201)/6 = -20100$
30. If the servant breaks x glasses, Amount to be paid = $(100 - x)^3 - 9x = 240 \Rightarrow x = 5$.
31. $2x / (1+x) = 2 / [(1/x) + 1]$. Since x is very large $1/x \approx 0 \therefore$ Given expression close to 2.
32. Total cost = $6 + (6+x) + (6+2x) + \dots + (6+99x) = 600 + x(1+2+3+\dots+99)$
= $600 + x(99 \times 100)/2 = 20400 \Rightarrow x = 4$
33. Required number of groups = ${}^{20}C_4 = 4845$.
34. x will be minimum if $d = e = f = 0 \therefore a+b+c+x = 100$.
 $a+b+x = 65, a+c+x = 70$ and $b+c+x = 75$. Solving these three equations we get $x = 10$.
35. Total number of points are $m+n+k$. Three points will give one triangle, but co-linear points will not give any triangles. Therefore answer option will be b.
36. From the given equations we get $x \geq 5$ and $y \geq 3 \therefore xy$ will be smallest if $x = 5$ and $y = 3 \therefore xy = 15$.



37. We can choose three vertices out of six in ${}^6C_3 = 20$
Chosen vertices can form equilateral triangle in just two ways
Therefore required probability = $2/20 = 1/10$
38. Clearly $x = m$ is a root of the equation. Therefore, the other root must be $(-m)$
That is, $(1/-m) + (1/(-m+b)) = (1/m) + (1/(m+b))$
Solving this we get $b^2 = 2m^2$
39. Let a and s be the present ages of Anand and his sister respectively $\therefore a = 2s$. When Anand's age is double his sister's age will be $a+s = a+a/2$. \therefore Required ratio = $2a/(a+a/2) = 4/3$.
40. Let the first principal be Rs. X \therefore the second principal will be Rs. $5X/4$.
 $\therefore X \times 2 \times 6/100 + (5X/4) \times 2 \times 7/100 = 354$. $\Rightarrow X = 1200$. \therefore Second principal = Rs. 1500
 \therefore Total sum = Rs. 2700.
41. $OF = OG \Rightarrow \triangle OGH \cong \triangle OFE$... A-S-A Test. $\therefore OH = OE$.
42. $\triangle OCD \sim \triangle OAB \therefore OD/5 = 3/8 \Rightarrow OD = 15/8 = 1\frac{7}{8}$. $BD = OB - OD = 5 - 15/8 = 25/8 = 3\frac{1}{8}$
43. $\triangle OGH \cong \triangle OCD \sim \triangle OAB \therefore AB/CD = OA/OC = OB/OD$ AND $GH = CD = 2$, $OC = OG = 1$
 $\therefore AB = (CD \cdot OA)/OG = 6$.
44. $\triangle OEF \sim \triangle OGH \sim \triangle OIJ$ and $\triangle OCD \sim \triangle OAB$. \therefore Pairs of similar triangles = ${}^3C_2 + {}^2C_2 = 4$.
45. Sum of any two sides of a triangle is greater than the third side. \therefore Triangle will not be possible if
 $m + (m+2) \leq (m+3) \Rightarrow m \leq 1$. \therefore Required answer is $m = 1$.
46. Given expression = $\log [(9/14)(16/15)(35/24)] = \log (9/9) = 0$.
47. An English alphabet can be chosen in 26 different ways and three different digits can be arranged in ${}^5P_3 = 60$ different ways. \therefore Required number of license plates = $26 \cdot 60 = 1560$.
48. Let amount saved in first year = a . In successive years he will save $3a/2$, $9a/4$, $27a/8$, $81a/16$ and $243a/32$. $\therefore a [1 + 3/2 + 9/4 + 27/8 + 81/16 + 243/32] = 6650$. $\Rightarrow a = 320$.
49. Captain's score below average = $197 - 47 = 150$. \therefore the average of other 10 players increases by $150/10 = 15$. \therefore Required average = $197 + 15 = 212$.
50. Let $r = 2n - 1$, $s = 2n+1$ and $t = 2n+3$. $\therefore r + t = 4n + 2 = 2(2n+1) = 2s$.

EXERCISE – 5A

- Let the no of ants be $6x$. Then $2x$ are lured by the cockroach so that $4x$ are left and half of them that is $2x$ are tired. $2x$ ants now move ahead of which 19 stop to drink water and then the remaining which is $1/6^{\text{th}}$ of the total i.e. x reach the destination. Thus x ants stopped to drink water i.e. $x = 19$. Thus no of ants that are tired = $2x = 38$. Ans. d.
- Ans.d. Speeds of A and B are 10m/s and $25/3\text{ m/s}$ respectively. Thus they took 10 and 12 seconds respectively. While D took 10 seconds. Thus the total time is 44 seconds. Thus the 1st and 3rd team reached first.
- Let the second last digit in base 12 be x then that in base 8 will be $x+1$. Thus the number is: $(x+1)1$ in base 8 and $x1$ in base 12. Thus converting both to base 10 we have, $(x+1)8+1 = 12x+1$. I.e. $8x + 8 = 12x$. or $x = 2$. Thus the number in base 8 is 31 equivalent to 25 in base 10. Ans a.
- Simplifying by factoring each base into prime factors the expression reduces to $-2^{18}5^33^3$. $= (64.5.3)^3$. Thus x can be $64 \times 5 \times 3 = 960$ and $y = 3$. Ans. b.

5. 1 cat takes 3 minutes to kill 1 mice. Therefore 100 cats would take 3 minutes to kill 100 mice.
Ans c.
6. Ans b.. $CI = 12100 - 10000 = 2100$. $SI = 3000$. Thus Difference = 900
7. Ans b. The CP of 20 articles is say Rs20. Then that of 21 articles is Rs21. Thus 20 articles are sold at Rs21. Thus profit = $1/20 = 5\%$.
8. Let the number of weeks required be w. We have: work = men x time x rate = $5 \times 20 \times 5$. Since 3 women are equivalent to 5 men, 2 women will be equivalent to $10/3$ men. Thus $w = 500 = (10/3) \times 60 \times w$. Thus $w = 500/200 = 2.5$ weeks. Thus answer = c..
9. The nth root of the product of n numbers in GP gives the middle most term. Taken 3 nos in GP at a time, the value of the middle term is equal to the cube root of their product. Thus Ans.= a..
10. Ans.c., Let P be the principal. Then SI for 2 years = $16P/100$ and CI is $[P(112/100)^2 - P]$. Profit earned = $CI - SI = 944$. Thus solving we get $P = 10,000$.
11. The square is of side 6 thus the coordinates will be (0,0), (0,6), (6,0), (6,6) Thus midpoint of diagonal is (3,3). Thus it lies on each of the three lines thus Ans e..
12. The number of people who are carrying water as well as mirror will be 22. Since there must be at least five people in a group who carry water as well as mirror, the maximum groups that can be formed are 4. Ans. a.
13. Ans c.. The minute hand and the hour hand coincide after every $65 \frac{5}{11}$ minutes. In a week there are $7 \times 24 \times 60$ minutes. So, in a week they will coincide $(7 \times 24 \times 60) / (65 \frac{5}{11}) = 154$ times.
14. If S is the selling price of the article paid after deducting the production cost, D is the custom duty paid on the article, then, $S \propto D^2$
So, $S_1 = K_1 D_1^2$ (for lipstick)
 $\therefore 200 = K_1 (10)^2 \quad \therefore K_1 = 2$
And, $S_2 = K_1 D_2^2$ (for face cream)
 $\therefore 7^2 = 2(D_2)^2 \quad \therefore D_2 = 6$
15. Let CP of article be Rs30. Then SP is Rs27 and CP of other article = Rs10 with SP Rs12. Thus total CP = 40 and total SP=39. Thus loss =Rs1=2.5% Thus Ansd..
16. If S_t is the speed of the train and l is the length of the train in km, then $S_t = l / (18/1600)$, i.e., $S_t = 200l$. $S_t - 20 = l / (27/3600)$. $\therefore 200l - 20 = 400l/3$, or, $200l = 60$. $\therefore l = 60/200$.
 $\therefore l = 0.3 \text{ km} = 300 \text{ m}$. Hence answer is (b).
17. The slant height of the cone will be 9. The outer surface area of the cone will be $\pi r l = 198$ sq. units. The inner surface area will be the curved surface area of the hemisphere with radius $3\frac{1}{2} = 77$ sq. units and the area of the annular ring formed at the base = 115.5 sq. units. Thus the total surface area is $198 + 77 + 115.5 = 390.5$ sq. units. Thus Ans. is a.
18. Open the cylindrical vessel and lay it flat like a paper. Plot the two points; the ant's position, A, and the sugar cube's position, S. Now, the rim will act as a mirror from which the ant turns back to get the cube. The shortest distance will be when the point of reflection, R, is such that the angle of incidence is equal to the angle of reflection (Rule of thumb: Follow the path of light, that is always the quickest one!!). In this case since the diagram is symmetric the diagram is as shown below. The distance is the sum of the diagonals ≈ 24 . Answer is b.

19. The total expenditure of the husbands is Rs3500 while that of Mr. Nene is Rs.1,700. Thus Mr. Dixit spends Rs.1,800 which corresponds to 9 on the ratio scale. x corresponds to Rs.2,800 on the ratio scale. Thus $x = 14$.

	Mr.	Mrs.	Total
Nene	17	29	46
Dixit	18	28	$(92 - 46) = 46$
Total	35	57	92

20. Let Batliboi start off with 100 units. After the initial gold investment, he has 200 with him. One hundred he invests in shares and after a loss of 50%, he has totally 150 with him. To make a profit of 100% on his initial investment, he has to end up with 200, which means that he has to make a profit of 50 on the 100 he invests in gold the second time, which means a profit of 50%. Answer is b.

EXERCISE – 5B

- $CD = \sqrt{49-9} = \sqrt{40} = 2\sqrt{10}$ and $DB = \sqrt{25-9} = 4$
 \therefore Perimeter of the triangle = $7+5+4+ 2\sqrt{10} = 16+ 2\sqrt{10}$
- Difference in the C. I. of two successive periods = S.I. on the C.I. of the earlier period
 \therefore 11.25 is S.I. on Rs. 225 at same rate, for six months.
 $\therefore 225 \times 1 \times r / 100 = 11.25 \Rightarrow r = 5\%$. Hence the annual rate of interest = 10 %
- $x^2 - xy = 2x - 2y \Rightarrow (x - y)(x - 2) = 0$ then $x = 2 \Rightarrow x - y \neq 0 \therefore x \neq y$.
- Average speed = (Total distance travelled) / (Total time taken) = $150 / [(20+5)/6] = 36$ miles / hour.
- $\angle ABC = 90^\circ - \angle CFD = 90^\circ - (60^\circ - \angle ECF) = 60^\circ$.
- Using the formula $t = 12/11(m+x)$ and $t = 12/11(m-x)$ and substituting $m = 35$ m.s and $x = 84/6 = 14$ m.s, we get the two times as 23 and 53 min. past 7. Ans. is c..
- Let first term of G.P. be a and the common ratio be r. $\therefore a r^2 = 3$.
Product of the first five terms of the G.P. = $a \times ar \times ar^2 \times ar^3 \times ar^4 = [(ar^2)]^5 = 243$.
- Let families requirement of water is x litres per day. If there would not have been any leakage the supply of water would have lasted for 60 days, because of the leakage of 5 litres per day it will last for 50 days only. $\therefore 60x = 50(x + 5) \Rightarrow x = 25$ litres.
 \therefore Volume of water in the tank = $60 \times 25 = 1500$ litres. When there is a leakage of 50 litres per day if the supply lasts for d days, we get $1500 = d(25 + 50) = 75d \Rightarrow d = 20$ days.

9– 10

Let the first term of A.P. be a.
Then the series is a, $a + 3$, $a + 6$, $a + 3(n-1)$.
Also, first term \times last term = (third term)²
So, $a[a + 3(n-1)] = (a + 6)^2$
We get, $a(n-5) = 12$equation (1)
The required G.P. be $a/2$, $a^2/4$, $a^3/8$, $a^4/16$
Where $a^4 = 16a + 192$
Only value which satisfies the above equation is 4, i.e., $a = 4$.
Hence $n = 8$ [from equation (1)]
And common ratio of G.P. = $a/2 = 4/2 = 2$

- Interior angle of a regular polygon of n sides = $(n - 2) 180^\circ / n = 135^\circ$. \therefore EJ and FI are perpendicular to AB then $\angle IFB = \angle IBF = 45^\circ \therefore AJ = BI = s / \sqrt{2} \therefore AB = (1 + \sqrt{2}) s$
Area of the rectangle = $s [s (1 + \sqrt{2})] = (1 + \sqrt{2}) s^2$.

12. If n is any integer then $[n] = (n) \Rightarrow [n] - (n) = 0$. If x is a positive number other than integer then it can be written as $n+f$ where n is its integral part and f is its fractional part.
 $\therefore [x] - (x) = n - (n+f) = -1$. This is also true if x is any negative number.
13. Let $x = n+f$ where n is its integral part and f is its fractional part. $\therefore |x| = n+f$ if x is positive and $|x| = -n-f$ if x is negative. If x is -ve, then $|x| = -n-f$. $\therefore [|x|] = -n$ and $[x]$ is always non negative. Hence the alternative (b) holds good.
14. By considering different cases $a > b$ and $a < b$, it can be verified that the only alternative that holds good is d.
15. Let $y = 2x^3 - 3x^2 - 12x + 8$
 y will have maxima or minima, only if $dy/dx = 0$ (i.e., differentiation of y with respect to x)
 $dy/dx = 6x^2 - 6x - 12 = 6(x^2 - x - 2) = 6(x-2)(x+1)$
 The values of x for which dy/dx is zero are 2 and -1.
 Hence, other than all these values the function has neither maxima nor minima.
16. In the letters D,R, AU, G,H,T vowels are A and U which can be put together in $2!$ ways and these two vowels together with the other five letters can be arranged in $6!$ ways. \therefore Required number of arrangements = $2! \cdot 6! = 1440$ different ways.
17. The total no. of arrangements in which the letters of the word SUNRISE can be arranged are $7!/2!$.
 The no. of arrangements in which the vowels are always together are $5!/2!$.
 Hence, the no. of ways in which they are never together are $7!/2! - 5!/2!$. But these arrangements include the arrangement SUNRISE hence we need to subtract this one.
 Hence, total number of ways = $(7! - 5! - 2!)/2$
18. From the figure $B = (0,3)$ and $D = (-4,0)$ \therefore Required area = Sum of the areas of $[OBCD + \Delta OAB + \Delta OAE + \Delta ODE] = 12 + 9/2 + 15/2 + 10 = 34$.
19. The function assigns a no. (either -2, 0 or 2) to all the real values of x . Hence, the domain of the function is the set of all the real numbers.
20. Put $|x| = y$. \therefore The given equation reduces to $y^2 + y - 6 = 0$. $\therefore y = -3$ or 2 . But $|x| = -3$ is not possible. Hence $|x| = 2 \Rightarrow x = 2$, or -2 . \therefore Roots of the given equation are 2 and -2. \therefore Sum of the roots = 0.
21. Let $y = (x^2 - 6x + 5)/(x^2 + 2x + 1)$
 for $x = 0$, $y = 5$; for $x = 1$, $y = 0$; for $x = 2$, $y = -1/3$; for $x = 3$, $y = -1/4$ so it again start increasing and least value is at $x = 2$ and the value is $-1/3$
22. Since both the trains start at the same time, when they meet their travelling time is same
 $\therefore x/16 = (x + 60)/21 \Rightarrow 21x = 16x + 960 \Rightarrow x = 192$
 \therefore distance between the stations = $2x + 60 = 444$ miles.
23. First $(5x-1) < (x+1)^2 \Rightarrow x^2 + 1 + 2x > 5x - 1 \Rightarrow (x-2)(x-1) > 0 \Rightarrow x < 1$; $x > 2$
 Second $(x+1)^2 < 7x-3 \Rightarrow (x-4)(x-1) < 0 \Rightarrow 1 < x < 4$
 So in this range its only $x = 3$ which satisfies the inequality. Hence answer is b.
24. Let total number of workers = x . $\therefore [3/4 \cdot 2/10 + 1/4 \cdot 8/10]x = 63 \Rightarrow x = 180$. Alternatively
 Let total workers be 100 \therefore skilled workers = 75 and unskilled workers = 25. Skilled temporary workers = 15 and unskilled temporary workers 20. \therefore When total temporary workers are 35 then total workers are 100. \therefore When total temporary workers are 63 then total workers = $63 \cdot 100 / 35 = 180$.
25. Since tax is calculated on 60% of the value of the property, taxable cost of the shop = 14160 and taxable cost of the warehouse = 5760. \therefore tax on the shop = 14160 $\cdot 1/40 =$ Rs 354 and tax on warehouse = 1440 $\cdot 1/40 =$ Rs 144.

26. Cost of each cow = $37500 / 30 = \text{Rs } 1250$. Amount he obtained by selling 6 cows at 10% loss is $6 \cdot (9/10)(1250) = \text{Rs } 6750$. If he sells the remaining cows at Rs x per cow to gain a profit of 10% $\therefore 6750 + 20x = (11/10) 37500 = 41250 \Rightarrow x = \text{Rs. } 1725$.
27. $(a+b+c)$ objects can be divided into groups of a, b and c in $(a+b+c)! / a! b! c!$ if any two of them are not equal. \therefore Required number = $(45)! / 10! \times 15! \times 20!$
28. Food required per man per day is $1 / (2000) (54)$. Let strength of the reinforcement be x. Since food required per man per day is same, we get $1 / 2000 \cdot 54 = 1 / [(2000 \cdot 15) + (2000 + x) 20] \Rightarrow x = 1900$.
29. Putting $2^{-x} = t$, the inequality becomes $2t^2 - 7t - 4 < 0$ or $2(t + \frac{1}{2})(t - 4) < 0$
 $\Rightarrow -1/2 < t < 4$
 As $t = 2^{-x} > 0$ for all $x \in \mathbb{R}$ we get
 $0 < t < 4$; $0 < 2^{-x} < 4 = 2^2$
 As 2^x is an increasing function, we get $-x < 2$ or $x > -2$
 Thus the solution set is $(-2, \infty)$
30. When A runs 1000 metres B runs 960 metres and when B runs 1000 metres C runs 950 metres. \therefore When B runs 960 metres C will run $(960)(950) / 1000 = 912$. i.e. In a race of 1000 metres A beats C by 88 metres. \therefore in a race of 500 metres A beats C by 44 metres.
31. $k = (x^2 - x + 1) / (x^2 + x + 1) \Rightarrow kx^2 + kx + k = x^2 - x + 1$
 $(k-1)x^2 + (k+1)x + k-1 = 0$
 As x is real, the discriminant
 $D = (k+1)^2 - 4(k-1)^2 \geq 0 \Rightarrow (3k-1)(-k+3) \geq 0$
 $\Rightarrow (k-1/3)(k-3) \leq 0 \Rightarrow 1/3 \leq k \leq 3$
32. $OP = OQ = 3$ units. Taking the points P, Q, R and S on X and Y axis, $PQ = (9+9)^{1/2} = 3\sqrt{2}$. \therefore Area of the square = 18 square units.
33. Let the man met his wife at A. \therefore Usually time taken by his wife to move from A to Railway Station and Railway Station to A = time saved in the trip on that day = 10 minutes. \therefore Time required by his wife to go from A to Railway Station is 5 minutes. Since he started 60 minutes earlier and he got into the car 5 minutes earlier than his usual time of 6 p.m. \therefore He walked for 55 minutes before he was picked up by his wife.
34. $x^2 + 2x + 2 = (x+1)^2 + 1 > 0$; for $x \in \mathbb{R}$
 $\therefore (mx^2 + 3x + 4) / (x^2 + 2x + 2) < 5 \Rightarrow mx^2 + 3x + 4 < 5(x^2 + 2x + 2)$
 $\Rightarrow (m-5)x^2 - 7x - 6 < 0$; for $x \in \mathbb{R}$
 This is possible if $D = b^2 - 4ac = 49 + 24(m-5) < 0$ and $m-5 < 0$
 Both the inequalities are met if $m < 71/24$
35. A, B and C's work per day is respectively $1/36$, $1/54$ and $1/72$. If C works for x days to complete the work then A works for x - 8 days and B works for x - 12 days.
 $\therefore (x-8)(1/36) + (x-12)(1/54) + x/72 = 1$. $\therefore 13x - 48 - 48 = 216$. $\therefore x = 24$.
 \therefore C worked totally for 24 days.
36. $(0.2)^{\log_{\sqrt{5}} (1/4 + 1/8 + 1/16 + \dots \infty)}$
 $= (1/5)^{\log_{\sqrt{5}} \{1/4(1 - 1/2)\}} = (1/5)^{\log_{\sqrt{5}} (1/2)}$
 $= 5^{-[\log_{\sqrt{5}} (1/2)]} = 5^{[\log_{\sqrt{5}} (2)]}$
 $= 5^{[\log_5 (2)] / \log_5 \sqrt{5}} = 5^{2 \log_5 2} = 4$
37. From the information, $CK = 2$, $EF = 6 \Rightarrow GH = 3$, and $DK = 5$. \therefore Required area = 15 square units.
38. Probability of winning a game by Black thropo = 0.585. Hence in the season of 53 games they can win $53 \times 0.585 = 31.005$ games.

Probability of winning a game by Green horn = 0.509. Hence in the season of 53 games they can win $53 \times 0.509 = 26.977$ games. Hence they are four games behind the Black thropo.

39. Let a, b and c respectively be the amounts that A, B and C gets after completing their job. Total work of A, B and C in completing the work is respectively 39 hours, 46 hours and 53 hours.
 $\therefore a/39 = b/46 = c/53 = (a+b+c)/138 = 27.60/138 = \text{Rs } 0.2$. \therefore A's share = Rs 7.80, b's share = Rs 9.20 and C's share = Rs 10.60.
40. Let f and s respectively be the number of first and second class tickets that the man purchased. $\therefore f + s = 16$ and $50f + 15s = 450$. $\Rightarrow 10f + 3s = 90$ and $3f + 3s = 48$. $\therefore f = 6$ and $s = 10$.
 \therefore Required cost when he interchanges the number of tickets = $10 \times 50 + 6 \times 15 = \text{Rs. } 590$.
41. Choose any three positions out of 10 and arrange ABC (in that order) in one way. The remaining 7 can be arranged in $7!$ ways.
42. Let velocity of the train be x km / hr. \therefore Resultant velocity of the train when it crosses the man is $(x + 10)$ km / hr. $\therefore 1/10 = (10+x) (7.2) / (3600) \Rightarrow x + 10 = 50 \therefore x = 40$ km / hr.
43. If A had bought the radio for Rs. a, then $[(a+110) (12/10)] (9/10) (11/10) = 1188$. $\therefore a = \text{Rs. } 890$.
44. Let the number of eggs in the beginning be x $\therefore (0.96x \cdot 0.20) = 96 \Rightarrow x = 500$.
45. We have $P(S) = P[5,6] = 2/6 = 1/3$
 Let S denotes the occurrence of a number greater than 4 in a single throw of the die and F denotes its failure. $P(F) = 2/3$ (P - an even number of tosses is needed)
 $P = P(\text{FS or FFFS or FFFFFS or } \dots\dots\dots)$
 $= P(F)P(S) + P(F)^3P(S) + P(F)^5P(S) + \dots\dots\dots$
 $= P(F)P(S)/(1-P(F)^2)$
 $= (2/9)/(1-4/9)$
 $= 2/5$
46. After opening the tap C let the cistern can be filled after t minutes.
 $\therefore 7 (1/45 + 1/36) + t (1/45 + 1/36 - 1/30) = 1$. $\therefore 63 + 3t = 180 \Rightarrow t = 39$ minutes. \therefore Total time taken to fill the cistern = $39 + 7 = 46$ minutes.
47. The given equation can be written as $x[1 - \log 5] + \log(1 + 2^x) = \log 6$
 $x[\log 10 - \log 5] + \log(1 + 2^x) = \log 6$
 $x \log 2 + \log(1 + 2^x) = \log 6$
 $\log 2^x + \log(1 + 2^x) = \log 6$
 $2^x (1 + 2^x) = 6 \Rightarrow 2^x = 2, 2^x = -3$
 But $2^x = -3$ is not possible. Therefore $2^x = 2 = 2^1$. Hence $x = 1$
48. The area will be covered by three lines i.e $y = 1$
 $y = x - 1$ & $y = -(x - 1)$. It will form a triangle of area 1.
49. Consider $t_n = (n^2 + n + 2) / 2$, $t_{n-1} = (n^2 - n + 2) / 2$, $t_{n-2} = (n^2 - 3n + 4) / 2$, \therefore Last and second last terms of the required sequence are $a_n = 2n$ and $a_{n-1} = 2n - 2$, $a_n - a_{n-1} = 2$ which is a constant $\therefore t_n$ satisfies required condition. Similarly it can be shown that b. and c. also satisfies the given condition
50. He can come to any of the 25 stations in 25 different ways and he can chose his second destination out of the 24 stations in 24 different ways. \therefore By fundamental principle of multiplication required number of different tickets = $(25)(24) = 600$.

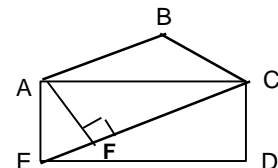
EXERCISE – 6A

1. Ans b. Since time required by both of them is constant, we get that speed \propto distance. Thus if A's speed is 3, B's speed will be 2. Thus distances are in the ratio 3:2. Difference in distances on ratio scale is 1km which is equal to actual difference. Thus the distance of A's house from college is 3km.
2. Ans. a.. Interest for x years is: $P \cdot x \cdot 10/100$. Interest for x+3 years is $P(x+3) \cdot 10/100$. Thus difference in interests is $3P/10 = 60$. Thus $P = \text{Rs.}200$
3. The pipe is turned on for double the time and capacity of B is twice that of A. Thus the fraction of tank B that is filled in 40 minutes is same as that of A filled in 20 minutes = $1/3^{\text{rd}}$. Thus Ans c..
4. Suppose B pays back Rs x in the first year, the interest on that would be $12 \cdot x/100$. The interest on the remaining amount would be $15(2000-x)/100$. But the total interest is Rs255. Thus solving we get $x = 1500$. Thus Ans is d.
5. Let the ages of A and B two years back be 2x and 3x. 3 years hence, their ages will be 2x+5 and 3x+5 respectively. Thus $(2x+5)/(3x+5) = \frac{3}{4}$. Thus solving we get: $x = 5$. Thus their ages 2 years back were 10 and 15 and today they will be 12 and 17. Thus Ans is a.
6. Ans. b.. Suppose the Marked Price is x. Then after 10% discount, the price at which the man purchased it will be $90x/100$. He sells away the car at a price that is 25% less than MP i.e. at $75x/100$. Thus He faces a loss of $15x/100$ over a Cost Price of $90x/100$. Thus loss % is $(15x/100)/(90x/100) \times 100 = 16.66\%$.
7. Suppose each bee cleans x cells in 3 minutes. Then no of cells cleaned by 5 bees is 5x. Thus 15 bees can clean $15x$ cells = $5x+30$. Thus $x=3$ and $5x = 15$. Thus Ans d.
8. Let a and b be two numbers with LCM 56. Since 56 is the LCM, a and b will be divisors of 56. Following are the divisors of 56:
1, 2, 4, 7, 8, 14, 28 and 56. Combining two of these at a time, the possible pairs with LCM as 56 are: 1,56; 2, 56; 4, 56; 8, 56; 14, 56; 28, 56; 56, 56; 8, 28; 8, 14; 7,8. Thus there are 10 pairs. Ans. c.
9. Let the numbers be a-2, a-1, a, a+1, a+2. Then $(a-1)(a-2)=a+2$. Thus solving, $a = 4$. Therefore the numbers are 2,3,4,5,6 and their sum is = 20. Ans. c..
10. To earn 33.33% i.e. $1/3^{\text{rd}}$ profit on selling the milk at Rs16.00 per litre, the cost price of each liter of the adulterated milk should be Rs12. Thus, alligating we get that the ratio of mixing should be 3:1.
Thus if milk is 12 litres, water should be 4 litres. Thus Ans b.
11. Ans.c.. If the cost price of the eggs was 10 then marked price would be 12 but after loss of 10%, SP would be Rs9. Thus difference between the MP and the SP on the ratio scale would be 3 but actual difference is 21. Thus factor of multiplication is 7. Thus Cost price is Rs $10 \times 7 = 70$.
12. By formula $\theta = 6 (45 - (11 \cdot 18) / 12) = 171^\circ$. Ansb..
13. If by selling milk at 40 lira a litre he makes a profit of 14.28%, which is $1/7$, it means that the cost of that litre to Mario is 35 lira. Alligating, 50 with 0 to get the mean cost price as 35, we get the ratio as 35 : 15, or 7 : 3 which is the ratio of milk to water. We want the ratio of water : milk which will be 3:7. Answer is d..

14. We get the following two equations:
 $2500k_1 + 36k_2 = 61$
 and $1000k_1 + 60k_2 = 70$
 We need to find the value of $3000k_1 + 24k_2$.
 Solving the above two equations simultaneously, we get $k_1 = 0.01$ and $k_2 = 1$. Thus the required weight is 54kgs. Ans. c.
15. The train is moving at 60kmph. Thus it covers 100m in 6 seconds. Since it takes 30 seconds to pass the platform, the length of the train must be 300m. Now the train takes 20 seconds to overtake the man which means that relative speed is 300/20m/s i.e. 54kmph. Thus speed of the man is 6kmph. Ans.c.
16. The third vertex will be either $(6, 2\sqrt{3})$ or $(6, -2\sqrt{3})$. Of these $(6, 2\sqrt{3})$ lies on the given line. Thus answer is e.
17. If thrice of A is equal to twice of B and 7 times B is equal to 9 times C then the ratio between A and C is
 $3A = 2B \Rightarrow A/B = 2/3$
 $7B = 9C \Rightarrow B/C = 9/7$
 Therefore $A/C = A/B \times B/C = 2/3 \times 9/7 = 6/7$. Ans.d..
18. There are only 0.15 million households owning atleast one car. Of them, 0.1 million own atleast 3 cars which amounts to 0.3 million of the cars. This must be the least number of people who can own exactly 3 cars. The remaining 0.2 million cars are owned by 0.05 million people where each must own on an average four cars to account for the 0.5 million cars. Thus Ans. b.
19. A gets 25000 thus B's share in profit apart from the compensation for managing the business will be 30000. thus total profit = 25000+30000+12000 = 67,000. ans b..
20. Let the base be x. Then $x^2 = 25$ implies $x = 5$. Thus 24 will be written as 44 in base 5. Ans. c..

EXERCISE – 6B

1. G can go to any of the 4 places with any of his 3 GF's in $4 \times 3 = 12$ ways.
 Now, two of his GF's don't want to come to Yerwadi. Hence, the no. of ways decrease by $1 \times 2 = 2$ ways.
2. Solving the eqn. $x + 3 > 8x/(x-3)$, we have
 $(x+3)(x-3) > 8x$ or $x^2 - 8x - 9 > 0$
 $\Rightarrow (x-9)(x+1) > 0$
 $\Rightarrow x > 9$ or $x < -1$(1)
 The other eqn $x^2 - 4 < 0$ becomes $(x+2)(x-2) < 0$
 or $-2 < x < 2$(2)
 Combining (1) and (2), we get $-2 < x < -1$



3. $\triangle AEF \sim \triangle CEA \Rightarrow AE / CE = EF / EA$
 $\therefore AE / 20 = 5 / AE \Rightarrow (AE)^2 = 100 \therefore AE = 10$.
4. Required value = $27400 [1 - (5/100)]^4 = 27400 (19/20)^4 = 22317.47$
5. Out of the numbers on the faces of the dice are 4 odd and 4 even. So the probability of number being odd or even is $1/2$. There are two possible cases:
 (i) The effaced no. is odd. Then two even nos. can be selected in 4C_2 ways.
 (ii) The effaced no. is even. Then the two even nos. can be selected in 3C_2 ways.
 $P(\text{Even no is effaced}) = \frac{\frac{1}{2} {}^4C_2}{\frac{1}{2} {}^4C_2 + \frac{1}{2} {}^3C_2} = \frac{6}{6+3} = 2/3$

6. If x workers are employed to complete it in 18 days. Work done per worker per day is $1/(75)(90)$. $\therefore 18x / (75)(90) = 1 \Rightarrow x = 375$.
7. Since food required per man is same and first 1500 men are there for (13+25)days. If x is the reinforcement which will be for 25 days, we get
 $1 / (1500) (48) = 1 / [(1500) (38) + 25x] \Rightarrow x = 600$.
8. Let a, b respectively be the speeds of A and B. $\therefore a+b=7$ and $24/a + 24/b = 14$. $\therefore 1/a + 1/b = 7/12$. $\therefore a^2 - 7a + 12 = 0 \Rightarrow a = 3$ or 4 km/hr $\therefore b = 4$ or 3 km/hr.
9. Letters which remains same when reflected in the mirror are **B, C, D, E, H, I, K, O**, and **X** which are 9 in number. \therefore Number of three letter words with or without meaning can be formed with the help of these letters $= 9 \times 9 \times 9 = 729$
10. Let B runs x meters before quickening his pace. Let a and b respectively be the initial speeds of A and B. $\therefore a = 1.2b \Rightarrow b = a/(1.2)$ and $1760/a = x/b + (1760 - x)/(1.2)a$
 $= 1.2x/a + (1760 - x)/(1.2)a \Rightarrow x = 800$.
11. First number m is at $n = 5$. \therefore Required number $= 15$.
12. An identity function is given as $f(x) = x$. Thus, for every value of x , there exists same value for y . Hence, Range and Domain for an identity function are equal sets. Hence, their union is also a set equal to R and D .
 A constant value function is given as $f(x) = k$. Thus for any value x takes, the value of the function is going to remain the same i.e. equal to k . Look at the function as $f(x) = k.x^0$ Hence, whatever we put the value of x as, it'll become 1. Thus, the range of the function has only one element: k while domain comprise all the real values.
 No. of sub-sets of any set are given by 2^n , where n is the no. of elements in that set. As there is only one element in range of the constant value function. The no. of sub-sets are $2^1 = 2$
13. α and $1/\alpha$ are the roots of equation : $x^2 - (\alpha^2 + 1)x/\alpha + 1 = 0$.
 $\therefore (8 + 2m) = 3^2 + 1$ or $m = 1$
 \therefore The other eqn becomes $x^2 - nx + 1^2 = 0$. The value of n should therefore be either 2 or -2.
14. Initial amount $= 12820$; \therefore Amount to be paid after one year $= 12820 + 1282 = 14102$. If his first year's instalment is a , then the principal for second year $= 14102 - a$. \therefore Amount to be paid after two years is $(14102 - a) 11/10$. His second and third instalments will be $2a$ and $3a$.
 $\therefore [(14102 - a) (11/10) - 2a] 11/10 = 3a \Rightarrow a = 2662$, $2a = 5324$ and $3a = 7986$.
15. Let x kg of first quality mixture is added to 10 kg of second quality mixture so that the ratio of two varieties in the new mixture is 5:4, but 10 kg of second quality mixture will contain 4 kgs of variety 1 and 6 kgs of variety 2. \therefore Variety 1/Variety 2 $= [(4x/7) + 4] / [(3x/7) + 6] = 5/4$
 $16x + 112 = 15x + 210 \therefore x = 98$ kg.
16. Let the cash value of the Fan now is Rs. x . \therefore Amount payable next year will be
 $(x - 500) (1 + 25/400) = (x - 500) (17/16)$. Similarly the Amount payable in next year will be
 $[(x - 500) (17/16) - 425] (17/16) = 289 \Rightarrow x = 1156$.
17. The minimum value will be when a, b, c, d all are equal to 1 and the value will be 12
18. Let the cistern will be full in t more minutes. $\therefore 3 (1/10 + 1/15 + 1/18) + t (1/10 + 1/15) = 1$. Solving this equation we get $t = 2$ minutes.
19. Required number of books $= [k (\text{lcm of } 6, 8, 12) + 3]$ which is divisible by 17. Smallest of such numbers is 51.

20. $x > y \Rightarrow -x < -y$ and $x > y$ and $2 > 1 \Rightarrow x+2 > y+1$. Also $x > y \therefore x/3 > y/3$ but if $x = 0$ and $y = -1$ then $x^2 = 0$ and $y^2 = 1$. Here $x > y$ but $x^2 < y^2$. $\therefore x > y \Rightarrow x^2 > y^2$ need not hold.
21. Favourable numbers for $x + 1/x$ to be > 50 are 1, 2, 48, 49, . . . 100. \therefore Favourable number of cases = 55, and total number of cases = 100. \therefore Required probability = $55 / 100 = 11 / 20$
22. Requirements on x if $x > 3$, then x is given by
 $(x - 3)^2 = (x - 1)$, i.e. $x^2 - 7x + 10 = 0 \Rightarrow (x - 2)(x - 5) = 0$
 $x = 5$ is the only permissible value.
23. Volume of the new mixture is 5 gallons of which 2 gallons of first mixture and three gallons of the second mixture. \therefore Total wine in new mixture = $(2/4) + (9/4) = 11/4$ gallons. and total water in new mixture = $(6/4) + (3/4) = 9/4$ gallons. \therefore wine : water in new mixture = 11 : 9.
24. Take random values for a and b , and find out values for x and y , and then find out the value of given expression. Now substitute values of a and b in answer options none of the option will give the value of given expression. Hence answer is d.
25. Since p is a prime number all numbers less than p will be relatively prime to p . e.g. If $p = 7$, then the numbers less than 7 and relatively prime to 7 are 1, 2, . . . , 6. $\therefore \phi(7) = 6$. In general $\phi(p) = p - 1$.
26. Since one of a, b, c , and d is a prime number say p if any one of the remaining three is not an integral multiple p then their GCD will be 1, If all of them are integral multiples of p then their GCD will be p
27. From the given answer options -6 is the smallest value of x which satisfies the equation.
28. The domain of admissible value of this equation satisfies the inequalities
 $x \geq -1, x \geq 1$ and $x \geq 1/4$.
 All these inequalities are satisfied when $x \geq 1$.
 Squaring both the sides of the equation we get
 $(x + 1) + (x - 1) - 2\sqrt{(x^2 - 1)} = 4x - 1$ or $2\sqrt{(x^2 - 1)} = 1 - 2x$
 Squaring again we get $4(x^2 - 1) = 1 - 4x + 4x^2$; $4x = 5$; $x = 5/4$
 For $x = 5/4$, LHS becomes 1 and RHS is 2
 So $x = 5/4$ is not a root of the equation
29. Amount of the tank filled in one hour with two pipes = $60 (1/24 + 1/40) = 4$. \therefore If V is the volume of the tank, third pipe can drain off the water in the tank three times in one hour. $\therefore 3V = (60)(30)$
 \therefore Volume of the tank = 600 gallons.
30. If we take $c < a, b$, then a and b cannot hold. For c , if $a \geq b$, then $|a - b| = a - b$
 $\therefore \frac{1}{2}(a + b - a - b) = \frac{1}{2}(a + b - a + b) = b = \min(a, b)$
 If $a < b$ then $|a - b| = b - a$
 $\therefore \frac{1}{2}(a + b - a - b) = \frac{1}{2}(a + b - b + a) = a = \min(a, b)$
31. $S = 1 + 2.2 + 3.2^2 + 4.2^3 + \dots + 100.2^{99} \dots \dots \dots (1)$
 $2S = 1.2 + 2.2^2 + 3.2^3 + 4.2^4 + \dots + 99.2^{99} + 100.2^{100} \dots \dots \dots (2)$
 Subtracting (2) from (1), we get,
 $-S = 1 + 2 + 2^2 + \dots + 2^{99} - 100.2^{100}$
 $= 2^{100} - 1 - 100.2^{100} = -99.2^{100} - 1$
 $S = 99.2^{100} + 1$
32. Amount of water in container C = $[(a/2) + (b/3)] / 3$. \therefore The container C will be full by $(3a+2b) / 18c$.

33. Diameter of pie crust = $(2/n)$. \therefore Radius of cherry pie = $(1/n)$.
 \therefore Area of one pie crust = π / n^2 . Hence total area of pie crust = $n^2 \times (\pi / n^2) = \pi$
34. 18 persons can be arranged around a circle in $(18 - 1)! = 17!$ ways. Now there are exactly 18 places where we can arrange the two brothers. Also the two brothers can be arranged in $2!$ ways. Thus total ways = $(17!) 18 (2!) = 2(18!)$
35. Probability of getting a white ball at any draw is $p = 12/24 = \frac{1}{2}$
 The probability of getting a white ball 4th time in the 7th draw
 = $P(\text{getting three white balls in 6 draws}) \times P(\text{white ball at the 7th draw})$
 = $({}^6C_3)(1/2)^6 \times (1/2) = 20/2^7 = 5/32$
36. $x+y$ is smallest if $2x + 5y = 16$. $\therefore 16 = 2 \cdot 3 + 5 \cdot 2 \Rightarrow x = 3+2 = 5$.
37. Two teachers out of 14 can be chosen in ${}^{14}C_2 = 91$ different ways. One P.T. instructor can be chosen in only one way, two captains out of 5 can be chosen in ${}^5C_2 = 10$ different ways. \therefore By fundamental principal of multiplication total number of ways of forming the committee = $91 \times 10 \times 1 = 910$.
38. $\pi r^2 = 9 / \pi \Rightarrow r = 3 / \pi$. Circumference = $2\pi r = 6$ ft. \therefore Number of revolutions = $120 / 6 = 20$.
39. L.H.S. = $(n^2 + 1/n^2 + 2) - (n^2 + 1/n^2 - 2) / [(1-n) / n] = 4n / (1-n) =$ R.H.S. will hold for all real values of n except $n = 0$ and $n = 1$, because at $n = 1$ R.H.S. is not well defined and at $n = 0$ $(n+1/n)^2$ is not well defined.
40. Let a , b and c respectively be the shares in rent of A, B and C. A put 70 sheep for four months, 60 sheep for eight months. B put 50 sheep for seven months, 70 sheep for five months. C put 40 sheep for four months, 50 sheep for three months and 30 sheep for five months.
 $\therefore a / 76 = b / 70 = c / 46 = (a+b+c)/192 = (12)(64)/192 = 4 \therefore a = \text{Rs.}304$, $b = \text{Rs.}280$ and $c = \text{Rs.}184$
41. It is clear from the graph that for each value of x in (a, b) there is unique value of y .
42. Let his income is Rs. 100, Since he is allowed a deduction of 20% his taxable income will be Rs. 80. \therefore tax = 5% of Rs 80 = Rs. 4. and Special surcharge = 10% of Rs 4 = Rs. 0.4. \therefore Total tax = Rs. 4.40. His gross income will be $1100 \times 100 / 4.40 = \text{Rs. } 25000$
43. Required cost = $(32)(30)(61) / 500 = \text{Rs}117.12$
44. Circumference of the circle = $2\pi r = 44 \Rightarrow r = 7 \therefore$ Required answer is 44.
45. If $n = 4k$, digit at unit's place is 1; if it is of the form $(4k + 1)$, digit at unit's place is 3; if it is of the form $(4k+2)$ digit at unit's place is 9; if it is of the form $(4k+3)$, digit at unit's place is 7. Since $13 = 4 \times 3 + 1$, digit at units place must be 3.
46. Let number of one paisa stamps be x . \therefore number of two paisa stamps will be $6x$. Since for the rest of the amount he gets 5 ps stamps. $[2(6x) + x]$ must be a multiple of 5. $\therefore x = 5$. Hence he will get two stamps of five paisa.
47. Since A worked for 7.5 days, he can complete half of the work and remaining half work is done by B alone. B can complete half of the work in 6 days. \therefore A and B worked together for 6 days.
48. $n(3n + 3) = 3.n.(n+1)$ is divisible by 3. If n is even it is also divisible by 2. If n is odd then $n+1$ is even hence it is divisible by 2. \therefore It is divisible by 6.

49. Total runs scored in the last three innings = $28+34+37 = 99$. Runs which he scored more with the earlier average = $99 - 3(21.75) = 33.75$. If total innings are n then $33.75 / n = 1.125 \therefore n = 30$.
50. Substitute the value of x from the options and check it is satisfied for both 2 and -2

EXERCISE – 7A

- Let the numbers be A and B . $A/B = 2/3$ and $A-6/B = 1/3$. Solving we get $A = 12$ and $B = 18$. Thus Ans. c.
- Let the number of students be x . therefore total age = $8x$. Average of class including the teacher = $(8x+28)/(x+1) = 8.5$ Thus solving we get, $x = 39$. Ans. d.
- Bozo invests 20,000 in real estate, which becomes 21,000 after an increase of 5%, and he invests 5,000 in bullion, which becomes 6,000 after an increase of 20%. He has 40% of this amount after the stock crash, i.e., $2/5$ of 27,000 = 10800. Ans.b.
- Let the work be $9 \times 24 \times 8 = 1728$. Let the number of days required by 16 men be x . Then we have $16 \times x \times 12 = 1728$. Thus $x = 9$. Ans.b.
- On the ratio scale, let each Uzi cost Leon 100. Then The first one is sold to Jackal at 125, and the second one is sold to Carlos at 80: the difference in the price is 45 on this scale, while actually it is 450. That means that the factor of multiplication is 10. That means that the actual price of each Uzi for Leon is $100 \times 10 = 1000\$$. Answer is b..
- Since the work done is same, $M_1 T_1 R_1 = M_2 T_2 R_2$. Thus $24 \times 5 = 5x \times 6$ where x is the number of days required. Solving we get $x = 4$. Ans.d..
- Let the amount of work be 30. Then A and B together do 3 units of work per day while C does 2 units per day. Thus A, B and C can together do 5 units in a day. Thus they would require 6 days to complete the job. Ans.a.
- The length of the longest diagonal of a cube of side a is $\sqrt{3}a$. Here the longest diagonal will be equal to the diagonal of the sphere i.e. $2R$. Thus side of the cube is $a = 2/\sqrt{3} \times R$. Thus volume of the cube = $a^3 = 8/(3\sqrt{3}) \times R^3$. Ans. d..
- Original SI = $P.T.R/100$. New SI = $(P.T/2.2R)/100$. Thus SI remains same. Ans.a..
- Rito has to pay 1.2 lakh as interest, and his running cost is 0.2 lakh per annum.
Man takes Rs 10 lacs loan at a rate of interest 12% per annum. Therefore interest would be Rs. 1.2 lacs. He should return total $10 + 1.2 = 11.2$ lacs.
Also to get profit of 500% over running cost, selling price should be 1.2 lacs.
Therefore total selling price = $11.2 + 1.2 = 12.4$ lacs
which means that he has to sell the roses at Rs 12.4 apiece. Answer is d..
- When Runman runs 1000 m, Bhagatram runs 800 m. When Bhagatram runs 800 m, Padtabhau runs 600 m. So, when Runman runs 1000 m Padtabhau runs 600 m, thus he beats him by 400 m. Ans.c.
- The volume of the larger cylinder will be $1/3 \times \pi 3^2 \times h = 3 \times 1/3 \times \pi.3^2 \times 7$. Thus $h = 21$. Ans.d..
- Alligating we get that the ratio in which acid and water should be mixed is 10:8 i.e. the amount of acid is 270 = 10×27 . Thus amount of water should be $8 \times 27 = 216$ ml. Ansc..
- When the time taken by each to cover a certain distance is known, and both start at the same time from opposite ends, the time required for them to meet is given by:

$T = \frac{A \times B}{A+B}$, where A and B are the time taken by each respectively. So the time elapsed will be $\frac{(3 \times 5)}{(3+5)} = \frac{15}{8} = 1 \text{ and } 7/8 \text{ hrs.}$ Answer is a..

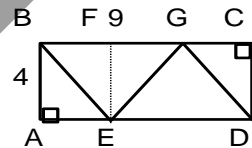
15. Let the radii be $2x$ and $3x$. Then the ratio volumes is $\frac{4}{3} \times \pi \times (2x)^3 : \frac{4}{3} \times \pi \times (3x)^3 = 8:27$. Ans.a..
16. Let the number of people who drank only coke but not pepsi be x . Then those who drank pure water is $2x$. But we do not know how many drank pure water as well as coke. Thus data is insufficient. Ans. d.
17. The speeds are 80 and 40, which give an average of 60. On alligating, the ratio of time comes to 1:1. That means that the time traveled at these speeds should be equal, i.e., 1 hr each. This means that the total distance is $80+40= 120 \text{ km}$ from Nashik to Pune. Answer is b..
18. Since the water is filled into the tank at the same rate at which it is emptied, the water level will remain at the same height i.e. at h . Thus answer is d..
19. The interests in the first year are the same for both CI and SI. The difference in the second year comes due to the excess interest on the first year's interest that is being charged in the CI deposit. Which means that 5% of 5% of $X= 200$; or, $X = 200 \times 20 \times 20 = 80000$. Answer is c..
20. Let the nos be $a-2d, a-d, a, a+d, a+2d$ which are same as $a/r^2, a/r, a, ar, ar^2$. Solving these we get that $r = 1$ and $d = 0$. Which means that the progression is constant or each term is equal to a . Thus Ans. c.

EXERCISE – 7B

1. Probability of any sand-dune being blown out is $P(b/o) = 2/3$
Probability of the blown-out sand-dune containing treasure is $P(b/o \& t) = 1/5$
Probability of any sand-dune containing lucky coupons is $P(l/c) = 2/5$
Hence, the probability of the blown-out sand-dune containing lucky coupon is $P(b/o \& l/c) = 2/3 \times 2/5 = 4/15$
Probability of the blown-out sand-dune containing both treasure and lucky coupon is $1/5 \times 4/15 = 4/75$
2. $2/9, 1/4, 2/7, 1/3, \dots$
This is an H.P. series. The corresponding AP will be $9/2, 4/1, 7/2, 3/1, \dots$
or $4.5, 4, 3.5, 3, \dots$
i.e. this is an AP with first term 4.5 and common difference -0.5 .
Hence, $T_{11} = 4.5 + 10(-0.5) = -0.5$
The corresponding T_{11} H.P. is $1/(-0.5) = -2$
3. Since 27% failed in both the subjects. Percentage of students who passed in at least one subject is 73 %. \therefore Percentage of students who passed in both the subjects = $70+65 - 73 = 62\%$.
total number of students = $24800 / 62 = 400$.
4. $A \circ A(x) = A[A(x)] = A(x) = x$ (Because for any identity function, $f(x) = x$)
5. Let minimum marks required to pass the examination be $x\%$. \therefore Marks of A = $0.8x$. Also Marks of B = 10% less than A = 90% of A = $0.72x$. \therefore Marks of A and B = $1.52x$. C obtained $(650/19)\%$ less than $1.52x$ i.e. $(1250 / 19)\%$ of $1.52x = x$. \therefore C passes the examination.
6. Area of two similar triangles is directly proportional to the square of it's sides. Since shape is same and the perimeter is doubled, hence side of each triangle is doubled. \therefore Area is multiplied by 4.

7. Only factors of 999919 are 991 and 1009. Since each cat killed equal number of mice which are more in number than the cats, required number of cats = 991.
8. Let the distance between two towns is x km and it takes t hours with speed 40 km/hr. \therefore with speed 30 km/hr it will take $(t + 6/60)$ hrs. $\therefore x = 40t = 30(t + 1/10) \Rightarrow t = 3/10$ and $x = 12$ kms
9. In 20 minutes first two pipes will full the cistern by $(20/30 + 20/36)^{\text{th}} = 11/9^{\text{th}}$ part of the cistern. \therefore In 20 minutes the third pipe C will drain $2/9^{\text{th}}$ part of the cistern. \therefore to drain full tank it will take $(20) \cdot 9/2 = 90$ minutes. \therefore Capacity of the cistern = $(90)(50) = 4500$ litres.
10. In a game of 60, A can give 10 points to B and 15 points to C means when A scores 60 points, B scores 50 points and C scores 45 points. \therefore When B scores 90 points C will score $(90 \cdot 45) / 50$ i.e. 81 points. \therefore In a game of 90 B can give 9 points to C.
11. A month has $31 - 2 = 29$ days only for February in a leap year. A leap year comes once every 4 years (Neglecting the case of century years) hence out of total 48 months only one month i.e., February has exactly 29 days. Therefore required probability = $1/48$. Correct answer is c.
12. In $\triangle ABC$, $AB + BC > AC$ and In $\triangle ACD$, $AC + CD > AD \therefore AB + BC + CD > AD \Rightarrow AD < 30$. Hence perimeter of the figure is less than 30.
13. $\sqrt{6x^2 - 5x + 11} + \sqrt{6x^2 - 5x - 25} = 12 \dots\dots\dots(1)$
 $(6x^2 - 5x + 11) - (6x^2 - 5x - 25) = 36 \dots\dots\dots(2)$
 Dividing (2) by (1), we get
 $\sqrt{6x^2 - 5x + 11} - \sqrt{6x^2 - 5x - 25} = 3 \dots\dots\dots(3)$
 Adding (1) and (3), we get
 $2\sqrt{6x^2 - 5x + 11} = 15$
 $6x^2 - 5x + 11 = 225/4$
 $6x^2 - 5x = 181/4$
14. $P + 3Pr / 100 = 944 \dots\dots\dots(I)$ and $P + 3(P + r) / 4(100) = 980$. Subtracting these two equations we get $Pr = 4800$ and substituting this in equation (I) we get $P = 800 \therefore r = 6\%$
15. Number of layers in the box = $(42875)^{1/3} = (125 \cdot 343)^{1/3} = 35$.
16. If $x + y + z = 0 \Rightarrow x + y = -z \therefore (x + y) / -z = -1$. \therefore If $(x+y) / z = 1$ then $x+y+z$ is not equal to zero.
17. Let $s = 8\sqrt{t} + t^2$
 \therefore velocity $v = ds/dt = 4t^{-1/2} + 2t$
 We have to find v_{\min} , so dv/dt has to be zero and $d^2v/dt^2 > 0$
 $dv/dt = -2t^{-3/2} + 2$
 Equate this to zero to obtain $t = 1$
 Hence, v is minimum at $t = 1$, $v_{\min} = 4 \cdot 1^{-1/2} + 2 \cdot 1 = 6$
 Check for $d^2v/dt^2 > 0$ on your own.
18. Since in case of a triangle, square and octagon it is impossible to divide any one of them in to two squares by drawing one straight line. In case of a rectangle whose length is twice the breadth it is possible to draw a line which divides it in two squares and every rectangle is a trapezoid.
19. Resultant velocity = $12 \text{ km/hr} = 10/3 \text{ m/sec}$, and total distance = $(60+84) = 144 \text{ m}$. \therefore total time required to fully cross it = $144 / (10/3) = 43.2 \text{ sec}$.

20. $\sec 2x - \tan 2x$
 $= 1/\cos 2x - \sin 2x/\cos 2x$
 $= (1 - \sin 2x)/\cos 2x$
 $= (\cos x - \sin x)^2/(\cos^2 x - \sin^2 x)$
 $= (\cos x - \sin x)/(\cos x + \sin x)$
 $= (1 - \tan x)/(1 + \tan x) = \tan(\pi/4 - x)$
21. Let the number of workers be n . $\therefore 60n = 12(400) + (n - 12)56 \Rightarrow n = 1032$.
22. Lcm of 7, 9 and 11 is 693. \therefore In 693 the ratio of spirit to water in each glass is 297 : 396, 308 : 385 and 315 : 378. \therefore Ratio of spirit to water in the mixture is $(297+308+315) : (396+385+378)$ i.e. 920 : 1159.
23. Since c is co - prime to a , there will not be any prime factor common in a and c and As c divides ab it must divide b . i.e. c is a factor of b .
24. Retailer 's cost price $= (75/100)(85/100)800 = \text{Rs. } 510$. If his list price is x
 $(90x/100) = 510(12/10) \Rightarrow x = \text{Rs. } 680$.
25. Let manufacturing cost of the item be Rs. x . $\therefore (1.1)(1.2)(1.25)x = 41.25$. $\therefore x = \text{Rs. } 25$.
26. When they cross each other, time taken by each of them will be same. If distance travelled by B is x units then distance travelled by A will be $x+30$ units and distance travelled by C will be $[210 - (x+30)]$ units. $\therefore x/40 = (x+30)/(50+k) = (180 - x)/50$. Where k is minimum speed that A should increase in order to pass safely. Equating first and last we get $x = 80$, then solving for k we get $k = 5$.
27. By Right Hypotenuse Side theorem $\triangle ABE \cong \triangle FEB \cong \triangle FEG \cong \triangle CDG$
 $\therefore BF = GF = GC$ and $BF+GF+GC = 9 \Rightarrow BF = 3 \therefore BE = 5$.
 \therefore Sum of the lengths of the segments = 15 units.
28. We have $2\log_{10}x - \log_x(0.01)$
 $= 2\log_{10}x - \log_{10}(0.01)/\log_{10}x$
 $= 2\log_{10}x + 2/\log_{10}x = 2(y + 1/y)$ [where $y = \log_{10}x$]
 < 0 for $0 < x < 1$
29. Required number of plants $= 60k + 1$. which is divisible by 7, and smallest of such numbers is 301.
30. Number of boys $= (1089)^{1/2} = 33$.
31. Let speed of the escalator be x steps per second. \therefore In 30 second the escalator will come down by $30x$ steps and in 18 seconds it will come down by $18x$ steps. Since height of the stair way is same. $26 + 30(x) = 34 + 18(x) \therefore x = 2/3$. \therefore height of the stair way $= 26 + 30(2/3) = 46$ steps.
32. Since $30 = 2.3.5$. We can assign 2 to x_1 or x_2 or x_3 . Thus 2 can be assigned in 3 ways. In the similar way 3 and 5 can be assigned in 3 ways. Thus number of solutions is $3.3.3 = 27$
33. If we take minimum possible values of four unequal numbers 1,2,3 and 4, $S = 10$ and $(s-a)(s-b)(s-c)(s-d) = 9.8.7.6 > 81.1.2.3.4$, so answer option will be a.
34. $a/b = c/d = y/x \Rightarrow y/a = x/b$.
35. Let his annual instalment is Rs. P . Amount to be paid after one year $= 25220 + 1261 = 26481$.
Amount to be paid after second year $(26481 - P)(1 + 5/100) = (26481 - P)(21/20)$. \therefore
Amount to be paid after third year $= [(26481 - P)(21/20) - P](21/20) = P \Rightarrow \text{Rs. } 9261$.



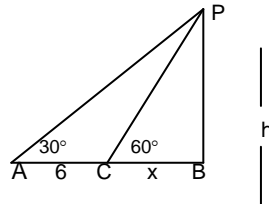
36. In the square triangles formed by half squares are 4, triangles formed by quarter squares are also four and small triangles are 4. \therefore Total number of triangles = 12.
37. Take arbitrary four values, substitute and check for the inequality as solving conventionally will take more time.
38. $3/7 - 4/7^2 + 3/7^3 - 4/7^4 + 3/7^5 - 4/7^6 + \dots$, rearrange the given series
 $[3/7 + 3/7^3 + 3/7^5 + \dots] - [4/7^2 + 4/7^4 + 4/7^6 + \dots]$
 $3/7[1 + 1/7^2 + 1/7^4 + \dots] - 4/7^2[1 + 1/7^2 + 1/7^4 + \dots]$
 $3/7[1/(1 - 1/7^2)] - 4/7^2[1/(1 - 1/7^2)] = 17/48$
39. $a < b < 0 \Rightarrow -a > -b > 0 \Rightarrow (-a)/(-b) > 1 \therefore a/b > 1$.
40. Let weight of the body as obtained by the fourth experiment be x .
 $\therefore 53.735 = [(3)(54.005) + x + x - 0.004 + 2(53.995)]/7 \Rightarrow x = 53.072$.
41. In three man jury since the decision is taken by majority, the only possibilities are a. Two members with probability p may give the correct decision OR b. First of the two makes the correct decision OR c. second of the two makes the correct decision In case a. the decision of the third jury will not affect the decision of the three men jury. In case b. and c. his probability of making correct decision is $1/2$ which will affect the decision of the three men jury.
Probability of making the correct decision by three men jury $= p^2 + p(1-p)(1/2) + (p-1)p(1/2) = p$. which is equal to the probability of one man jury.
42. $1/(1-n) \approx 1+n \Rightarrow 1 \approx 1-n^2 \Rightarrow n^2 \approx 1-1=0 \therefore n \approx 0$.
43. a, b, c are in AP, so $2b = a + c \Rightarrow 4b^2 = a^2 + c^2 + 2ac$
 $\Rightarrow 4b^2 - 4ac = a^2 + c^2 + 2ac - 4ac \Rightarrow 4(b^2 - ac) = (a - c)^2$
Discriminant of given equation is $4(b^2 - ac) = (a - c)^2 > 0$
Therefore answer will be d.
44. For each question in part A, the student has three choices :
(i) he does not attempt the question
(ii) he attempts the first part of the question
(iii) he attempts the alternative part of the question,
Therefore, the total no. of choices is 3^5 . But this includes a choice in which the student does not attempt any question in part A. Therefore, the total no. of choices is $3^5 - 1$.
Similarly, we can show that there are $2^4 - 1$ choices in part B.
So total no. of ways $= (3^5 - 1)(2^4 - 1)$
45. $p + q = -p, pq = q$ if $q = 0$ then $p = 0$
if $q \neq 0$ then $p = 1$ and $q = -2$. Thus $p = 1$ or 0
46. Let b, n and p respectively be the number of books, note books and pencils. $\therefore b/n = n/p \therefore n^2 = bp = 100$. $\therefore n = 10$.
47. Since base is a square of area 9, It's length = breadth = 3 units. \therefore Area of the side = 24 (height = 3). Hence height of the box = 8 units. \therefore It's volume = $9(8) = 72$ cubic units.
48. $m+n=0 \Rightarrow m = -n$. $\therefore 1/m + 1/n = 1/m - 1/m$ will be equal to zero if m is well defined non zero number. but $1/m - 1/n \neq 0 \Rightarrow m = 0 \therefore n = 0$. hence $m = n$.
49. We have $a^2 + b^2 + c^2 + 2(bc + ca + ab) = (a + b + c)^2 \geq 0$
 $1 + 2(bc + ca + ab) \geq 0 \Rightarrow bc + ca + ab \geq -1/2$
Also since $A.M \geq G.M$, we get
 $(b^2 + c^2)/2 \geq \sqrt{(b^2 c^2)} = bc$; $(c^2 + a^2)/2 \geq \sqrt{(c^2 a^2)} = ca$ & $(a^2 + b^2)/2 \geq ab$
Adding the above inequality, we get
 $a^2 + b^2 + c^2 \geq bc + ca + ab \Rightarrow bc + ca + ab \leq 1$
Hence, the value of the expression $bc + ca + ab$ lies in the interval $[-1/2, 1]$

50. $y + x^3 + xy = y^3 + y^2 + x \Rightarrow y^3 - x^3 + y^2 - xy + x - y = 0 \Rightarrow (y - x)(y^2 + xy + x^2 + y - 1) = 0 \Rightarrow x = y \therefore x^2 = y^2$.

EXERCISE – 8A

1. $MTR \propto W$. Here $M_1=120$, $T_1=40$, $R_1=8$, $W_1=2$ & $M_2=120$, $T_2=x$, $R_2=8$, $W_2=5$, from this we get value of x which is no. of days =100, $M_3=y$ =no. of men, $T_3=40$, $R_3=9$, $W=3$, from this we get $y=160$, hence additional men required =160-120 = 40. Ans.b.
2. Interest paid by C to A was $5000 \times 6 \times 2 / 100 = 600$, total money A got =5600 and paid to B is=5400,hence gain of A=200. Rate of interest = $400 \times 100 / (5000 \times 2) = S.I. = 4\%$. Ans.c.
3. Equivalent capital of A= $400 \times 12 + 200 \times 8 = 6400$, of B= $400 \times 4 + 200 \times 8 = 3200$, and of C= $800 \times 12 = 9600$, Total money invested =19200, share of A, B, C are 1/3, 1/6, 1/2 of total. Total profit=900, hence respective shares are 300, 150, 450. Ans. d.
4. The trick here is that all the intermediate transactions make no difference on the outcome as all the transactions are done between Milo's stooges. The outcome is that, Milo buys eggs at 7 cents a piece and sells at 5 cents apiece. Therefore, his loss %age is $2/7 = 28.56\%$. Answer is c..
5. $M_1 = M_2 = 4$, $T_1 = 4$, $T_2 = \text{let } x$, $R_1 = 6$, $R_2 = 8$, $W_1 = 15 \times 8 \times 6$, $W_2 = 20 \times 8 \times 6$, So $x = 4$. Thus number of days taken are the same or 0 extra days are required. Ans. d..
6. Let the volume of the tank be 60 litres. In one min A fills $1/12^{\text{th}}$ i.e. 5 litres, B fills $1/15^{\text{th}}$ i.e. 4 litres & C empties $1/20^{\text{th}}$ i.e. 3 litres. Thus when all the 3 taps are open the water filled in one minute is $5 + 4 - 3 = 6$ litres. Thus time taken = $60/6 = 10$ min. Ans. b.
7. The angle subtended by the diameter of a circle is 90° . Thus the diameter is the hypotenuse of the right angled triangle formed.
diameter = $\sqrt{[(57)^2 + (76)^2]} = 95$. Ans.c..
8. Alligating we get that the ratio of number of students of age 15 to that of age 17 should be 3:1. Thus there should be 8 student of age 17. Ans. b.
9. John's final cost for one tonne of wheat comes to $14000 + 5\%$ of 20000 = 15000, which he sells for 20000. That means that his profit %age is $5000/15000 = 33.3\%$. Answer is c..
10. At 7 O'clock distance between the minute hand and hour hand is 35 m.s. In 60 minutes, the minute hand gains 55 m. over hour hand. So it will gain 35 m.s. in $60 \times 35 / 55 = 38.18$ minutes. Ans.b..
11. Area of square = 100 cm^2 , area of triangle = $1/2 \times 10 \times 10 = 50 \text{ cm}^2$, area of rectangle = $20 \times 10 = 200 \text{ cm}^2$. Uncovered area = $200 - 100 - 50 = 50$, fraction $50/200 = 1/4$. Ans.c..
12. GCD = LCM therefore clearly $a = b$. Ans. b.
13. The two speeds are 500 and 200, and the mean speed is $1200/3 = 400$. On alligation, the time ratio comes to 2:1, that is, 2 hr at 500 and 1 hr at 200. So, he travels for two hrs at 500 km/hr to reach Rome from Paris, which makes that distance 1000 km. Answer is d..
14. Let the average marks be x and therefore the number of students will be $2x$. Thus total marks = $x \times 2x = 2x^2$. Therefore the total number of marks is two times a perfect square. Therefore from the answer options given, we can rule out a., b., d. and e.. Ans. c.

15.



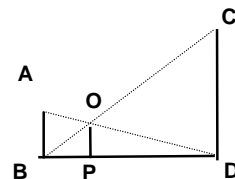
Let height of pole be h . From the above diagram, $\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{h}{(x+6)}$. Thus $h = \frac{(x+6)}{\sqrt{3}}$.
 $\tan 60^\circ = \sqrt{3} = \frac{h}{x} = \frac{(x+6)}{\sqrt{3}x}$. Thus solving we get $x=3$. Thus height of pole $h = \frac{9}{\sqrt{3}} = 3\sqrt{3}\text{m}$.
 Ans.b.

16. The tribe will have to represent the numbers in binary number system where 0 is represented by \times and 1 by ∇ . $12_{(10)} = 1100_{(2)} = \nabla\nabla\times\times$. Ans. a.
17. Let earlier base and current base is $4x$ and $5x$ respectively and height be $5y$ and $6y$ respectively. Earlier area $= \frac{1}{2} \times (4x \times 5y)$ and current area $= \frac{1}{2} \times 5x \times 6y$, so the ratio of old and new area is $= 2:3$. Ans.a..
18. The speeds are in the ratio $1:2$, therefore, since the distance is constant, the time taken should be in the opposite ratio $2:1$, which gives a difference 1 on the time ratio scale. This difference of 1 corresponds to 10 min in actual life. Therefore, the factor of multiplication is 10. It means that the actual times taken are 20 min and 10 min at speeds of 5 km/hr and 10 km/hr respectively. The distance comes to $(5 \text{ km/hr}) \times (20/60 \text{ hr}) = \frac{5}{3} = 1 \frac{2}{3} \text{ km}$. Ans. c..
19. Suppose that initially Johnny takes $6x$ toffees from the jar. Then he puts back $3x$ of them in jar and he admits to have taken only $2x$. Thus there should have been $4x$ toffees in the jar but there are only $3x$ toffees. Thus $x = 5$. Thus initially Johnny took $6x = 30$ toffees. Ans. c..
20. After 4 days there is provision for 99 soldiers for 66 days. When no. is increased by 220, total men are 1210. Assuming that each person consumes the same amount of food, let the number of days for which the food will last be x days. Thus $\frac{x}{66} = \frac{990}{1210}$, $x = 54$ days. Ans. b.

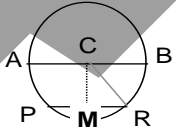
EXERCISE – 8B

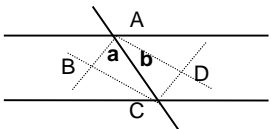
1. Take any odd function like $F(x) = x^3$ and put various values of $G(x) = x^2$ or x , we'll get the even and odd values for $F(G(x))$ respectively.
2. Required probability $= \frac{(2! \times 2! \times 2!)}{{}^{11}C_4} = \frac{(8 \times 4 \times 3 \times 2)}{8 \times 9 \times 10 \times 11} = \frac{4}{165}$
3. If A and B are adjacent vertices, then the remaining vertices could be (9,3) and (9,10) or (-5, 3) and (-5, 10). If they are opposite vertices then none of the given points could be it's vertex.
4. $\cos(\log x) = 3^{2x} + 3^{-2x}$
 $= (3^x)^2 + (3^{-x})^2 - 2 \cdot 3^x \cdot 3^{-x} + 2$
 $= (3^x + 3^{-x})^2 - 2 + 2$
 ≥ 2
 But this is not possible as $|\cos \phi| \leq 1$ for all real values of ϕ
5. $f(x) = \sin x + \cos x$
 $= \sqrt{2} \left(\frac{\sin x}{\sqrt{2}} + \frac{\cos x}{\sqrt{2}} \right)$
 $= \sqrt{2} \sin(x + \pi/4)$
 But $-1 \leq \sin \phi \leq 1$
 $\therefore f(x)$ lies in the range $[-\sqrt{2}, \sqrt{2}]$

6. Let AB and CD be the poles. Clearly by A - A - A test $\triangle ABD \sim \triangle OPD$ and $\triangle BCD \sim \triangle BOP$. From first similarity we get $20 / OP = 100 / PD$ and from the second we get $80 / OP = 100 / BP$. $\Rightarrow (PD / OP) + (BP / OP) = 5 + 5/4$
 $\therefore 100 / OP = 25/4 \Rightarrow OP = 16m$.



7. By indistinguishable dice, we imply that occurrence of 1, 2, 3 is same as 1, 3, 2 or 3, 2, 1 or 3, 1, 2 etc, etc. So the no. of outcomes in this case are not equal to 216. But the outcomes comprise
 (i) All digits different: ${}^6C_3 = 20$ ways
 (ii) Two digits same: ${}^6C_1 \times {}^5C_1 = 30$ ways
 (iii) No digit different (all digits same): ${}^6C_1 = 6$ ways
 Hence, the total no. of ways are $20 + 30 + 6$ are 56 ways.
8. D—C—B—A—O—E—F—G—H—I. Let they start from O, after half an hour before changing their direction they will be at B and G, After next one hour they will be at F and C. After three and half hours they will arrive at the same points again. \therefore they will be 5 kms. at the end of three and half hours.
9. $(a \# b) \# c = a \# (b \# c) \Rightarrow [(a+b)/2 + c] / 2 = [a + (b+c)/2] / 2$. $\therefore a+b+2c = 2a+b+c \Rightarrow a - c = 0$.
10. When D runs 860 m, B runs 880 m. \therefore When D runs 850 m, B runs $(85 \times 880) / 86 = b \dots$ (say)
 . When B runs 870 m, A runs 880 m. \therefore When B runs b m, A will run $(880 b) / 870$ m. \therefore C will win by $[880 - (85 \times 88 \times 880) / (86 \times 87)] = 880 / 3741$ m.
11. $T_{2r+1} = {}^{15}C_{2r} \cdot 1^{15-2r} (x)^{2r}$
 $T_{r-2} = {}^{15}C_{r-3} \cdot 1^{18-r} (x)^{r-4}$
 Given that the coefficients of these are equal.
 $\therefore {}^{15}C_{2r} = {}^{15}C_{r-3}$
 Either $2r = r - 3$ or $2r + r - 3 = 15$
 $r = -4$ or $r = 6$
 Accepting the +ve value of r.
 $T_6 = {}^{15}C_5 1^{15} x^5 = {}^{15}C_5 x^5$
12. For first nine months his salary is Rs 380 per month, for next 12 months it was Rs. 420, for next 12 months it was Rs. 460 and for the last three months it was Rs. 500. \therefore His average salary of last 36 months = $[2(380) + 12(420 + 460) + 3(500)] / 36 = 430$. \therefore His pension is Rs.215 per month.
13. These two curves do not intersect even at single points i.e 0
14. Ratio of the distance travelled per leap of hound and hare = $1/4 : 1/5$.
 Ratio of the time taken per leap of hound and hare = $1/5 : 1/6$.
 Ratio of velocities of hound and hare = $\frac{1/4}{1/5} = \frac{1/5}{1/6}$ i.e. $\frac{5}{4} : \frac{6}{5}$ i.e. 25 : 24
15. 23 being a prime number its only factors are 1 and 23. and factors of 8 are 1 & 8 or 2 & 4. Since sides of the rectangle are greater than 2. The numbers 23 and 8 can not be the areas of the rectangle.
16. If $a_1 + a_2 + \dots + a_n = k(\text{constant})$, the value of $a_1 a_2 a_3 \dots a_n$ is greatest when $a_1 = a_2 = \dots = a_n$
 So that the greatest value of $a_1 a_2 a_3 \dots a_n$ is $\{k/n\}^n$
 Given $yz + zx + xy = 12$ (constant), the value will be greatest when $yz = zx = xy$
 $\therefore yz = zx = xy = 4$
 so greatest value of $(yz)(zx)(xy)$ is 4.4.4
 Hence greatest value of xyz is 8

17. Since A's 3 days work is equivalent to C's 4 days work. \therefore If A can finish his work in 18 weeks, C can finish the same work in 24 weeks. Also C's 6 days work is equivalent to B's 5 days work. Hence the work which C can finish in 24 weeks will be completed by B in 20 weeks.
18. Since any number is not divisible by 0, there do not exist any real numbers whose GCD is 0. Also by the definition of GCD, it is the greatest of the divisors common to both a and b. \therefore At most it can be smaller of a and b. Also $G.C.D. \times L.C.M. = \text{Product of two numbers}$ \therefore correct statements are I and III
19. Consider $y = 5$, $x = 10$, $\phi(5) = \phi(10) = 4$ \therefore a. and d. need not be true. Since $[x, y, z] = y = p$; $[y, z] = [x, y] = p \Rightarrow \phi[y, z] = \phi[x, y]$
20. $OP = \sqrt{(2.98)^2 + (3.97)^2}$ Which is slightly less than $\sqrt{3^2 + 4^2} = 5$. \therefore Required answer is $4.75 < D < 5$.
21. $x \geq 0$; $\sqrt{x+3} \geq \sqrt{3} > 1$, so the value of expression will be more than 1, so no solution is possible.
22. Let capacity of the can be Q liters and the amount of milk left after removing milk and adding water four times be A. $\therefore A/P = (1 - 10/Q)^4$ $\therefore 16/(16+65) = (1 - 10/Q)^4$ $\therefore 1 - 10/Q = 2/3$. Hence $Q = 30$ litres.
23. Cross section of the pipe is as shown in the figure. $CR = 50$ cm. $CM = 40$ cm. To find PR, By Pythagoras theorem $MR^2 = 50^2 - 40^2 = 900 \Rightarrow MR = 30$ cm. \therefore breadth of the water surface = $PR = 60$ cm.
- 
24. $\cos 90^\circ$ is one factor therefore it is 0
25. i. $7^7 > 1.3.5.7.9 \dots 13$
this is in the form of $n^n > 1.3.5 \dots (2n-1)$; substitute small values of n and see this is always true.
ii. $2^n > 1 + n\sqrt{2^{n-1}}$
check by substituting the values of n
iii. $1/(7+1) + 1/(7+2) + \dots + 1/(2.7) > 1/2$
Now $1/(n+r) > 1/(2n)$ for $r = 1, 2, 3, \dots, (n-1)$ Therefore,
 $1/(n+1) + 1/(n+2) + \dots + 1/(n+n) > 1/(2n) + 1/(2n) + \dots + 1/(2n)$ (n times) $= n/(2n) = 1/2$
26. For such problems we can substitute the values of n,
put $n=1$, then Sum of one term of series is $(2n-1) = 1$, put $n=2$
then Sum of two terms of series is $(2n-1) + 2(2n-3) = 5$
When we put $n=1$ and 2 in option b, we will get 1 & 5 respectively. So answer will be b.
27. Total number of outcomes = $6 \times 6 \times 6 \times 6$. Number of outcomes, none of them showing 3 = $5 \times 5 \times 5 \times 5$ \therefore Required number of cases = $36^2 - 25^2 = 11 \times 61 = 671$.
28. $(a + 1/a)^2 = a^2 + 1/a^2 + 2$, and $(a + 1/a)^3 = a^3 + 1/a^3 + 3(a + 1/a) \Rightarrow 3\sqrt{3} = (a^3 + 1/a^3) + 3\sqrt{3}$
 $\therefore (a^3 + 1/a^3) = 0$.
29. Since in any triangle each side has to be greater than zero and sum of any two sides of a triangle is to be greater than the third side. \therefore If $c > 0$ then $(1-c) + (1-2c) > 1 \Rightarrow c < 1/3$. and if $c < 0$ then
 $1+c > 0 \Rightarrow c > -1$. Hence required limits of c are $-1 < c < 1/3$.
30. $x/y = (a_2 + a_4 + \dots + a_{400}) / (a_3 + a_5 + \dots + a_{401})$
 $= (a_2 + a_4 + \dots + a_{400}) / \{r(a_2 + a_4 + \dots + a_{400})\}$
 $x/y = 1/r$. Thus $r = y/x$

31. From 36 butts 6 standard size cigarettes can be made. After smoking one butt of each cigarette will be left from which one more cigarette can be made. \therefore Totally seven cigarettes can be made and smoked out .
32. From the figure it is clear that $a + b = 90^\circ$.
 $\therefore \angle A = \angle C = a + b$ and $\triangle ABC \cong \triangle CDA$ Hence Quadrilateral ABCD is a rectangle.
- 
33. Let a and b be the lengths in meters respectively of two trains with speeds of 75 km/hr, and 60 km/hr Their velocities are $125/6$ m/sec. and $100/6$ m/sec.
 \therefore In opposite direction their velocity is $225/6$ m/sec , time is 8 seconds and distance is $a+b$ meters. In parallel direction their velocity is $25/6$ m/sec., distance is b and time is $63/2$ sec.
 $\therefore 25/6 = b/(63/2) \Rightarrow b = 131.25$ m. and $225/6 = (a+b)/8 \Rightarrow a = 300 - 131.25 = 168.75$ meters.
34. There are 32 places for the teeth in the mouth. For each place we have two choices either there is a tooth or there is no tooth.
 Choice for 1 teeth = 2
 Choice for 2 teeth = 2^2
 Similarly, Choice for 32 teeth = 2^{32}
 In these one such case is also included ,in which a person has no tooth, But it is given that no person is there without tooth, Hence the maximum possible population of the city = $2^{32} - 1$
35. Since $(x+1)^2 \geq 0$ and $(y-1)^2 \geq 0$ and $(x+1)^2 + (y-1)^2 = 0 \Rightarrow (x+1)^2 = (y-1)^2 = 0 \Rightarrow x = -1, y = 1 \therefore x + y = 0$.
36. Perimeter of the square = circumference of the circle = $2\pi r = 44$ feet. \therefore Side of the square = 11 feet. \therefore Area of the square = 121 square feet.
37. Let the n consecutive whole numbers be $a, a+1, a+2, \dots, a+(n-1)$. \therefore Their average is given by $a + n(n-1)/2n = a + (n-1)/2$ will be a whole number if $n-1$ is even $\therefore n$ is odd.
38. A man can be chosen in 8 different ways and a woman can be chosen in 5 different ways. Hence by fundamental principal of multiplication total number of ways = $8 \times 5 = 40$.
39. For $px^2 + qx + 1 = 0$ to have real roots, we must have $q^2 - 4p \geq 0$ or $q^2 \geq 4p$.
 If $p = 1$, then $q^2 \geq 4$; $q = 2, 3, 4$
 If $p = 2$, then $q^2 \geq 8$; $q = 3, 4$
 If $p = 3$, then $q^2 \geq 12$; $q = 4$
 If $p = 4$, then $q^2 \geq 16$; $q = 4$
 Thus , the number of equations of the form $px^2 + qx + 1 = 0$ which have real roots is 7.
40. First card can be chosen from any of the 40 cards in 40 different ways. Second card of same suite but different denomination can be chosen in 9 different ways. Third card of same suite but different denominations can be chosen in 8 different ways and fourth card of same suit but different denominations can be chosen in 7 different ways. Total number of ways of drawing first card = 40, Second card = 39 (any card of that suit), Third card = 38, Fourth card = 37. \therefore Required probability = $(40 \times 9 \times 8 \times 7) / 40 \times 39 \times 38 \times 37 = (9 \times 8 \times 7) / (39 \times 38 \times 37)$
41. $a+b = x$ and $2a = y$ then $a^2 - b^2 = (a+b)(a-b) = (a+b)[2a - (a+b)] = x(y-x)$
42. By A - S - A test $\triangle ABE \cong \triangle DCE$ and $\triangle AEC \cong \triangle DEB \therefore AC = BD$.
43. Let the three numbers be $n, (n+1)$ and $(n+2)$. Clearly statement (I) need not be true. Similarly their sum is $3(n+1)$ at $n = 4$, it is divisible by 5. \therefore III also need not be true and one of them is divisible by 3. Hence the required answer is b..

44. Let A, B and C will take x hrs to do the job, then A will take $x+6$ hrs, B will take $x+1$ hrs, And C will take $2x$ hrs. Then $\frac{1}{x} = \frac{1}{x+6} + \frac{1}{x+1} + \frac{1}{2x}$
Instead of solving this, substitute the values from answer options. Option b. will satisfy the equation.
45. Let the number of marbles be m . $\therefore m = 3k+2 = 5t+1 \Rightarrow 5t = 3k+1$ where k and t are natural numbers. Since he had more than 15 marbles, required smallest number will be at $k = 8$ and the number of marbles $= 3 \times 8 + 2 = 26$.
46. $x^4 + x^3 - 4x^2 + x + 1 = x^2 (x^2 + x - 4 + \frac{1}{x} + \frac{1}{x^2}) = x^2 (x^2 + \frac{1}{x^2} + 2 + x + \frac{1}{x} - 6)$
 $= x^2 [(x + \frac{1}{x})^2 + (x + \frac{1}{x}) - 6] = x^2 (y^2 + y - 6)$
47. Let r and p respectively be the initial number of one rupee and 20 paise coins. With the given condition we get $100r + 20p = 1440$, and $100p + 20r = 480$. Adding these two equations we get $r + p = 16$. and subtracting them we get $r - p = 12$. $\therefore r = 14$.
48. Required probability $= 1 - (\text{Probability of getting 7 in single throw with a pair of dice})$.
Favourable cases for sum to be 7 are $\{(1, 6); (2, 5); (3, 4); (4, 3); (5, 2); (6, 1)\}$
 \therefore Required probability $= 1 - \frac{6}{36} = \frac{5}{6}$.
49. Radius of the circle $= \frac{\sqrt{2}}{2} = \text{diagonal of the square}$. \therefore Area of the circle $= \pi r^2 = 2\pi$.
50. Given that $x < z$ and $z < y \Rightarrow x < y$; but $x - a > y - a \Rightarrow x > y$ which is a contradiction.

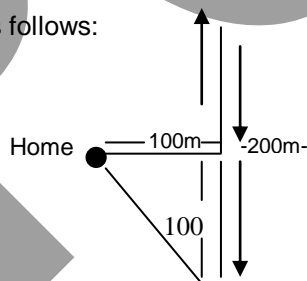
EXERCISE - 9A

- Let the man have x rupees. He gives 10% i.e. $\frac{1}{10}$ of his money to his wife i.e. he is left with $\frac{9x}{10}$ rupees. After giving money to his son and daughter, he is left with $\frac{9 \times 9 \times 9x}{1000} = 65610$, Thus $x = 90000$. Thus his wife gets $\frac{1}{10}$ of this i.e. Rs. 9000. Ans.d..
- Since a , c and b are in HP, $c = \frac{2ab}{(a+b)} = \frac{2ab}{2} = ab$. Geometric mean of a and b is \sqrt{ab} . Thus geometric mean of a, b is \sqrt{c} . Ans. a..
- Fully automatic has to buy 0.6 pounds of raw iron to make one sword. To make 10 swords he has to buy 6 pounds, which will cost him 240 sesertii. He will get $10 \times 50 = 500$ sesertii for these 10 swords. Hence, his profit comes to 260 sesertii. Answer is a..
- 25 men working 8 hrs a day complete a work in 20 days. Let the work be $25 \times 20 \times 8 = 4000$ units. In two days they will complete 400 units of work. Thus 3600 units of work are left which is done by say x number of people in 12 days when they work for 10 hours a day. Thus we have $x \times 12 \times 10 = 3600$. Thus $x = 30$ and therefore number of extra people who joined will be 5. Ans.c.
- If there are 25 people who are 12 years old and 20 who are 14 years old, there should be $89 - (20 + 25) = 44$ students who should be 13 or 15 years old. We have $89 \times 13 = 1157$. So total age of students is $1157 - (25 \times 12 + 20 \times 14) = 577$. This has to be distributed among 44 students. Out of these 41 students can be 13 years old and remaining are 15, 15, 14 years old. Hence maximum number is 41. Hence answer is a.
- Let the original price of rice per kg be Rs. x . Then the amount of rice that can be bought in Rs. 300 will be $\frac{300}{x}$ kgs. Thus after dropping by 25%, the price will be Rs. $\frac{3x}{4}$ and the amount of rice that can be bought will be $\frac{300}{(3x/4)}$ kgs, which is 10 kgs more than earlier. Thus we have: $\frac{300}{x} + 10 = \frac{400}{x}$. Thus solving we get $x = 10$. Thus original price of rice is Rs. 10 per kg and one can buy 30 kg of rice. Now if the price reduces by 40%, price of rice per kg will be Rs. 6 and one can buy $\frac{300}{6}$ kgs i.e. 50 kg of rice which is 20 kg more than earlier. Ans. b..
- Let the C.P. of the apples per kg be Rs. 20. Let x be the amount of apples sold at 10% profit i.e. at Rs. 22 per kg. Then the apples sold at 15% profit i.e. at Rs. 23 per kg will be $100 - x$. Total profit is 12% i.e. Rs. 240. But total profit $= 22x + (100 - x)23 - 2000 = 240$. Thus $x = 60$. Thus 40 kg of apples are sold at 15% profit. Ans. b..

8.	Runbha	Bhagatram	Padtaram
	19878	10110	
		98767	94195
	78987		38313

So the difference in the distance covered by ranbhau and padtram in a 78987 m race is approximately 40 Kms.

9. A and C move 80 kgs in a day. Since A, B and C move 100 kgs in a day, B must move 20 kgs per day. Thus, he would take 5 days to move 100 kgs. Ans.c..
10. One cask of fresh wine would have fetched him $10 \times 100 = 1000$ sesertii. After one year, the cask has 9 liters left, which he sells at 120 per litre, and that fetches him 1080 sesertii. Whatever his profits maybe in the first case, the profit increases by 80 sesertii. Answer is c..
11. Let P be the amount invested initially. We have $2P = P(1 + 20/100)^n$. Thus $2 = (1.2)^n$. Thus n has to be 4 as $(1.2)^4 > 2$ Thus Ans.a.
12. Let the length of the two trains be "D" metres each. When the train X crosses the 100 m long platform at $90 \times (5/18) = 25$ m/s, the time required is 10 s. On solving the equation: $(D + 100)/25 = 10$, we get D = 150 m. When train X overtakes train Y, the equation becomes: $2D/(25 - S_y) = 40$. On solving this equation, we get the value of $S_y = 17.5$ m/s = $17.5 \times (18/5) = 63$ km/hr. Answer is d..
13. Let x and y be the amount of tea sold at Rs. 90 and Rs. 80 per kg respectively. Then we have:
 $x + y = 20$ and
 $90x + 80y = 1700$.
Solving the two equations simultaneously we get y = 10 and x = 10. Thus Ans. d..
14. By using the distance formula and the given vertices we can find the lengths of sides of the triangle which are: 5, 5, $\sqrt{50}$. Thus the triangle is a isosceles triangle. Ans.b..
15. The path the man follows is as follows:



Thus the distance he is from home is $100\sqrt{2} \text{m} \approx 140\text{m}$. Ans.b..

16. Let the numbers be 2x and 3x. Their product is $6x^2 = 36 \times 6$. Thus x = 6, or the numbers are 12 and 18. There fore sum = 30. Ans. a.
17. Area of the trapezium is $(10+15) \times 8/2 = 100$. The largest square that can be drawn inside the trapezium will have side 8 and area 64. Thus the ratio is $64:100 = 16: 25$. Ans.c..
18. Let the numbers be x and y. Thus: $x/y = 3/5$.
 $(x+10)/(y+10) = 7/11$.
Thus simplifying we get y = 100 and x = 60. Thus Ans. d..
19. While moving to the front, the relative speed of the car is 30 km/hr and while moving back to its position, the relative speed is 90 km/hr. The speed ratio comes to 1:3, and since the relative distance covered in both the cases is the same, the time ratio would be the inverse, 3:1. If we

divide the $1\frac{1}{2}$ hr into four parts, three parts would be required by the car to reach the front of the convoy at a relative speed of 30 km/hr. It means that the length of the convoy is $(30 \text{ km/hr}) \times (3/4 \text{ of } 1\frac{1}{2} \text{ hr}) = 30 \times (9/8) \text{ km} = 33.75 \text{ km}$. Answer is b..

20. Let one ml of the 3 substances weight $7x$, $8x$ and $9x$ respectively. Then 4 ml of substance one will weigh $28x$ while 5 ml of substance 2 will weigh $40x$ and 6 ml of substance 3 will weigh $54x$. Thus the ratio of their weights now will be: $28x: 40x: 54x = 14:20:27$. Ans.a..

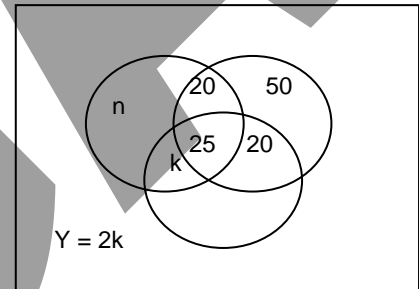
EXERCISE - 9 B

1. The fraction can be written as $F = (4+c)(2+c)/(5+c)$
Put $5+c = t$ or $c = t - 5$
 $\therefore F = (t-3)(t-1)/t = (t^2 - 4t + 3)/t$
 $= (t^2 - 4t + 4 - 1)/t = (t-2)^2/t - 1/t$
Hence, the given expression is minimum, if the square term is zero.
 $\therefore (t-2)/t = 0$ or $t = 2$, there fore $c = -3$ and for this value, $F = -1/2$.
2. Since no two Americans are together seven Englishmen can be seated at round table by leaving a vacant chair between any two of them in $6!$ ways and in seven vacant chairs seven Englishmen can be seated in $7!$ ways. \therefore Required number of arrangements $= 6! 7! = 3628800$

3-5

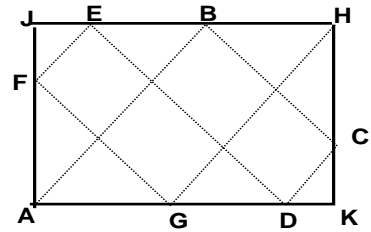
$U = 400$
 $\Rightarrow 310 + 3k = 400$
 $\therefore k = 30$
People speaking H are $h + k + 20 + 25$ and those speaking W are $w + 20 + 25$
 $\therefore h + k - 20 - w = 2k$
 $\Rightarrow h - 50 = 50$
 $h = 100$
 $Y = 2 \times 30 = 60$
Or $n = 245 - (100 + 50) = 95$
People who speak N or W are $95 + 50 + 20 + 25 + 20 + 30 = 240$

$$X = I + II + III = 310 + k \text{ \& } Y = 2k$$



6. Let a boy has x brothers and x sisters. \therefore Number of the children in the family $= 2x + 1$. \therefore A girl in the family has $(x - 1)$ sisters. \therefore Number of her brothers $= 2(x - 1)$. Hence total number of children in the family $= 3(x - 1) + 1 = 3x - 2$. $\therefore 3x - 2 = 2x + 1 \Rightarrow x = 3$. Total number of boys in the family $= 4$ and total number of girls in the family $= 3$.
7. Required ratio $= [1225 / (7/4)] / [1300 / 2] = 14 / 13$.
8. Any no. is divisible by 9 if the sum of its digits is divisible by 9. The sum of all the digits from 1 to 9 is 45, which is divisible by 9. Hence, when we are selecting 7 digits out of 9 so that the no. formed is divisible by 9, we can reject only those two digits which sum to 9. These nos. are (1,8), (2,7), (3,6), and (4,5). So, the numbers divisible by 9 are $4 \times 7!$
9. Number of diagonals of a polygon having n sides $= {}^nC_2 - n = {}^{20}C_2 - 20 = 170$.
10. $\sin \alpha + \cos \alpha = -b/a$, $\sin \alpha \cos \alpha = c/a$
Now, $1 = \sin^2 \alpha + \cos^2 \alpha = (\sin \alpha + \cos \alpha)^2 - 2 \sin \alpha \cos \alpha = (b^2/a^2) - 2c/a$
 $a^2 = b^2 - 2ac$; $a^2 - b^2 + 2ac = 0$
 $a^2 + c^2 + 2ac = b^2 + c^2$; $(a + c)^2 = b^2 + c^2$
11. Three cards can be drawn in ${}^{52}C_3$ ways while one king, one queen and an ace can be drawn in $4 \times 4 \times 4 = 64$ different ways. \therefore Required probability $= 64 / {}^{52}C_3 = 64 / 22100$.

12. Path of the ball is as shown by the dotted lines
 A - B - C - D - E - F - G - H. It reaches the corner
 of the rectangle AJHK first time at H. $AJ = JB = 3$
 $\Rightarrow AB = 3\sqrt{2}$, Similarly we get $BC = GF = 2\sqrt{2}$; $CD = EF =$
 $\sqrt{2}$, DE
 $= GH = 3\sqrt{2}$.
 \therefore Total distance travelled $= 9\sqrt{2} + 4\sqrt{2} + 2\sqrt{2} = 15\sqrt{2}$.



13. Let it's price be x . $\therefore 5x / 100 = (x - 5) (5.5 / 100) \Rightarrow x =$
 Rs.55.
14. Let it's usual speed be v and it's usual time be t hours. Since it saves 18 minutes in the journey
 of 54 km. With the speeds $2v / 3$ and v , $18 = 54 (3/2v - 1/v) \Rightarrow v = 3/2 \text{ km/min} = 90 \text{ km / hour}$.
 \therefore Total distance $= x = 90t = 45 + 60 [t - 1/2 + 45/60] \Rightarrow t = 2 \text{ hours}$. \therefore distance $= 180 \text{ kms}$.
15. Let $f(x) = x^{25}(1-x)^{75}$, so $f'(x) = 25x^{24}(1-x)^{75} - 75x^{25}(1-x)^{74}$
 $= 25x^{24}(1-x)^{74}(1-4x)$
 Thus $f'(x) = 0$ for $x = 0, 1, 1/4$. Now $f(0) = 0$, $f(1) = 0$ and $f(1/4) = (1/4)^{25} (3/4)^{75}$
 Hence f has maximum at $x = 1/4$
 Or $x / 25 = (1 - x) / 75$ so, $x = 1/4$
Alternate solution:
 This is in the form $x = a^p b^q$ where $a + b = \text{constant}$.
 Maximum value of the expression will be when $a/p = b/q$,
 Therefore $x/25 = (1-x)/75$, thus $x = 1/4$.
16. Let it's cost price be x . $\therefore 1.12 (0.96x) = 1.06x + 1.90 \Rightarrow x = 1.90 / 0.0152 = \text{Rs.}125$.
17. Put $\sqrt{x-1} = t$ or $x = t^2 + 1$ so the equation becomes
 $\sqrt{t^2 + 4 - 4t} + \sqrt{t^2 + 9 - 6t} = 1$ or $\sqrt{(t-2)^2} + \sqrt{(t-3)^2} = 1$
 or $|t-2| + |t-3| = 1$
 This equation is satisfied for all values of t lying between 2 & 3, i.e. $2 \leq t \leq 3$
 Thus the given equation is satisfied for all values of x lying between 5 and 10
18. $y = \sin 2x - \cos 2x = \sqrt{2} \sin(2x - \pi/4)$
 $\therefore -\sqrt{2} \leq y \leq \sqrt{2}$
19. Intersection of a sphere and a plane is always a circle. Let C be the center of the sphere. O be
 the foot of the perpendicular drawn on the plane from C . $\therefore CO = h = \text{constant}$. If P is any point
 of the intersection of the sphere and the plane, then $CP = r = \text{Radius of the sphere}$.
 $OP^2 = CP^2 - CO^2 = r^2 - h^2 = \text{constant}$. Hence the required locus is the circle.
20. Check by substituting the values.
21. Let b and c respectively be the share in the profit of B and C and B invested an additional
 capital after n months. Since profit is directly proportional to the principal and the time. The
 profit is to be divided in the ratio $1100(12) : 1300n + 1800(12 - n) : 1700(12)$ i.e. $132 : 216 -$
 $5n : 204$.
 $\therefore 627/132 = b/(216 - 5n) = c/204 = 2527 / (552 - 5n) \therefore n = 4$.
22. Let x litres of water be added in 70 litres of the mixture so that percentage of water in new
 mixture is 12.5%. \therefore In 70 litres of mixture amount of water is 7 litres $\therefore 12.5\% \text{ of } (70+x) = 7+x$.
 $\therefore 1/8(70+x) = 7+x \Rightarrow x = 2 \text{ litres}$.

23. In an AP ,
 $a_1 + a_n = a_2 + a_{n-1} = a_3 + a_{n-2} = \dots$
 $a_1 + a_{24} = a_5 + a_{20} = a_{10} + a_{15}$
 Now, $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$
 $(a_1 + a_{24}) + (a_5 + a_{20}) + (a_{10} + a_{15}) = 225$

$$3(a_1 + a_{24}) = 225,$$

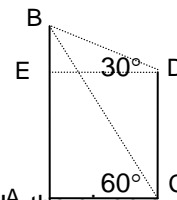
$$a_1 + a_{24} = 75,$$

$$S_{24} = 24/2 (a_1 + a_{24}) = 900$$

24. Let x minutes past 3 the hands of the clock are equi-distance from the figure of 3. This can happen if (i) Both the hands are on opposite sides of three or (ii) They overlaps. Since in x minutes the minute hand covers an angle of $6x^\circ$ and the hour hand covers an angle of $x/2^\circ$ we get $90 - 6x = \pm(x/2)$ or $(6x - 90) = \pm(x/2)$. $\therefore x = 180/13$ or $180/11$ i.e. $13^{11}/13$ minutes or $16^{4}/_{11}$ minutes.
25. Given equation can be written as $-2 < (10 - x)/3 < 2 \Rightarrow -6 < 10 - x < 6$
i.e. $-16 < -x < -4$ i.e. $4 < x < 16$.
26. Let its cost price be Rs. x . $\therefore x(12/10)(95/100) = 285/10 \Rightarrow x = 25$. \therefore Actual profit = Rs. 3.50
27. Volume of the reservoir = $2 \times 1 \times 1/2 = 1 \text{ m}^3 = 1000$ litres. \therefore Number of flower pots that can be watered = $1000 / 0.5 = 2000$.
28. Since (LCM) (HCF) = Product of two numbers \therefore Second number = $(4125)(25) / 375 = 275$.
 \therefore The second number is less than the first by 100.
29. $\alpha + \beta = (1/\alpha^2) + (1/\beta^2) = (\alpha^2 + \beta^2) / \alpha^2 \beta^2 = [(\alpha + \beta)^2 - 2\alpha\beta] / \alpha^2 \beta^2$
 $-b/a = [(b^2/a^2) - 2c/a] / (c^2/a^2) = (b^2 - 2ac) / c^2$;
 $2a/c = b^2/c^2 + b/a = ab^2 + bc^2 / ac^2$
 $2a^2c = ab^2 + bc^2$; $2a/b = b/c + c/a$ [dividing by abc]
 $c/a, a/b, b/c$ are in A.P.; $a/c, b/a, c/b$ are in H.P.
30. Taxable value = $(45/100)(280,00,000) = 126,00,000$. Let the tax percentage be $x\%$.
 $\therefore 126,00,000 (x/100) = 441,000 \Rightarrow x = 3.5\%$. \therefore Tax on house = $(52,000/100)(45/100)(7/2) = 819$
31. First arrange m men, no. of ways are mP_m . Since no two women are to sit together we have $(m+1)$ places for the women. Thus women can take their seats in ${}^{m+1}P_n$ ways. So total no. of ways = ${}^mP_m ({}^{m+1}P_n)$
32. Given that $xy + yz + zx = 5$. Since $(x - y)^2 \geq 0 \Rightarrow x^2 + y^2 \geq 2xy$. Similarly we get $x^2 + z^2 \geq 2xz$ and $z^2 + y^2 \geq 2zy$. Adding them we get $x^2 + y^2 + z^2 \geq xy + yz + zx = 5$,
 $(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$. As x, y and z are sides of a triangle satisfying $xy + yz + zx = 5$; Maximum value of $x + y + z$ is 5. Using this inequation, we get $x^2 + y^2 + z^2 \leq 15$
 $\therefore 5 \leq x^2 + y^2 + z^2 \leq 15$.
33. Let u and v be the velocities of the two trains. \therefore Resultant velocity = $u+v$ and total distance travelled = $2a$, where a is length of each train. \therefore Total time = $2a / (u+v) = 2a / (a/3 + a/4) = 24/7$ sec
34. Altitude on the third side will be greatest if it is a right angled triangle and in that case the hypotenuse will be 8. Hence the altitude on third side cannot exceed than 7.
35. Let number of people who belongs to both the clubs = b . $\therefore x = a+b+c$
 $y = a+b$ and $z = b+c$. \therefore Number of people who belongs to only one club = $a+c = 2(a+b+c) - (a+b) - (b+c) = 2x - y - z$.
-

36. $1 < 3x - 5 < 10 \Rightarrow 1+5 < 3x < 10+5 \therefore 6 < 3x < 15 \Rightarrow 2 < x < 5$.

37. Amount of cistern that can be filled in first two minutes = $1/20 + 1/30 = 1/12$. \therefore to fill the cistern completely it will take 24 minutes, but because of the hole it takes 27 minutes. and in last 3 minutes the cistern can be filled by $1/20 + 1/30 + 1/20 = 2/15$. \therefore In 27 minutes it drains out $2/15^{\text{th}}$ part of the cistern. \therefore Time taken to vacate it = $(27 \cdot 15) / (2 \cdot 60) \text{ hrs.} = 3.375 \text{ hrs.}$
38. $99 \# 1/99 = (99 \times 1/99) + [1 / (99 \times 1/99)] = 1 + 1 = 2$. Similarly $\frac{1}{2} \# 2 = 1 + 1 = 2$
39. $c \# d = (c + 1/c)(d + 1/d) = cd + c/d + d/c + 1/cd = (cd + 1/cd) + [c/d + 1/(c/d)]$
 $= (c \# d) + (c \# 1/d)$
40. Number of pounds of oranges will be maximum if it's cost is minimum i.e. 15 ps / pound. In that case number of pounds of the oranges = $500 / 15 = 33.33$. Hence required answer = 33.
41. Letters of the word "Independence" are E E E E, N N N, D D, P, I, C. Total number of letters are 12 of which E is repeated four times, N is repeated thrice and D is repeated twice. Hence total number of arrangements = $12! / (2! \cdot 3! \cdot 4!) = 1663200$.
42. The solution to the given equation is as follows: $x = 2$, $x = 3$; $y = 1$ and $y = 5$. Therefore angular points are A(2,1), B(2,5), C(3,5), D(3,1), where A,B,C and D are the vertices of parallelogram. Equation of AC is $y = 4x - 7$
Equation of BD is $4x + y = 13$
43. From the figure it is clear that $\triangle ABC \sim \triangle AED \Rightarrow AB / AE = AC / AD \therefore 4/AE = 5/3 \Rightarrow AE = 2.4$.
44. Velocity of the motor boat = $100 / 9 \text{ m/sec.}$ and the velocity of the current = $10 / 9 \text{ m/sec.}$
 \therefore Resultant velocity of the boat = 10 m/sec. \therefore total distance travelled = 100 m. Since length of the motor boat is 20 m. length of the temple = 80 m.
45. Cost of carpeting a room of size $6 \times 0.5 \text{ m}^2 = 270 - 240 = \text{Rs.}30$. \therefore Cost of carpeting = Rs.10 per square meter. \therefore Actual area of the room = $270 / 10 = 27 \text{ m}^2$.
 \therefore width of the room = $27 / 6 \text{ m.} = 4.5 \text{ m.}$
46. To earn the profit of 10% his S.P. must be $1350 + 135 = 1485$. Amount obtained by selling $1/3^{\text{rd}}$ of wheat at 10% loss = Rs.405. \therefore To get a profit of 10% S.P. of remaining wheat of Rs.900 must be Rs.(1485 - 405) = Rs.1080. \therefore Profit = Rs.(1080 - 900) = Rs.180. \therefore Profit percentage = 20 %.
47. Let the height of the tower CD be x meters.
 $\therefore \tan 60^\circ = AB / AC = 60 / AC = \sqrt{3} \Rightarrow AC = 20\sqrt{3}$
 $\tan 30^\circ = BE / ED = BE / AC = (60 - x) / 20\sqrt{3} = 1/\sqrt{3}$
 $60 - x = 20 \Rightarrow x = 40 \text{ meters.}$
48. Since $\sqrt{8 \times 2} = \sqrt{16} = 4$ which shows that x and y need not be perfect squares but z can be a perfect square. In the given example, $z = 4$
Hence z needs be greater than zero.
49. Any number can appear on the first die. Probability that same number will appear on both second and third die is $1/6$ and $1/6$. \therefore Required probability = $1 \times 1/6 \times 1/6 = 1/36$.
50. 63% Indians like Hritik. If all of them like Big B, then maximum who like both will be 63%. However minimum who like both will be $(76 + 63) - 100 = 39$

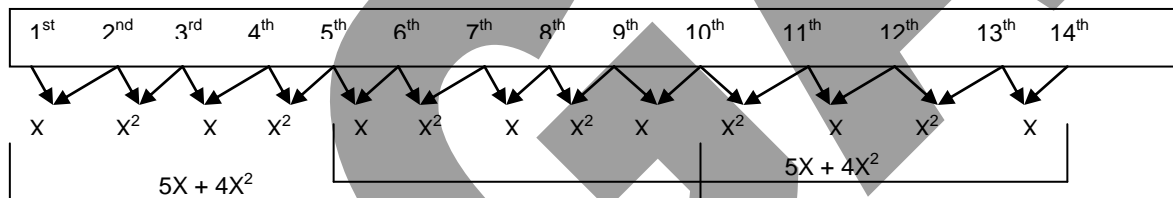


EXERCISE – 10A

1. Let the original price be Rs. $10x$ per kg. After reduction by 10%, the price will now be $9x$. So that the man can buy $1800/9x = 200/x$ kg rice. Thus $1800/10x + 10 = 200/x$. Thus solving we

get $x = 2$. Thus original price is Rs.20 per kg and one can buy 90 kg rice in Rs. 1800. Now if the price increases by 12.5% i.e. becomes Rs. 22.5 per kg, one can buy $1800/22.5 = 80$ kg. Thus the man buys 10 kg less. Ans.b..

2. Let Batliboi start off with 100 units. After the initial gold investment, he has 200 with him. One hundred he invests in shares and after a loss of 50%, he has totally 150 with him. To make a profit of 100% on his initial investment, he has to end up with 200, which means that he has to make a profit of 50 on the 100 he invests in gold the second time, which means a profit of 50%. Answer is b..
3. Suppose that one man does work equivalent to x women. Then the work is $w = (2x+3) \times 3 \times 8 = (3x+3) \times 2 \times 9$. Thus solving we get $x = 3$. Thus work is 216. Let the number of men required to complete the work be y . Then we have $(3y+3) \times 2 \times 6 = 216$. Thus $y = 5$. Ans.a..
4. Let the capacity of the tank be 120 litres. Then A can fill 3 litres per minute while B at 4 litres per minute. C then empties 2 litres per minute. Suppose that the tank will take x minutes after taps A and B are opened to get filled. Then A and B are turned on for x minutes while C is working for $x-10$ minutes. Thus we have $3x+4x-2(x-10) = 120$. Solving we get $x = 20$. Thus the tank will be full after 20 minutes i.e. at 3:30pm. Ans.d..
5. The distances between the birds as per the given information are as follows:
let x be the distance between first and the second bird then,



- Here we can observe that any value of x satisfies the given condition. Hence no unique value can be determined. Ans is e.
6. Let the sums be x and $2x$. Then interest earned will be $(x \times 5 \times 2) / 100 + (2x \times 8 \times 2) / 100 = 420$. Thus solving we get $x = 1000$. But total sum is $3x$ i.e. Rs. 3000. Ans.c..
 7. By formula $\theta = 6 (50 - (11 \times 36) / 12) = 102^\circ$. Ans.d..
 8. In 2000 ml mixture, 0.2 litre water is present. Let the amount of water added be x litres. Now the total volume of mixture is $2+x$ of which water is 20%. Thus we have $20(2+x)/100 = x + 0.200$. Solving we get $x = 0.25$ litres. Thus Ans.a.
 9. The rays are perpendicular to the ground therefore the length of the shadow is the length of the side opposite to the 30° in the right-angled-triangle which is half of the hypotenuse (100ft) i.e. 50 feet. Ans.c..
 10. Let the present ages be a , b and c . One year back, the ages will be $a-1$, $b-1$ and $c-1$. Thus $a-1 : b-1 = 1:2$ and $a+4 : b+4 = 3:4$. Thus solving we get $a = 4$, $b = 7$. Therefore $c = 13$. Ans. d..
 11. Let the speed of the man on still water be x km/hr. Then the speed of the stream is $x/4$ km/hr. Speed upstream is $3x/4$ km/hr and speed downstream is $5x/4$ km/hr. Hence the total time will be given by time upstream + time downstream i.e.
 $8/(5x/4) + 8/(3x/4) = 4$.
Solving this we get $x = 4.27$ km/hr. Thus Ans. d..
 12. Three consignments cost Suketu $3 \times 10 \times 150 = 4500$ Lac. The two he sells fetches him $2 \times 20 \times 150 = 6000$ Lac. That means three consignments sent gives him a profit of 1500 Lac, i.e., 15 Crore. To make a profit of 600 Crore, he has to send forty times three = 120 consignments. Answer is d..

13. Simple interest at 11% for 2 years on a sum of Rs. 1000 is Rs. 220. Since it is half of the compound interest for 2 years, we have
 $440 = 1000(1+R/100)^2 - 1000$
 Thus, $144/100 = (1+R/100)^2$.
 Or, $1.2 = 1+R/100$. Thus $R = 20\%$. Ans.c..
14. After first discount of 10%, the MP will be Rs. 900. Now the second discount of 15% is given on Rs. 900 so that the SP will now be: $900 - (15/100 \times 900) = 765$. Ans.d..
15. Let the length be L and W be the width,
 therefore $W = 0.65L$ and perimeter = $3.3L$
 New width = $1.2 \times 0.65L = 0.78L$
 Change in perimeter = $0.26L$
 $\%$ increase in perimeter = $(0.26L/3.3L) \times 100 = 7.87\%$

 Since width is 65% of length, it will be $0.65L$. New width will be $120/100 \times 0.65L = 0.78L$. The original perimeter is $2(1.65L)$. Now it is $2(1.78L)$. Thus increase % is $0.13L/1.65L \times 100 \approx 8.4\%$.
 Ans.d..
16. Let the difference between the greatest and least part be $2d$, then the difference between the 2nd least and least part will be d . Let the parts be $a+d$, a , $a-d$. We have $3a = 23100$. Thus $a = 7700$. Now $7700+d$: $7700-d = 4:3$. Thus solving we have $d = 1100$. Thus the amounts are 8800, 7700 and 6600. Ans. b.
17. Let the work be 12. A's rate of work is 4 per day while that of B's is 3 per day. When they work together, the rates will be 3 and 2 respectively. When they work with C, their rates will improve to 4 and 3 again. C works at the rate of 1 per day. Hence the total rate of work of all 3 together is 8. Thus the work will be completed in $1 \frac{1}{2}$ day. Ans.a.
18. Diameter of the pond is 100 feet i.e. radius is 50 ft. Area of the walk = $\pi 52^2 - \pi 50^2 = 204\pi$ feet. Ans.b.
19. We have to find the minimum number which when divided by 14, 11 and 12 gives the same remainder 5. This is given by $N = \text{LCM}(14,11,12) \times n + 5$. For $n=1$, we will get the minimum number. Thus $N= 929$. Then total cows that are given to Brahmins are $929-5= 924$. Thus the no of cows each Brahmin gets is $924/11 = 84$. Ans.d.
20. The speed ratios are: $A:B::1:2$, and $A:C::3:4$. This gives the speed ratio $B:C$ as $3:2$. Therefore, the time ratio would be the inverse; $b:c::2:3$. Now, if B takes 10 hrs, C will take $3/2$ times that much, i.e., 15 hrs. Answer is a.

EXERCISE – 10B

1. In the expression index $(n) = 11$, number of terms = $n+1 = 12$, sixth term from the end = 7th term from the start thus $r = 6$, therefore as per the formula, seventh term i.e., $T_7 = {}^{11}C_6 (-2x/5)^6 (5x^2/4)^5$ but ${}^{11}C_6 = {}^{11}C_5$ thus, $T_7 = {}^{11}C_5 (x^{16}/80)$
2. On factorizing the expression $\frac{2x^2 + x - 1}{x^2 - 5x + 6} < 0$ So, $\frac{(2x-1)(x+1)}{(x-2)(x-3)} < 0$

Multiplying both the sides with the square of the denominator (square of any no. is a +ve quantity), we obtain $(2x-1)(x+1)(x-2)(x-3) < 0$
 Equating each of the factors to zero, we get
 $x = -1, \frac{1}{2}, 2, 3$
 So, $-1 < x < \frac{1}{2}$ or $2 < x < 3$

3. In first hour difference between A and B is of four km. \therefore they can come together after every three hours. Similarly B and C can come together after every two hours. Hence all of them can be together after every six hours.

4. Number of cards in the pack are of the form $5a + 2$, $7b + 2$ and $3c + 1$, The only number which is not in this form is 107.
5. Let the principal be P. \therefore Amount to be paid after one year = $21P/20$. Since he pays Rs.441, his principal for next year = $21P/20 - 441$.
 \therefore Amount to be paid after second year = $[21P/20 - 441] \cdot 21/20 = 441 \Rightarrow P = \text{Rs.}820$.
6. Area will be minimum if four circles touch each other externally. In that case required rectangle will be square of side $4a$. \therefore Its area = $16a^2$.
7. $x^4 + 1/x^4 = (x^2 + 1/x^2)^2 - 2 = 727 \Rightarrow (x^2 + 1/x^2)^2 = 729 = (27)^2 \therefore (x^2 + 1/x^2) = 27$.
 $(x^2 + 1/x^2) = (x - 1/x)^2 + 2 = 27 \Rightarrow x - 1/x = \pm 5$. $(x - 1/x)^3 = x^3 - 3(x - 1/x) - 1/x^3$
 $\Rightarrow x^3 - 1/x^3 = \pm 140$
8. Let the entries in second column first row be **a** and in the middle it is **b**. Since sum of all the rows and all the columns is same $15+a+10 = a+b+25 \Rightarrow b = 0$.
9. Three boys can be chosen out of 10 in ${}^{10}C_3 = 120$ ways. Since two girls refuse to join the group, three of the remaining can be chosen in ${}^5C_3 = 10$ different ways. \therefore Total number of ways = $120 \times 10 = 1200$
10. Since he uses equal amounts of two kinds of petrol his cost per gallon = 35 ps. Hence in Rs.3.50 he will get 10 gallons of petrol. \therefore total distance travelled = $15 \times 10 = 150$ miles.
11. From the figure it is clear that $\triangle APE \sim \triangle BQE$, $PQ = 15$, $AP = 4$ and $BQ = 8$. $\therefore AP/BQ = PE/EQ = 1/2 \Rightarrow QE/2 = PE/1 \therefore QE = 2PE$. $PQ = PE + EQ = 3PE$
 $= 15 \Rightarrow PE = 5$. \therefore By Pythagoras theorem $AE = 3$ units.
12. Eight months = $2/3$ of a year. As per the contract he should get Rs. 2000 and $2/3^{\text{rd}}$ of the bicycle. Since he gets bicycle and Rs. 1700, cost of $1/3^{\text{rd}}$ bicycle is Rs. 300. \therefore Total cost of the bicycle is Rs. 900.
13. There are several possibilities as
 I) $x < 3$
 $3 - x + 4 - x + 5 - x \geq 12$ or $12 - 3x \geq 12$ or $x \leq 0$
 II) $4 \geq x > 3$
 $x - 3 + 4 - x + 5 - x \geq 12$ or $6 - x \geq 12$ or $x \leq -6$
 III) $5 \geq x > 4$
 $x - 3 + x - 4 + 5 - x \geq 12$ or $x - 2 \geq 12$ or $x \geq 14$
 IV) $x > 5$
 $x - 3 + x - 4 + x - 5 \geq 12$ or $3x - 12 \geq 12$ or $x \geq 8$
 From above we have only I and IV satisfying the inequality.
 $\therefore x \leq 0$ or $x \geq 8$
14.
$$\frac{\sqrt{(1-x/3)}}{(2+4x)^2}$$

$$= (1-x/3)^{1/2} (2+4x)^{-2}$$

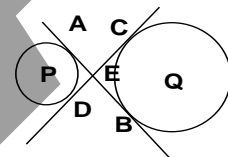
$$= \frac{1}{4} [(1-x/3)^{1/2} (1+2x)^{-2}]$$

$$= \frac{1}{4} [1 - x/6 - x^2/72 - \dots] [1 - 4x + 12x^2 - \dots]$$

 (Expansion of the binomials is required only upto terms containing x^2 as the third term has power of x as 2)

$$= \frac{1}{4} [1 - (4 + 1/6)x + (4/6 - 1/72)x^2 + \dots]$$

 Therefore, the third term is $\frac{1}{4}(864+48-1)x^2/72 = 1311x^2/288$.
15. A is set of elements in A.P. with first term as 1 and common difference as 10.
 $452/2 = 226$



The smallest term in A nearest to 226 is 221. So the largest value in the set R could be 221. And 221 is $(221-1)/10 + 1 = 23^{\text{rd}}$ term of A. Hence, there can be a maximum of 23 elements in R.

16. Total number of ways of forming a two digit number (with different digits) = ${}^{10}P_2 = 90$. Since he takes one trial, required probability = $1/90$.
17. From the figure, $\angle EBC = 30^\circ$. Produce EB so that BD is perpendicular to CD. $\therefore \angle DCE = 45^\circ$.
 $\therefore CD = DE = x/2$. Hence $EC^2 = (x^2/4 + x^2/4) = x^2/2$. $\therefore EC = x\sqrt{2}/2$.
18. Let the roots of the equation be α & β ,
 $\alpha + \beta = a - 2$, $\alpha\beta = -(a+1)$
 We have, $\alpha^2 + \beta^2$
 $= (\alpha + \beta)^2 - 2\alpha\beta$
 $= (a - 2)^2 + 2(a + 1)$
 $= a^2 - 4a + 4 + 2a + 2 = (a - 1)^2 + 5$
 Thus, $\alpha^2 + \beta^2$ is least if $a = 1$
19. $a \square b = (a + 1) / b$ and $b \blacklozenge a = (a + 1) / b$. $\therefore a \square b = b \blacklozenge a$.
20. Let the cistern can be filled in t minutes. $\therefore t (1/18 + 1/24 - 1/12) = 5/6 \Rightarrow t = 60$ minutes.
21. Let a, b, c and d respectively be the number of 1 Re., 50 Ps. 25 Ps, and 10 Ps. coins.
 $\therefore 100a/2 = 50b/3 = 25c/4 = 10d/6$ and $a + b + c + d = 840$. $\Rightarrow b = 3a$, $c = 8a$ and $d = 30a$.
 $\therefore a(1 + 3 + 8 + 30) = 840 \Rightarrow a = 20$.
22. It's clear that $x = 3$ satisfies the given equation and this is the only solution for it.
 As $a = 3^{x-1}$ and $y = 5^{x-1}$ are both increasing function of x . Therefore their sum $y = 3^{x-1} + 5^{x-1}$ is
 Also an increasing function of x , for $x < 3$; $y < 34$ and for $x > 3$; $y > 34$.
 Thus equation has no other solution.
23. Given expression is divisible by 49 for all positive integers, so answer option will be a.
24. i. If $x \leq 2$ then, $2 - x + 4 - x + 6 - x \geq 12$; $12 - 3x \geq 12$; $x \leq 0$
 ii. If $2 < x \leq 4$ then, $x - 2 + 4 - x + 6 - x \geq 12$; $x \leq -4$
 iii. If $4 < x \leq 6$ then, $x - 2 + x - 4 + 6 - x \geq 12$; $x \geq 12$
 iv. If $x > 6$ $x - 2 + x - 4 + x - 6 \geq 12$; $x \geq 8$
 So, $x \leq 0$ or $x \geq 8$
25. Number of turns of wire on the cylinder = Length of the cylinder / diameter of the wire = $12 / 0.5 = 24$. \therefore Length of the wire = $2 \times \pi \times 5 \times 24 = 240\pi$ cm. = 754.28 cm = 7.54 m.
26. Expenditure of six persons per week = $750 / 10 = \text{Rs. } 75$. Hence the expenditure of 18 persons for 12 weeks = $3(75)(12) = \text{Rs. } 2700$.
27. Since 2 men and 7 boys can complete the work in 14 days. If m and b respectively be the work done per day by a man and a boy $\Rightarrow 14(2m + 7b) = 1 \Rightarrow 7(4m + 14b) = 1$. Hence four men and fourteen boys can complete the work in seven days.
28. $a_1 + a_{2n+1} = a_2 + a_{2n} = \dots = a_{n+1} + a_{n+1} = 2$. $a_{n+1} = 200$
29. Let the distance between two lines X and Y be h units.
 $\therefore (\text{Area of II}) / (\text{Area of I}) = (2h \cdot \frac{1}{2}) / (6+4)h \cdot \frac{1}{2} = 2/10 = 1/5$.
30. Let the manufacturing price be Rs.100. \therefore His list price = Rs.160. $\therefore \text{S.P.} = (78/100)(160) = 124.80$ Hence his profit percentage = 24.80.

31. Let the ages before four years of the old and new persons respectively be a and b years and the average age of remaining nine persons be x years. $\therefore (9x + a) / 10 = [9(x+4) + (b+4)] / 10$.
 $\therefore a - b = 40$.
32. Cost of the watch = S.I. - $(2500 - 2000) = [(2000)(6)(8) / 100] - 500 = \text{Rs.}460$.
33. (i) From 1 to 10, 3 will be written once,
(ii) From 11 to 99, if 3 is fixed at 10s digit, unit digit can be filled in 10 ways. And if 3 is fixed at unit digit, 10s digit can be filled in 9 ways. So total $10 + 9 = 19$ times
(iii) From 100 to 999, If 3 is fixed at 100s digit, then 10s digit and unit digit can be filled in 10 ways. Thus total such no. will be $10 \cdot 10 = 100$.
If 3 is fixed at 10s digit, 100s digit can be filled in 9 ways and unit digit in 10 ways, so total $10 \cdot 9 = 90$ ways.
And if 3 is fixed at unit digit, 10s digit can be filled in 10 ways, and 100s digit in 9 ways, so total 90 ways.
Therefore total no. of times 3 will be there = $1 + 19 + 100 + 90 + 90 = 300$ times
Alternate solution:
(i) when 3 is at the unit place $\underline{\quad} \underline{\quad} \underline{3}$,
total number of ways = $10 \times 10 \times 1 = 100$
(ii) When 3 is at the 10^{th} place, $\underline{\quad} \underline{3} \underline{\quad}$.
total number of ways = $10 \times 1 \times 10 = 100$.
(iii) when three is at the 100^{th} place, $\underline{3} \underline{\quad} \underline{\quad}$.
total number of ways = $1 \times 10 \times 10 = 100$.
Therefore total number of ways = 300.
34. Interior angle of a regular polygon is $[(n - 2) \pi] / n \therefore 6A_6 / 5A_5 = 4.5.6\pi / 3.5.6.\pi = 4/3$.
35. Relative speed = $60 + 40 = 100 \text{ km/hr.} = 250/9 \text{ m/sec}$. They cross each other in $9/2$ seconds.
 \therefore Total distance travelled = $(250/9)(9/2) = 125 \text{ m}$, which is the sum of the lengths of the two trains
Total time taken to pass the tunnel = 277.5 seconds, and the distance travelled = length of the longer train ($125 \times 2/3 \text{ m}$) and length of the tunnel(x).
 $\therefore x + 125(2/3) = (100/9)(277.5) \Rightarrow x = 3000 \text{ meters}$.
36. If bath can be filled in t minutes, $t(1/9 + 4/45) = 1 \Rightarrow t = 5$ minutes. Part of the bath that can be filled in $3\frac{3}{4}$ minutes = $(1/5)(15/4) = \frac{3}{4}$. \therefore In 5 minutes the waste pipe drains out $\frac{3}{4}$ of the tank. Hence to empty the bath time taken by waste pipe = $5(4/3) = 20/3 = 6\frac{2}{3}$.
37. Area of the lawn = $(30)(10) = 300$ square yards. \therefore Cost of fertilisation = $300 / 300 \text{ ps/sq. yard.} = 1 \text{ ps/sq. yard.}$
38. Let A's investment be Rs. A . \therefore B's investment will be Rs($A + 500$). If their shares in the profit be respectively a and b . $a / 5A = b / (6A + 3000) = 2600 / 11A + 3000$.
 $\therefore a = (2600 \cdot 5A) / (11A + 3000)$ and $b = 2600(6A + 3000) / (11A + 3000)$ and $b = a + 600$.
Hence $A = \text{Rs.}1500$ and $B = \text{Rs.}2000$
39. Total cost of ten kg mixture = $12 \cdot 4 + 15 \cdot 3 + 18 \cdot 2 + 21 \cdot 1 = \text{Rs.}150$. Hence to get 10 % profit S.P. of ten kg mixture = $150 + 15 = \text{Rs.}165$. \therefore S.P. of the mixture = Rs.16.5 per kg.
40. Exactly 29 matches are required to determine the winner. As winner of the first match between any two players will play with the third player, their winner with fourth, . . .
41. Let the principal in each case is P . Since the amount is same interest in both cases must be same.
 $\therefore 7Pn / 100 = 8P(n - 0.5) / 100 \Rightarrow n = 4$ years. (Since 6 months = 0.5 years)

Also $2560 = P [1 + (7 \cdot 4/100)] \Rightarrow P = \text{Rs.}2000$. Hence the principal is Rs. 2000 and the respective periods will be 3.5 years and 4 years.

42. Let us arrange 16 apples in a row.
To divide these 16 apples among 4 persons so that each of them gets at least one apple is equivalent to inserting 3 partitions in 15 available places. Thus no. of ways = $^{15}C_3$

43. There is no short test of divisibility by 7. By test of divisibility by 7 these numbers need not be divisible by 7. Let the number is ABAB dividing it by 101 we get quotient = AB and remainder = 0. \therefore These numbers are divisible by 101.

$$\begin{array}{r} \text{AB} \\ 101 \overline{) \text{ABAB}} \\ \underline{\text{A0A}} \\ \text{B0B} \\ \underline{- \text{B0B}} \\ 000 \end{array}$$

Alternate solution:

Let AB be a two digit number, then the new four digit number will be ABAB,

Now, $AB \times 100 = AB00$,

Also $AB00 + AB = ABAB$,

Here first the assumed number is multiplied by 100 and then the same number is added to the result i.e., in turn the number is multiplied by 101.

44. ΔACD being an equilateral triangle $\angle A = 60^\circ$. In triangle ACF, B is the mid-point of AC and $BE \parallel CF$. As BE is perpendicular to AD and CF is perpendicular to AD, $AF = 2AE = 2 = AB$. $\therefore AB = BC = 2$. \therefore area of $\Delta ACD = (\text{side})^2 \sqrt{3} / 4 = 4 \sqrt{3}$
45. The roots of $x^2 + x + 1 = 0$ are ω and ω^2 . Let $\alpha = \omega$ and $\beta = \omega^2$.
Then, $\alpha^{19} = \omega^{19} = (\omega^3)^6 \omega = \omega$ and $\beta^7 = (\omega^2)^7 = \omega^{14} = (\omega^3)^4 \omega^2 = \omega^2$.
The equation whose roots are ω and ω^2 is $x^2 + x + 1 = 0$
46. From first station 9 different tickets are available, one for each of the remaining 9 stations ; similarly from second station, 8 different tickets are available ; and so on.
Hence total number of available different tickets are $= 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 45$
Six person can select any 6 tickets in $^{45}C_6$ ways.
47. Since the largest angle is opposite the largest side , we have
 $\cos C = (3^2 + 5^2 - 7^2) / (2)(3)(5) = -15/30 = -1/2$
Therefore $C = 2\pi/3$
48. Given number is $(27)^{4N}$. If the powers of 27 are of the form $4k+0, 4k+1, 4k+2$ or $4k+3$ the digits at units place are respectively 1, 7, 9 or 3. \therefore The digit at units place of $(27)^{4N}$ is 1. Hence digit at units place of given number is $1 + 1 = 2$.
49. In the formula $A/Q = (1 - q/Q)^n$, $Q = 180$, $q = 60$, $n = 3$. $\therefore A = 180 (1 - 1/3)^3 = 53.33$. \therefore After three days 53.33 liters of wine will be there in the vessel.
50. Let m, s, g, and p respectively be the number of mules, sheep, goats and pigs.
$$\frac{50m+40s+25g+10p}{m+s+g+p} = 30 \Rightarrow 20m + 10s - 5g - 20p = 0 \Rightarrow 4m + 2s = g+4p$$

 $\therefore 2(2m+s) = g+4p$. Since LHS is an even number and $(4p)$ from RHS is also even g has to be an even number. Hence required number of goats = 2.