



Top 125 GMAT Quant Questions

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Top 125 GMAT Quant Questions

1. Let $f(x) = ax^2 + bx + c$, such that 1 and -1 are the roots of $f(x)$, then which of the following statements can never be TRUE?
- A $f(2) = 3a$
 - B $f(5)$ is a multiple of 6.
 - C $f(4) = -15c$
 - D $f(3) = 8a$
 - E $f(2) = 3c$
2. The n^{th} term of a sequence is given by $T_n = \frac{1}{n(n+1)}$. Find the value of S_{20} , the sum of first 20 terms.
- A $\frac{19}{20}$
 - B $\frac{20}{21}$
 - C 1
 - D $\frac{1}{2}$
 - E $\frac{9}{10}$
3. Ousman saves \$5 in the first week of the year. Every week, he plans to save \$2 more than the amount he saved in the previous week. What would be the total amount saved by the end of the year? (Assume 1 year = 52 weeks)
- A \$107
 - B \$2912
 - C \$1456
 - D \$2782
 - E \$1391
4. A sequence is defined as $a_n = 2a_{n-1} - 5$ for all integers $n > 1$. If $a_1 = 3$, what is the value of $a_6 - a_5$?
- A 23
 - B -32

- C** -86
- D** -59
- E** -27
5. The sum of n terms of a series is given as $S_n = 2n^2 + 5n$, find the difference between the 14th and 6th term of the series.
- A** 28
- B** 32
- C** 36
- D** 40
- E** 44
6. Let A_n be a sequence such that $A_n = 2A_{n-1} + 1$ and $A_1 = 1$, then which of the following statements is TRUE?
- I. A_4 is a Prime Number.
- II. $A_2 + A_4 + A_6$ is a Perfect Square.
- III. $A_1 + A_3 + A_5$ is a multiple of 13.
- A** Only I
- B** Only II
- C** Only III
- D** II and III
- E** I and III
7. Let $f(x)$ be a real-valued function satisfying the functional equation $f(2x) + 2f\left(\frac{24}{x}\right) = 4x$ for all $x \in \mathbb{R} - \{0\}$. Determine the absolute difference between $f(8)$ and $f(6)$.
- A** Cannot be determined
- B** 2
- C** 3
- D** 4
- E** 5
8. The function f is defined such that $f(x) = 2x + 1$ for odd integers and $f(x) = \frac{x}{2}$ for even integers. Find $f(f(f(f(f(8)))))$?
- A** 4

- B** 5
- C** 6
- D** 7
- E** 11

9. The solution set of the inequality $|x-3| < 2x$ is represented by which of the following values of x ?

- A** $x > 1$
- B** $x > 3$
- C** $x < 1$
- D** $x < -3$
- E** All real numbers

10. Find the number of positive integral values of a for which the inequality holds true.

$$2^{2a+3} - 2^{a+4} < 120$$

- A** 1
- B** 2
- C** 3
- D** 4
- E** 5

11. If $3^{m-1} \times 4 = 2^{n+3} \times 3^{2m+4n-1}$, then which of the following represents the ordered pair (m,n) ?

- A** (2,3)
- B** (3,2)
- C** (1,1)
- D** (4,-1)
- E** (2,2)

12. Find the number of integral values of " x " which satisfies $|5x - 2| \leq |3x + 7|$

- A** 7
- B** 3
- C** 4

- D** 5
- E** 2
13. If $-7 \leq x \leq 4$ and $-3 \leq y \leq 6$, what is the difference between the maximum and minimum possible values of the product xy ?
- A** 33
- B** 36
- C** 48
- D** 66
- E** 72
14. Find the sum of all positive integral values of x that satisfy the following inequality $\frac{x^2 - 4}{x - 6} < 0$?
- A** 0
- B** 8
- C** 3
- D** 12
- E** 9
15. If $10^{6a} \times 5^{2b-1} = 5^{35} \times 2^{18}$, where a and b are positive integers, then what is the value of $a + b$?
- A** 21
- B** 18
- C** 12
- D** 15
- E** 9
16. What is the minimum value of the function $f(x) = |x + 25| - |18 - x|$?
- A** -7
- B** 43
- C** 7
- D** -43
- E** The function has no minimum value

17. Which of the following is the largest number ?
- A 16^{40}
 - B 25^{80}
 - C 32^{28}
 - D 81^{40}
 - E 5^{80}
18. If $|x + 2| \leq 1$ and $|y + 3| \leq 2$, then which of the following cannot be the possible value of $x + y$?
- A -2
 - B -4
 - C -6
 - D -8
 - E -10
19. If $4^x > 300$ and $2^{x+2} < 600$, what is the set of possible integer values of x ?
- A [3, 4]
 - B [4, 6]
 - C [3, 7]
 - D [4, 7]
 - E [5, 7]
20. If p, q, r and s are positive integers such that $p \neq r$ and $\frac{p}{q} = \frac{r}{s} = \frac{2}{5}$, what is the value of $\frac{r^2 - p^2}{q^2 - s^2}$?
- A $\frac{16}{25}$
 - B $\frac{4}{25}$
 - C $\frac{9}{25}$
 - D $-\frac{16}{25}$

E $-\frac{4}{25}$

21. Find the value of $\frac{2^4 \times 3^5 \times 4^3 \times 5^6 \times 6^3}{8^2 \times 9^3 \times 10^5}$

A 135

B 160

C 180

D 195

E 200

22. Which of the following fractions has a terminating decimal when expressed in decimal form ?

A $\frac{14}{40}$

B $\frac{33}{36}$

C $\frac{26}{36}$

D $\frac{10}{56}$

E $\frac{18}{28}$

23. Find the value of $\frac{\sqrt[3]{0.000064}}{\sqrt{0.04} \times \sqrt{0.0001}}$

A 10

B 20

C 2

D 100

E 40

24. What is the units digit of the sum $3^{35} + 4^{46}$?

A 1

B 3

C 4

D 5

25. If x is a positive integer such that $\frac{3}{4} < \frac{x}{x+5} < \frac{4}{5}$, find the sum of all values of x that satisfy the inequality?
- A 70
B 72
C 74
D 76
E 78
26. $A = 84^{\frac{1}{4}}$
 $B = 33^{\frac{1}{5}}$
 $C = 66^{\frac{1}{3}}$
- Which of the following statements is TRUE?
- A $A > B > C$
B $C > B > A$
C $B > C > A$
D $C > A > B$
E $B > A > C$
27. Find the sum of all even factors of 1274.
- A 798
B 1596
C 2394
D 1274
E 1710
28. Alexia noticed that whenever she divided a particular integer by 3, the remainder was always 1. She then tried dividing the same integer by 9. How many different remainder values are possible in this case?
- A 3
B 4
C 5
D 2
E 1

29. What is the smallest positive integer n such that the product $1260 \cdot n$ is a perfect cube?
- A 490
B 1475
C 2960
D 7350
E 14705
30. If $\frac{3}{5}(0.0625) + \frac{1}{3}(0.0729) + \frac{5}{4}(0.1024) = P$
- Find the value of $10000P$
- A 18989
B 1989
C 1898
D 1889
E 1988
31. $N = 123612361236 \dots k \text{ digits}$. If $100 < k < 110$ and the sum of digits of N is divisible by 6, then what is the sum of all such possible values of k ?
- A 402
B 412
C 422
D 432
E 442
32. An art collector bequeathed the value of his collection to three museums and one charitable foundation as follows: Museum A receives $\frac{3}{4}$ th of the total value, Museum B receives $\frac{2}{3}$ rd of the remaining value, Museum C receives half of the remaining value, and the remaining part goes to a charitable foundation. If the charitable foundation receives Rs. 18,000, how much does Museum B receive?
- A Rs. 60,000
B Rs. 96,000
C Rs. 48,000
D Rs. 72,000
E Rs. 30,000
33. Salma was asked to take a number x , add 3, divide the result by 2, subtract 6 from the result,

and finally multiply the result by 7. Instead, she subtracted 3 at the first step and added 6 instead of subtracting at the third step, but carried out the rest correctly. Her final answer was 126. What should have been her correct answer?

- A 56
- B 63
- C 66.5
- D 70
- E 59.5

34. Find the number of positive integral solutions (x, y) that satisfies the equation $\frac{3}{x} + \frac{12}{y} = 4$

- A 0
- B 1
- C 2
- D 3
- E 4

35. Which of the following equations is not satisfied by the ordered pair $(x, y) = (2, 3)$?

- A $7x + 4y = 26$
- B $9x + 12y = 54$
- C $5x - 2y = 4$
- D $-7x + 11y = 21$
- E $4x + 7y = 29$

36. A stadium sold two types of tickets for a cricket match: regular tickets at Rs. x each and premium tickets at Rs. y each. A total of 600 tickets were sold, and the total collection was Rs. 4,80,000. Later, it was found that if the number of premium tickets sold had been 50 more and regular tickets 50 fewer, the collection would still have been the same. What is the price of a premium ticket?

- A Rs. 600
- B Rs. 500
- C Rs. 800
- D Rs. 1000
- E Rs. 750

37. A line L passes through $(6, 8)$ and has an x -intercept of 2. Which of the following points lie on this line L ?
- A $(3, -5)$
 - B $(3, 5)$
 - C $(7, 10)$
 - D $(4, -4)$
 - E $(1, 1)$
38. Five years ago, a father was 25 years older than his son. Eight years from now, the ratio of their ages will be 8:3. What will be the ratio of the father's age to the son's age 23 years from now?
- A 11:7
 - B 11:8
 - C 11:5
 - D 11:6
 - E 11:4
39. Rahul and Rohan are comparing their finances. Rohan's savings exceed Rahul's savings by the sum of their combined expenditures. If twice Rahul's savings are added to Rohan's savings, the total equals four times Rohan's expenditure minus twice Rahul's expenditure. It is also known that Rohan's savings are five times that of Rahul's. What is the ratio of Rahul's expenditure to Rohan's expenditure?
- A 1 : 1
 - B 2 : 3
 - C 1 : 2
 - D 3 : 4
 - E 3 : 5
40. y years ago, Mira's age was three times the age of her brother. Seven years before that, Mira's age was five times her brother's age. If y is a natural number, what is the difference between their present ages?
- A 16
 - B 24
 - C 18
 - D 28
 - E 36

41. If the digits of a two-digit number are interchanged, the resulting integer is 36 less than the original number. What is the value obtained when the digit from the tens place of the original number is subtracted from the digit from the units place of the original number?
- A 4
B 2
C -2
D -4
E 1
42. A restaurant sells sandwiches for \$15 each and burgers for \$22 each. On a particular day, the total number of sandwiches and burgers sold was 90, generating a total revenue of \$1560. How many burgers were sold that day?
- A 20
B 25
C 30
D 40
E 50
43. The total cost of 2 headphones, 3 speakers, and 2 mobile phones is Rs 47,000. It is also known that the combined price of 1 headphone and 1 speaker is Rs 6,500, while the combined cost of 1 speaker and 1 mobile phone is Rs 19,000. What is the cost price of 1 mobile phone?
- A Rs 14,000
B Rs 15,000
C Rs 16,000
D Rs 17,000
E Rs 18,000
44. Consider the quadratic equation:
- $$x^2 - (2n + 1)x + (n^2 - 4) = 0 \text{ where } n \text{ is an integer.}$$
- What is the minimum value of the sum of the squares of its roots?
- A 5
B 7
C 15
D 8
E 12

45. If a, b are the roots of $x^2 - 8x + 10 = 0$, then what is the value of $\left| \frac{a}{b} - \frac{b}{a} \right|$?
- A $\frac{2}{5}\sqrt{6}$
- B $\frac{8}{5}\sqrt{6}$
- C $\frac{16}{5}\sqrt{6}$
- D $\frac{4}{5}\sqrt{6}$
- E $\frac{9}{5}\sqrt{6}$
46. For how many integral values of a does the graph of this quadratic equation will not touch the x -axis?
- $$2(a-1)x^2 + 2(a-2)x - (a+3) = 0$$
- A 0
- B 2
- C 4
- D 5
- E 1
47. If $x^2 - kx + 24 = 0$, then which of the following cannot be the value of k ? (Assume the roots of the equation are unique positive integer values.)
- A 10
- B 11
- C 14
- D 15
- E 25
48. In solving a quadratic equation, one student made a mistake in copying the constant term and found the roots to be 9 and -4. Another student made a mistake in copying the coefficient of x and found the roots to be 12 and -2. At what value of x will the quadratic equation be minimum?
- A -4
- B -2.5
- C 5.5

D -2.25

E 0

49. If x is a real number that satisfies $\frac{2x - 1}{3x + 5} = 2x$, where $x \neq -\frac{5}{3}$, what is the value of $3x^2 + 4x + 5$?

A 12

B 5.5

C 3

D 4.5

E Cannot be determined

50. Find the number of integral values that n can take such that the quadratic equation $3x^2 - 8x + |n| = 0$ has real roots.

A 9

B 10

C 11

D 12

E 13

51. A sum of money doubles itself in 5 years at a specific rate of simple interest. At the same rate, after how many additional years will it become four times its original value?

A 10

B 15

C 20

D 5

E 25

52. Let t be the number of trailing zeros in $100!$. Find the number of trailing zeros in $((t + 3)!)^t$.

A 144

B 108

C 120

D 96

E 162

53. A chemist has two beakers. Beaker A contains a 10-litre solution that is 20% acid by volume.

Beaker B contains a 15-litre solution that is 60% acid by volume. The chemist pours all the contents of both beakers into a larger empty tank. Then, a certain amount of pure acid is added to the tank. If the final solution in the tank is 50% acid, how many litres of pure acid were added?

- A 3
- B 2.4
- C 2.6
- D 4.4
- E 6

54. Mr David has invested half of his capital at $r\%$, one-tenth of his capital at 25%, and the remaining capital at 12.5%, each rate being simple interest per annum. The total value of interest after 10 years from all these investments equals his initial sum. Find the value of r .

- A 10
- B 8
- C 6
- D 5
- E 15

55. An antique is sold for \$144. If the percentage profit earned is numerically equal to the cost price of the article in dollars, what is the cost price of the article?

- A \$72
- B \$80
- C \$90
- D \$100
- E \$120

56. A shopkeeper earns a profit of $x\%$ on selling an item. If he raises the selling price by Rs. 18, his profit becomes $2x\%$. If the cost price of the item is Rs 90, what is the value of x ?

- A $x = 25\%$
- B $x = 30\%$
- C $x = 20\%$
- D $x = 15\%$
- E $x = 10\%$

57. The profit earned by selling an article is \$ P . If the cost price were decreased by 10% and the selling price were increased by 10%, the new profit would be \$60 more than the original profit. If both the cost price and selling price were decreased by 20%, the new profit would be

- \$40 less than the original profit. What is the original cost price of the article?
- A** \$150
 - B** \$120
 - C** \$200
 - D** \$300
 - E** \$400
- 58.** By selling an article at 80% of its marked price, a merchant makes a loss of 10%. What percentage profit will the merchant make if the article is sold at its marked price?
- A** 10%
 - B** 12.5%
 - C** 15%
 - D** 201%
 - E** 25%
- 59.** A retailer buys an item and marks it up by 50%. He then holds a sale and offers a discount on the marked price. If the retailer wants to make a final profit of exactly 10%, what is the maximum percentage discount he can offer?
- A** 20%
 - B** 40%
 - C** 33.33%
 - D** 30%
 - E** 26.67%
- 60.** Pramod sells 40% of his oranges at a 30% profit and the remaining 60% at 10% loss, making an overall profit of A%. Alternatively, if he sells 60% of the oranges at a 20% profit and the remaining 40% at a 10% profit, his overall profit becomes B%. Find the ratio A: B.
- A** 2:7
 - B** 3:7
 - C** 4:9
 - D** 3:8
 - E** 6:13
- 61.** Rahul bought 10 apples and got an additional 6 apples for free. What percentage discount is offered to him by the shopkeeper?
- A** 25%

- B** 30%
- C** 32%
- D** 37.5%
- E** 40%
- 62.** A baker prepared 12 chocolate cupcakes and 8 vanilla cupcakes. He sold the chocolate cupcakes at a 10% loss and the vanilla cupcakes at a 25% profit. If he neither gained nor lost overall, what is the ratio of the cost price of a vanilla cupcake to a chocolate cupcake?
- A** 3 : 4
- B** 5 : 4
- C** 2 : 3
- D** 2 : 5
- E** 3 : 5
- 63.** Agatha has a collection of mangoes to sell. She sells 20% of them at a 30% profit. Later, she finds that 25% of the remaining mangoes are damaged and sells these at a 30% loss. To achieve an overall profit of 60% on all the mangoes, at what profit percentage must she sell the remaining mangoes?
- A** 112%
- B** 80%
- C** 50%
- D** 75%
- E** 100%
- 64.** A sum of ₹50,000 is invested by Ronaldo at 10% simple interest per annum for 5 years. The interest earned is then reinvested at 4% simple interest per annum for the next 3 years. What is the total amount he accumulates at the end of 8 years?
- A** ₹78000
- B** ₹79000
- C** ₹82000
- D** ₹84000
- E** ₹80000
- 65.** Sam invested \$10,00,000 in a scheme offering compound interest at 18% per annum for 2 years, while his friend Altman invested \$10,00,000 in another scheme offering simple interest at 20% per annum for the same period. Find the difference in the interest earned by Sam and Altman.
- A** \$7,600

- B** \$7,400
- C** \$7,200
- D** \$6,700
- E** \$6,900
66. Rahul invests a sum A in a compound interest scheme at an annual interest rate of $R\%$, compounded yearly. If the amount grows to Rs 36,000 in 1 year and Rs 43,200 in 2 years, which of the following statements is correct?
- A** $R = 10\%$
- B** $R = 15\%$
- C** $R = 30\%$
- D** $R = 20\%$
- E** $R = 25\%$
67. An amount compounded annually grows to 16 times its original value in 14 years. In how many years will it become 4 times its original value?
- A** 1.75 years
- B** 3 years
- C** 3.5 years
- D** 7 years
- E** 10.5 years
68. A fruit vendor has a 10-kg batch of grapes that contains 98% water by weight. After 3 days of drying in the sun, only water evaporates, and the water content of the grapes falls to 90% of the total weight. What is the new weight of the grapes?
- A** 9.8 kg
- B** 2 kg
- C** 4.9 kg
- D** 6 kg
- E** 5 kg
69. A tank contains 90 litres of a juice and water mixture in the ratio 1:4. Some amount of the mixture is removed and replaced by pure juice, so that in the final mixture, the quantity of juice and water becomes equal. How many litres of mixture were replaced?
- A** 28.5 litres
- B** 32 litres

- C** 33.75 litres
- D** 36 litres
- E** 42.5 litres
- 70.** A mixture of milk and water is in the ratio 3:7. After removing 30 litres of the mixture and replacing it with milk, the ratio becomes 7:3. Find the total volume of the original mixture.
- A** 50 litres
- B** 52.5 litres
- C** 55 litres
- D** 57.5 litres
- E** 60 litres
- 71.** A honey solution contains 40% pure honey and 60% water, while a coffee solution contains pure coffee and water. When 20 litres of the honey solution are mixed with 30 litres of the coffee solution, the overall water concentration becomes 54%. What is the percentage of pure coffee in the coffee solution?
- A** 30%
- B** 35%
- C** 40%
- D** 45%
- E** 50%
- 72.** A container holds 140 litres of a solution of milk and water. One-fifth of the solution is removed and replaced with pure water. After this replacement, the quantity of water in the solution becomes 80 litres. What was the original amount of milk in the solution?
- A** 75 litres
- B** 80 litres
- C** 85 litres
- D** 90 litres
- E** 95 litres
- 73.** A metallurgist prepares an alloy by combining copper, zinc, and nickel in the ratio 4 : 7 : 9 by weight. A single batch of this alloy weighs exactly 50 pounds. By how many pounds does twice the weight of zinc exceed the combined weight of copper and nickel in the batch?
- A** 1 pound
- B** 1.5 pounds
- C** 5 pounds

- D** 4 pounds
- E** 2.5 pounds
- 74.** A solution of 60 litres of acid and water contains 20% acid. How many litres of pure acid must be added to the solution to make it a 40% acid solution?
- A** 10
- B** 15
- C** 20
- D** 25
- E** 30
- 75.** A 720 kg mixture contains salt, sugar, and glucose in the ratio 2:3:4. How much sugar must be added so that the new ratio of salt, sugar, and glucose becomes 4:9:8?
- A** 100 Kgs
- B** 80 Kgs
- C** 150 Kgs
- D** 120 Kgs
- E** 180 Kgs
- 76.** In a population, 70% are aged 30 years or older, and 55% are aged 50 years or younger. What percentage of the population is between 30 and 50 years old (both inclusive)?
- A** 20%
- B** 25%
- C** 30%
- D** 35%
- E** 40%
- 77.** There are two boxes-Box 1 and Box 2. Box 1 has 90 balls, out of which 40% are red. Box 2 has a certain number of balls, out of which 70% are red. Combining both boxes, if 60% of the balls are red, find the total number of red balls in Box 2.
- A** 180
- B** 126
- C** 200
- D** 150
- E** 140
- 78.** Aitana's transfer market fee increased by 25% in 2021 when compared to 2020 and again

increased by 40% in 2022 when compared to 2021. If her transfer fee decreased by 20% in 2023 when compared to 2022, then by what percentage did the transfer fee change in 2023 when compared to 2020?

- A 45%
- B 110%
- C 90%
- D 40%
- E 65%

79. The average of a , b , and c is 7, and the average of b , c , and d is 8. If a , b , c , and d are integers, then which of the following can be TRUE?

- A $a = 7$ and $d = 11$
- B $a = 6$ and $d = 10$
- C $a = 9$ and $d = 9$
- D $a = 5$ and $d = 9$
- E $a = 7$ and $d = 10$

80. The difference between a number increased by 37.5% and the same number decreased by 22.5% is 60. Find the value of the number when it is increased by 20%.

- A 96
- B 108
- C 120
- D 132
- E 144

81. In a town, 50% of the population is men, 40% are women, and the rest are children. All women are literate, 80% of men are illiterate, and 60% of children are literate. If 136 people are literate in the town, then what is the difference between the literate population and the illiterate population?

- A 24
- B 26
- C 28
- D 30
- E 32

82. $A : B = 4 : 5$, $A : C = 7 : 6$, and $C : D = 8 : 9$. If $A - D = 4$, then what is the value of $B - C$?

- A** 36
- B** 40
- C** 44
- D** 48
- E** 52
- 83.** At a bookstore, every book is either fiction or non-fiction. Exactly 25% of the books are non-fiction; among the other books, 80% are damaged. What percentage of the books are both fiction and not damaged?
- A** 20%
- B** 50%
- C** 30%
- D** 15%
- E** 60%
- 84.** In a school, 20% of the students are girls and the rest are boys. 40% of the boys play cricket. The number of girls who play cricket is one-fourth of the number of boys who do not play cricket. If the total number of students who do not play cricket is 560, how many boys are in the school?
- A** 360
- B** 800
- C** 480
- D** 1200
- E** 1000
- 85.** In a company, 40% of the employees are men and 60% are women. If 70% of the men and 46% of the total employees play regularly, what percentage of the women play regularly?
- A** 20%
- B** 25%
- C** 40%
- D** 30%
- E** 35%
- 86.** In a survey, two prototypes of a particular item are tested. 42% of the people in the survey didn't like prototype A, and 6% of the surveyed people liked both prototypes. Then, what percentage of the surveyed people liked only prototype A?
- A** 36%

- B** 40%
- C** 46%
- D** 50%
- E** 52%
- 87.** In a college, $\frac{2}{3}$ rd of the students study English, $\frac{1}{5}$ th of the students study Telugu and $\frac{1}{10}$ th of the students study both subjects. What fraction of students study at least one of the two subjects?
- A** $\frac{17}{20}$
- B** $\frac{19}{30}$
- C** $\frac{7}{10}$
- D** $\frac{23}{30}$
- E** $\frac{4}{5}$
- 88.** Set P consists of 6 consecutive integers, and another Set Q consists of all the elements from P, along with them, elements obtained by subtracting 3 and adding 3 to each element of P, are also included in Set Q. How many elements are present in Q?
- A** 18
- B** 13
- C** 12
- D** 10
- E** 14
- 89.** What is the highest power of 12 that can divide 100!?
- A** 45
- B** 47
- C** 48
- D** 50
- E** 97
- 90.** What is the highest value of n such that 360! when divided by 28^n is an integer?
- A** 57

- B** 59
- C** 61
- D** 63
- E** 55
- 91.** Ram and Rahim travel from Kota to Agra, departing at the same time. Ram drives at a speed of 50 km/h, while Rahim drives at 40 km/h. If Ram takes a break of 1 hour and both of them reach Agra at the same time, what is the distance between Kota and Agra?
- A** 180 km
- B** 200 km
- C** 220 km
- D** 240 km
- E** 250 km
- 92.** A and B are starting from the same position on a circular track of length 420 m. If A and B are moving in opposite directions, then they will meet again after 30 seconds. If they are moving in the same direction, then they will meet again after 70 seconds. Which of the following statements is definitely TRUE?
- A** Speed of A = 10 m/s
- B** Speed of B = 10 m/s
- C** The time taken by A to complete one round is 42 seconds
- D** The time taken by B to complete one round is 105 seconds
- E** The difference between the distance covered by A and B in 50 seconds is 300 m.
- 93.** A conveyor belt in a factory moves boxes at a uniform speed from the loading area to the packing section, 300 meters apart. A worker, Ravi, walks against the motion of the belt at a speed of 2 m/s (relative to the ground). He takes 150 seconds to reach the loading area starting from the packing section. The same worker, when walking in the direction of the belt's motion, takes 50 seconds to reach the packing section starting from the loading area.
- If the belt is stopped and Ravi walks alone at his usual speed, how long will he take to cover the 300 meters?
- A** 50 seconds
- B** 25 seconds
- C** 75 seconds
- D** 100 seconds
- E** 150 seconds

94. A alone can complete a certain task in 20 days, B alone can complete it in 30 days, and C alone can complete it in 60 days. If A works every day but is assisted by B and C together every third day, how many days will it take to complete the task?
- A 12 days
B 15 days
C 9 days
D 11 days
E 10 days
95. A train, Tejas, moving at 162 km/h, crosses another train, Duronto, coming from the opposite direction at 90 km/h, in 20 seconds. If Tejas takes 15 seconds to pass a pole, find the difference in the lengths of the two trains. (in meters)
- A 100 meters
B 150 meters
C 120 meters
D 50 meters
E 80 meters
96. If 3 pipes can fill 50% of a tank in 4.5 hours, how long will it take 9 pipes to fill the entire tank? (Assume the efficiency of all the pipes is the same)
- A 1.5 hours
B 2.25 hours
C 3 hours
D 4.5 hours
E 6 hours
97. A thief escapes on a bike at a speed of 40 km/h. A policeman realizes this one hour later and starts chasing him in a car at a speed of 60 km/h. After how much time will the policeman catch the thief?
- A 1 hour
B 1.5 hours
C 2 hours
D 2.5 hours
E 3 hours
98. A 500-litre cistern is connected to three pipes. Pipe A can fill the cistern at a rate of 20 litres per hour, Pipe B can fill it at a rate of 30 litres per hour, and Pipe C can empty the cistern completely in 50 hours. Pipe A is opened at the start, while Pipe B is opened 5 hours later. Pipe

C is opened 3 hours after Pipe B. Determine the total time required to fill the cistern completely.

- A 13 hours 45 minutes
- B 14 hours 15 minutes
- C 14 hours 45 minutes
- D 15 hours
- E 16 hours 15 minutes

99. While running a race, Alex has 30 minutes to complete a 2100m course. In the first 20 minutes, he averages a speed of 1 m/s. By what percentage must he increase his average speed in order to finish the course within the remaining time?

- A 50%
- B 0%
- C 25%
- D 100%
- E 75%

100. Six men and fifteen women can finish a project in 6 days, with the men contributing 40% of the total work. If ten women and ten boys can complete the same project in 10 days, in how many days can twenty boys alone complete the project?

- A 10 days
- B 12 days
- C 15 days
- D 18 days
- E 20 days

101. If three coins are tossed, what is the probability of getting atleast 2 heads?

- A $\frac{3}{8}$
- B $\frac{1}{4}$
- C $\frac{3}{4}$
- D $\frac{1}{2}$
- E $\frac{1}{8}$

102. 11 friends are to be seated on 11 chairs, arranged in a horizontal line. If Chitra, Deepak, and

Esha are always together, and Aditya and Bipro are never together, then in how many ways can we arrange them?

- A $8! \times 3! \times 7$
- B $9! \times 3! \times 7$
- C $9! \times 2! \times 7$
- D $9! \times 3! \times 8$
- E $8! \times 3! \times 8$

103. If a pair of dice is rolled, what is the probability that the sum of the numbers on their top faces exceeds 10?

- A $\frac{1}{3}$
- B $\frac{1}{4}$
- C $\frac{1}{6}$
- D $\frac{1}{9}$
- E $\frac{1}{12}$

104. Five married couples are to be seated at random around a circular table. What is the probability that no two women sit together?

- A $\frac{5}{42}$
- B $\frac{1}{8}$
- C $\frac{1}{126}$
- D $\frac{1}{242}$
- E $\frac{7}{85}$

105. Tushar has 58 mobile phones in his shop, of which 50 are in working condition and 8 are damaged. If he randomly selects and packs 2 mobile phones, what is the probability that both selected phones are in working condition?

- A $\frac{1221}{1653}$

- B** $\frac{1222}{1653}$
- C** $\frac{1223}{1653}$
- D** $\frac{1224}{1653}$
- E** $\frac{1225}{1653}$

106. A bag contains 8 identical black balls and 10 identical white balls. If the balls are drawn one by one at random, what is the probability that the last ball drawn is black?

- A** $\frac{2}{5}$
- B** $\frac{3}{10}$
- C** $\frac{4}{9}$
- D** $\frac{5}{9}$
- E** $\frac{2}{9}$

107. An urn contains 3 red balls and 4 blue balls. Two balls are drawn at random without replacement. Find the probability that the two balls drawn are of different colours.

- A** $\frac{1}{3}$
- B** $\frac{3}{7}$
- C** $\frac{4}{7}$
- D** $\frac{5}{7}$
- E** $\frac{2}{3}$

108. A committee of 5 members is to be formed from a group of 6 men and 8 women. In how many ways can the committee be formed if it must contain more men than women?

- A** 560
- B** 126
- C** 2002
- D** 686
- E** 752

- A 53
- B 54
- C 55
- D 56
- E 57

110. A postman has 5 distinct letters, each addressed to a different house. In how many ways can the postman deliver all the letters so that no house receives its originally intended letter ?

- A 36
- B 45
- C 44
- D 52
- E 53

111. A round table has 8 seats. In how many ways can 4 men and 4 women be seated such that no two women sit together?

- A 576
- B 144
- C 24
- D 288
- E 40320

112. A bag contains 21 red balls, as well as some green and blue balls. If the probability of drawing a green ball is $\frac{5}{16}$, and the likelihood of drawing a blue ball is $\frac{1}{4}$, then what is the total number of balls in the bag?

- A 48
- B 56
- C 64
- D 72
- E 80

113. In how many distinct ways can the letters of the word LEADER be arranged such that all the vowels are never together?

- A 72
- B 144

- C 288
- D 360
- E 432

114. A mailman has 5 letters for 5 different mailboxes. If he places one letter in each mailbox at random, what is the probability that exactly 2 letters are placed in the correct mailboxes?

- A $\frac{1}{120}$
- B $\frac{1}{12}$
- C $\frac{1}{6}$
- D $\frac{1}{2}$
- E $\frac{3}{10}$

115. In a gymnastics competition, 5 teams are to perform. Each team has 2 members, and when a team performs, all its members perform consecutively, though the order of members within each team is random. If the order of team performances is also random, in how many distinct ways can the performances be scheduled?

- A 3840
- B 120
- C 2240
- D 960
- E 1200

116. A missile system fires at a fixed target; each shot independently hits the target with probability $P = \frac{1}{2}$. The system is allowed 5 shots. The mission is declared a success if the target is hit at least 2 times. Find the probability that the mission succeeds.

- A 62.5 %
- B 68.75 %
- C 81.25 %
- D 87.5 %
- E 93.75 %

117. A player rolls a fair six-sided die. If the player rolls a prime number (2, 3, or 5), they win that amount in dollars. If they roll a composite number (4 or 6), they lose that amount in dollars. If they roll a 1, nothing happens. What is the expected value of one roll?

- A \$1.67
- B -\$0.50

- C \$0.17
- D -\$1.67
- E \$0

118. In how many distinct ways can six people — A, B, C, D, E, and F — be seated around a round table so that A and B are always sitting next to each other ?

- A 36
- B 42
- C 48
- D 60
- E 72

119. A goat is tied with a rope of length 5 m at one corner of a square grass field measuring 5 m by 5 m. Approximately what is the probability that the goat can graze within the field ?

- A 0.20
- B 0.5
- C 0.78
- D 0.45
- E Cannot be determined

120. Bag X contains 3 red and 5 blue balls. Bag Y contains 4 red and 2 blue balls. A ball is randomly drawn from Bag X and placed into Bag Y. Then, a ball is randomly drawn from Bag Y. What is the probability that the ball drawn from Bag Y is red?

- A $\frac{1}{2}$
- B $\frac{5}{8}$
- C $\frac{15}{56}$
- D $\frac{21}{56}$
- E $\frac{9}{14}$

121. If 15 identical balls are to be divided among three players, such that no player gets more than 7 balls, then in how many ways can these balls be divided among the three players?

- A 21 ways
- B 24 ways
- C 28 ways
- D 35 ways
- E 40 ways

122. Two fair six-sided dice are rolled simultaneously. Find the probability that the sum of the numbers obtained is a prime number.
- A $\frac{1}{6}$
- B $\frac{5}{18}$
- C $\frac{5}{12}$
- D $\frac{7}{18}$
- E $\frac{1}{3}$
123. How many ways can four math books, three physics books, and three chemistry books be arranged on a shelf with 10 slots, if books of the same subject must stay together?
- A 1,728
- B 864
- C 5,184
- D 362,880
- E 10!
124. Two dice of different colours, Blue and Green, are rolled together. It is known that the product of the numbers obtained is 12. Find the probability that exactly one of the two dice shows an even number.
- A $\frac{1}{18}$
- B $\frac{2}{9}$
- C $\frac{1}{9}$
- D $\frac{2}{3}$
- E $\frac{1}{2}$
125. A game is organized in which a player has three identical rings to throw at a table containing 10 distinct positions, each holding a prize. The player must throw the rings in such a way that no two rings land on adjacent positions. In how many ways can the player throw the three rings following this rule ?
- A 36
- B 45

C 56

D 72

E 84



Answers

1. E	2. B	3. B	4. B	5. B	6. D	7. D	8. D
9. A	10. B	11. D	12. D	13. D	14. D	15. C	16. D
17. B	18. E	19. E	20. E	21. C	22. A	23. B	24. B
25. A	26. D	27. B	28. A	29. D	30. C	31. C	32. D
33. B	34. C	35. D	36. C	37. C	38. D	39. E	40. D
41. D	42. C	43. B	44. B	45. B	46. E	47. D	48. B
49. D	50. C	51. A	52. A	53. A	54. D	55. B	56. C
57. C	58. B	59. E	60. D	61. D	62. E	63. E	64. A
65. A	66. D	67. D	68. B	69. C	70. B	71. E	72. A
73. E	74. C	75. D	76. B	77. B	78. D	79. E	80. C
81. C	82. C	83. D	84. B	85. D	86. E	87. D	88. C
89. C	90. B	91. B	92. E	93. C	94. B	95. D	96. C
97. C	98. B	99. A	100. C	101. D	102. A	103. E	104. C
105. E	106. C	107. C	108. D	109. A	110. C	111. B	112. A
113. C	114. C	115. A	116. C	117. E	118. C	119. C	120. B
121. C	122. C	123. C	124. E	125. C			

Explanations

1. E

$f(x) = ax^2 + bx + c$, such that 1 and -1 are the roots of $f(x)$

This means that $f(1) = 0$ and $f(-1) = 0$

$$f(1) = a(1)^2 + b(1) + c = 0 \rightarrow a + b + c = 0 \rightarrow 1$$

$$f(-1) = a(-1)^2 + b(-1) + c = 0 \rightarrow a - b + c = 0 \rightarrow 2$$

Adding eq. 1 and eq. 2, we will get $a + c = 0$ or $a = -c$

Subtracting eq. 2 from eq. 1, we will get $4b = 0$ or $b = 0$.

Therefore, the equation becomes -

$$f(x) = ax^2 - a = a(x^2 - 1) \text{ or } f(x) = -cx^2 + c = -c(x^2 - 1)$$

$$f(2) = 3a \text{ or } f(2) = -3c$$

$$f(5) = 24a \text{ or } f(5) = -24c. \text{ This is a multiple of 6.}$$

$$f(4) = 15a \text{ or } f(4) = -15c$$

$$f(3) = 8a \text{ or } f(3) = -8c$$

Thus, option E can never be TRUE.

2. B

$$T_n = \frac{1}{n(n+1)}$$

$$T_n = \frac{1}{n} - \frac{1}{n+1}$$

$$\begin{aligned} S_{20} &= T_1 + T_2 + T_3 + \dots + T_{20} \\ &= 1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \dots + \frac{1}{20} - \frac{1}{21} \end{aligned}$$

$$S_{20} = 1 - \frac{1}{21} = \frac{20}{21}$$

3. **B**

The amount saved by Ousman in the first week is given to be \$5, since we are given that every week he saves \$2 more than the previous week, the amount saved by him every week would be as follows,

\$5, \$7, \$9,... for 52 weeks.

We can clearly see that the terms are in AP with a common difference of 2, and there are 52 terms in total in the sequence. The sum of these terms can be calculated as,

$$S_n = \frac{n}{2} (2a + (n - 1) d)$$

$$S_{52} = \frac{52}{2} (2(5) + (52 - 1) 2) = 26(10 + 102) = 2912$$

So, the total amount saved throughout the year is \$2912.

Hence, the correct answer is option B.

4. **B**

We are given $a_1 = 3$

$$a_2 = 2a_1 - 5 = 6 - 5 = 1$$

$$a_3 = 2a_2 - 5 = 2 - 5 = -3$$

$$a_4 = 2a_3 - 5 = -6 - 5 = -11$$

$$a_5 = 2a_4 - 5 = -22 - 5 = -27$$

$$a_6 = 2a_5 - 5 = -54 - 5 = -59$$

$$\text{We need to find } a_6 - a_5 = -59 - (-27) = -59 + 27 = -32$$

5. **B**

The sum of n terms of a series is given as $S_n = 2n^2 + 5n$.

$$\text{We know that } T_n = S_n - S_{n-1} = 2n^2 + 5n - (2(n-1)^2 + 5(n-1))$$

$$T_n = 2n^2 + 5n - (2n^2 + n - 3)$$

$$T_n = 4n + 3$$

Therefore, the 14th and 6th terms will be equal to

$$T_{14} = 4(14) + 3 = 59$$

$$T_6 = 4(6) + 3 = 27$$

$$\text{Difference} = 59 - 27 = 32$$

6. **D**

$$A_n = 2A_{n-1} + 1 \text{ and } A_1 = 1$$

$$A_2 = 2A_1 + 1 = 3$$

$$A_3 = 2A_2 + 1 = 7$$

$$A_4 = 2A_3 + 1 = 15$$

$$A_5 = 2A_4 + 1 = 31$$

$$A_6 = 2A_5 + 1 = 63$$

I. A_4 is not a Prime Number.

II. $A_2 + A_4 + A_6 = 3 + 15 + 63 = 81$ is a Perfect Square.

III. $A_1 + A_3 + A_5 = 1 + 7 + 31 = 39$ is not a multiple of 13.

Statements II and III are TRUE.

7. **D**

$$f(2x) + 2f\left(\frac{24}{x}\right) = 4x$$

1. At $X = 4$:

$$f(8) + 2[f(6)] = 16 \rightarrow \text{Eq(1)}..$$

2. At $X = 3$:

$$f(6) + 2[f(8)] = 12 \rightarrow \text{Eq(2)}..$$

By solving Eq(1) & Eq(2) : $f(6) = \frac{20}{3}$, $f(8) = \frac{8}{3}$

Therefore, $|f(6) - f(8)| = \frac{20 - 8}{3} = 4.$

8. **D**

1st Application: $f(8) = 8/2 = 4$

2nd Application: $f(f(8)) = f(4) = 4/2 = 2$

3rd Application: $f(f(f(8))) = f(2) = 2/2 = 1$

4th Application: $f(f(f(f(8)))) = f(1) = 2(1) + 1 = 3$

5th Application : $f(f(f(f(f(8)))))) = f(3) = 2(3) + 1 = 7$

9. **A**

Case 1: $(x-3 \geq 0 \rightarrow x \geq 3)$

Hence, we get

$$x-3 < 2x.$$

Solving gives $-3 < x$

Since $x \geq 3$ and $x > -3$, we get $x \geq 3$.

Case 2: $(x-3 < 0 \rightarrow x < 3)$.

$$-(x-3) < 2x$$

$$-x + 3 < 2x.$$

$$3 < 3x \text{ or } 1 < x$$

Since $x < 3$ and $x > 1$, we get $1 < x < 3$

The final solution is the union of the results from both cases : $(x \geq 3) \cup (1 < x < 3)$ which is $x > 1$

Alternatively, we can also use options by putting the ranges and see if that satisfies the equation or not.

10. **B**

We know $a > 0$ and is an integer.

$$2^{2a+3} - 2^{a+4} < 120 = 8(2)^{2a} - 16(2^a) < 120$$

Let us assume that $2^a = P$

$$8P^2 - 16P < 120$$

Dividing by 8 we get,

$$P^2 - 2P < 15$$

$$P^2 - 2P - 15 < 0$$

$$(P+3)(P-5) < 0$$

Therefore, $P \in (-3, 5)$

Therefore, the number of integral values of P that satisfy the equations is equal to 1,2,3,4
 $P = 2^a$

Thus, $a = 0, 1$ and 2 .

So, positive integral values of $a = 1$ and 2 .

11.

D

$3^{m-1} \times 2^2 = 2^{n+3} \times 3^{2m+4n-1}$. We will compare powers of 2 and 3 on both sides.

Comparing powers of 2 on both sides.

$$n + 3 = 2 \rightarrow n = -1$$

$$2m + 4n - 1 = m - 1$$

$$m = -4n$$

$$m = 4$$

$$\rightarrow (m, n) = (4, -1)$$

12.

D

Given : $|5x - 2| \leq |3x + 7|$

Case I: $x \geq \frac{2}{5}$

$$5x - 2 \leq 3x + 7$$

$$2x \leq 9$$

$$\text{So, } x \in \left[\frac{2}{5}, \frac{9}{2} \right] \rightarrow \text{.. Eq(1).}$$

Case II: $\frac{-7}{3} \leq x < \frac{2}{5}$

$$2 - 5x \leq 3x + 7$$

$$x \geq \frac{-5}{8}$$

$$\text{So, } x \in \left[\frac{-5}{8}, \frac{2}{5} \right] \rightarrow \text{.. Eq(2).}$$

Case III: $x < \frac{-7}{3}$

$$2 - 5x \leq -3x - 7$$

$x \geq \frac{9}{2} \rightarrow$ but this doesn't come within range of "x" in Case III . Hence, here no value of x.

Therefore, total range of value of "X" is $\left[\frac{-5}{8}, \frac{9}{2} \right]$

Hence, the number of integral values of "X" which satisfy is 5 : {0, 1, 2, 3, 4}.

13.

D

The extrema of xy occur at the endpoints of the intervals.

Check products:

$$(-7)(-3) = 21$$

$$(-7)(6) = -42$$

$$(4)(-3) = -12$$

$$(4)(6) = 24$$

So:

Maximum = 24

Minimum = -42

Difference = $24 - (-42) = 66$

Hence, the correct answer is option D.

14. **D**

The critical points are the roots of the numerator and the denominator, which are $x = -2, 2$ and 6 .

If we analyse the sign of the expression in the intervals defined by these points, we find the solution is $x \in (-\infty, -2) \cup (2, 6)$

The only $(-\infty, -2)$ contains only negative integers, but we want the positive integral values only.

The interval $(2, 6)$ contains the integers 3, 4, and 5.

Hence, the sum of these positive integers: $3 + 4 + 5 = 12$

15. **C**

The given equation is,

$$10^{6a} \times 5^{2b-1} = 5^{35} \times 2^{18}$$

$$2^{6a} \times 5^{6a} \times 5^{2b-1} = 5^{35} \times 2^{18}$$

$$2^{6a} \times 5^{6a+2b-1} = 5^{35} \times 2^{18}$$

Since both 2 and 5 are prime numbers and a and b are positive integers, we can directly equate the powers from LHS and RHS for the same bases.

Equating powers of 2, we get

$$6a = 18$$

$$a = 3$$

Equating powers of 5, we get,

$$6a + 2b - 1 = 35$$

Substituting the value of a in the above equation, we get,

$$6(3) + 2b - 1 = 35$$

$$2b = 35 - 17 = 18$$

$$b = 9$$

$$\text{The value of } a + b = 3 + 9 = 12$$

Hence, the correct answer is option D.

16. **D**

The critical points in the equation are -25 and 18.

Case 1: $x < -25$

$$f(x) = -(x + 25) - (18 - x) = -x - 25 - 18 + x = -43$$

So, in this region, $f(x) = -43$

Case 2: $-25 \leq x < 18$

$$f(x) = (x + 25) - (18 - x) = x + 25 - 18 + x = 2x + 7$$

$$f(x) = 2x + 7$$

Since it's a linear function increasing with x , the minimum occurs at the left endpoint $x = -25$:

$$f(-25) = 2(-25) + 7 = -50 + 7 = -43$$

Case 3: $x \geq 18$

$$f(x) = (x + 25) - (x - 18) = x + 25 - x + 18 = 43$$

So, in this region, $f(x) = 43$

Comparing all the regions, we can say that the minimum value of the function will be -43.

17. B

We know that : $(a^m)^n = a^{m \times n}$

1. $16^{40} = 2^{4 \times 40} = 2^{160}$

2. $25^{80} = 5^{2 \times 80} = 5^{160}$

3. $32^{28} = 2^{5 \times 28} = 2^{140}$

4. $81^{40} = 3^{4 \times 40} = 3^{160}$

5. 5^{80}

Therefore, among the given 5^{160} is the largest number .
Hence, Option B is the answer .

18. E

$$|x + 2| \leq 1$$

$$-1 \leq x + 2 \leq 1$$

$$-3 \leq x \leq -1 \rightarrow 1$$

$$|y + 3| \leq 2$$

$$-2 \leq y + 3 \leq 2$$

$$-5 \leq y \leq -1 \rightarrow 2$$

Adding eq. 1 and eq. 2 -

$$-8 \leq x + y \leq -2$$

Thus, the value of $x + y$ can never be -10.

19. E

$$4^x > 300 \longrightarrow 2^{2x} > 300$$

$$\text{So, } 2^x > \sqrt{300} \simeq 17.3$$

This means $x \geq 5$

$$\text{Also, } 2^{x+2} < 600$$

$$2^x \times 2^2 < 600$$

$$2^x < 150$$

$$x \leq 7$$

Hence, we get, $5 \leq x \leq 7$

20. E

$$\text{The ratio of } \frac{p}{q} = \frac{2}{5}.$$

If we assume the value of $p = 2k$, then the value of $q = 5k$ for a constant k .

$$\text{The ratio of } \frac{r}{s} = \frac{2}{5}.$$

If we assume the value of $r = 2m$, then the value of $s = 5m$ for a constant m .

Substituting the values in $\frac{r^2 - p^2}{q^2 - s^2}$, we get,

$$\frac{r^2 - p^2}{q^2 - s^2} = \frac{(2m)^2 - (2k)^2}{(5k)^2 - (5m)^2} = \frac{4m^2 - 4k^2}{25k^2 - 25m^2} = \frac{-4(k^2 - m^2)}{25(k^2 - m^2)} = -\frac{4}{25}$$

Hence, the correct answer is option E.

21. C

$$\begin{aligned}
& \frac{2^4 \times 3^5 \times 4^3 \times 5^6 \times 6^3}{2^4 \times 3^5 \times 2^6 \times 5^6 \times 2^3 \times 3^3} \\
& \frac{2^6 \times 3^6 \times 2^5 \times 5^5}{2^{13} \times 3^8 \times 5^6} \\
& \frac{2^{11} \times 3^6 \times 5^5}{2^2 \times 3^2 \times 5} \\
& 4 \times 9 \times 5 \\
& 180
\end{aligned}$$

22. **A**

A fraction has a terminating decimal if, in its simplest form, the denominator contains only the prime factors 2 and 5, and no others.

1. $\frac{14}{40} = \frac{7}{20} = \frac{7}{2^2 \times 5}$

2. $\frac{33}{36} = \frac{11}{12} = \frac{11}{2^2 \times 3}$

3. $\frac{26}{36} = \frac{13}{18} = \frac{13}{3^2 \times 2}$

4. $\frac{10}{56} = \frac{5}{28} = \frac{5}{2^2 \times 7}$

5. $\frac{18}{28} = \frac{9}{14} = \frac{9}{2 \times 7}$

Therefore, only $\frac{14}{40}$ has only 2 & 5 as prime factors for its denominator. Hence, it's the only terminating decimal among given options.

23. **B**

$$\sqrt[3]{0.000064} = \sqrt[3]{64 \times 10^{-6}} = 4 \times 10^{-2}$$

$$\sqrt{0.04} = \sqrt{4 \times 10^{-2}} = 2 \times 10^{-1}$$

$$\sqrt{0.0001} = \sqrt{1 \times 10^{-4}} = 10^{-2}$$

Putting these values in the numerator and denominator, we get

$$\frac{4 \times 10^{-2}}{2 \times 10^{-1} \times 10^{-2}} = 20$$

Therefore, the value is equal to 20.

24. **B**

We can find the units digit of each term separately using cyclicity.

Units digit of 3^{35} :

$$3^1 = 3, 3^2 = 9, 3^3 = 27, 3^4 = 81, 3^5 = 243$$

So, the cycle of the unit digit is (3, 9, 7, 1) and has a length of 4.

So, the unit digit of 3^{35} = dividing the exponent by 4: $35 \div 4$ has a remainder of 3.

The units digit is the 3rd in the cycle, which is **7**.

Similarly, we can do for 4^{46}

$$4^1 = 4, 4^2 = 16, 4^3 = 64$$

So, the cycle is (4, 6) and has a length of 2. For odd powers, it's 4, for even powers, it's 6.

Since the exponent 46 is even, the units digit is 6.

Add the units digits: $7 + 6 = 13$. The units digit of the sum is 3.

25. **A**

If x is a positive integer such that $\frac{3}{4} < \frac{x}{x+5} < \frac{4}{5}$, find the sum of all values of x that satisfy the inequality?

We know that x is a positive integer, and the given inequality is

$$\frac{3}{4} < \frac{x}{x+5} < \frac{4}{5}$$

Let us consider, $\frac{3}{4} < \frac{x}{x+5}$

Since x is a positive integer, we can cross-multiply it.

$$4x > 3x + 15$$

$$x > 15$$

Similarly, $\frac{x}{x+5} < \frac{4}{5}$

Cross-multiplying it,

$$4x + 20 > 5x$$

Therefore, $x < 20$

Combining both the values of x that satisfy the inequality, we get $x = 16, 17, 18$ and 19 .

$$16 + 17 + 18 + 19 = 70$$

26. **D**

$$81 < 84 < 256$$

Taking the 4th root of both sides.

$$81^{\frac{1}{4}} < 84^{\frac{1}{4}} < 256^{\frac{1}{4}}$$

$$3 < 84^{\frac{1}{4}} < 4$$

$$32 < 33 < 243$$

Taking the 5th root of both sides.

$$32^{\frac{1}{5}} < 33^{\frac{1}{5}} < 243^{\frac{1}{5}}$$

$$2 < 84^{\frac{1}{4}} < 3$$

$$64 < 66 < 125$$

Taking the 3rd root of both sides.

$$64^{\frac{1}{3}} < 66^{\frac{1}{3}} < 125^{\frac{1}{3}}$$

$$4 < 84^{\frac{1}{4}} < 5$$

The correct order is $C > A > B$.

27. **B**

$$1274 = 26 \times 49$$

$$= 13 \times 2 \times 7^2$$

As we concerned with even factors alone, the factor must & should contain "2" in it . Hence, we must not consider 2^0 .

$$\begin{aligned} \text{The sum of even factors} &= (2^1)(13^0 + 13^1)(7^0 + 7^1 + 7^2) \\ &= (2)(14)(57) \\ &= 28 \times 57 \end{aligned}$$

$$\begin{aligned}
 &= (2)(14)(57) \\
 &= 28 \times 57 \\
 &= 1596.
 \end{aligned}$$

28. A

Let the number be N .

Given that when N is divided by 3, the remainder = 1.

$N=3k+1$, for some integer k .

When dividing by 9, the remainder must be in $\{0,1,2,3,4,5,6,7,8\}$.

We check which are possible for numbers of the form $3k+1$.

Take $k=0,1,2,3,\dots$

$N=3k+1$.

Now let's compute $r = N \bmod 9$:

At $k=0$, $N=1$, the value of $r=1$

At $k=1$, $N=4$, the value of $r=4$

At $k=2$, $N=7$, the value of $r=7$

At $k=3$, $N=10$, the value of $r=1$ (pattern repeats)

So the only possible remainders mod 9 are 1, 4, 7.

Hence, the distinct remainders are 3, and the correct answer is option A.

29. D

For a number to be a perfect cube, all the exponents in its prime factorisation must be multiples of 3.

Prime factorization of 1260: $1260 = 126 \times 10 = (2 \times 63) \times (2 \times 5) = 2 \times (9 \times 7) \times 2 \times 5 = 2^2 \times 3^2 \times 5^1 \times 7^1$

Now, to make this a perfect cube, we need to raise each prime factor's exponent to the next multiple of 3.

For having all the powers of the prime factors a multiple of 3, we need to multiply the number by $2^1 \times 3^1 \times 5^2 \times 7^2 = 7350$

Alternative Solution:

Now, to avoid the calculation, we can observe the options.

We know that n should be a multiple of 5 and 2. So, it has to end with 0. Also, it should be a multiple of 3.

The only option satisfying both conditions is Option D

30. C

$$\text{If } \frac{3}{5}(0.0625) + \frac{1}{3}(0.0729) + \frac{5}{4}(0.1024) = P$$

$$\frac{3}{5}(0.0625) = 0.0375$$

$$\frac{1}{3}(0.0729) = 0.0243$$

$$\frac{5}{4}(0.1024) = 0.128$$

$$\text{Thus, } 0.0375 + 0.0243 + 0.128 = 0.1898 = P$$

$$\text{Therefore, } 10000P = 1898$$

$N = 123612361236.....k \text{ digits}$. In N , 1236 is repeated continuously.

Now, $(1 + 2 + 3 + 6 = 12)$. This is the sum of the first 4 digits, and it is a multiple of 6; therefore, the sum of the next 4 digits will also be a multiple of 6.

Thus, upto $n = 100$, the sum of the digits of N will be a multiple of 6. Let the sum of digits be $6a$.

For $k = 101$, the sum of digits will be $6a + 1$, which is not a multiple of 6.

For $k = 102$, the sum of digits will be $6a + 3$, which is not a multiple of 6.

For $k = 103$, the sum of digits will be $6a + 6$, which is a multiple of 6.

For $k = 104$, the sum of digits will be $6a + 12$, which is a multiple of 6.

For $k = 103$ and $k = 104$, the sum of digits is a multiple of 6. Similarly, for $k = 107$ and $k = 108$, the sum of digits will be a multiple of 6.

Sum of all possible values of $k = 103 + 104 + 107 + 108 = 422$

32. D

We can backtrack the question.

We are given that the charitable foundation received the final remaining amount, which was Rs. 18,000. This was the amount left after Museum C took half ($1/2$) of the money available at that stage.

If the foundation's Rs. 18,000 represents the second half, then Museum C also received Rs. 18,000.

Therefore, the total amount of money before Museum C received its share was:

Rs. 18,000(Foundation) + Rs. 18,000(MuseumC) = Rs. 36,000

Now, this Rs. 36,000 was the amount remaining after Museum B took its share of $2/3$ rd so it must be $1/3$ rd of the value at that stage.

So, the total value before Museum B took its share, we can calculate: Rs. $36,000 \times 3 =$ Rs. 108,000

Museum B received $2/3$ rd of this Rs. 108,000 i.e. Rs. 72,000

33. B

The operations performed by Salma,

Subtracted 3 from x : $x - 3$

Divided the result by 2 : $\frac{x - 3}{2}$

Added 6 to the result : $\frac{x - 3}{2} + 6$

Multiply the result by 7 : $\left(\frac{x - 3}{2} + 6\right) 7$

The final answer she obtained was 126.

$$\left(\frac{x - 3}{2} + 6\right) 7 = 126$$

$$\frac{x - 3}{2} = 18 - 6 = 12$$

$$x = 24 + 3 = 27$$

The operations she should have performed,

Add 3 to x : $27 + 3 = 30$

Divide the result by 2 : $\frac{30}{2} = 15$

Subtract 6 from the result : $15 - 6 = 9$

Multiply the result by 7 : $9 \times 7 = 63$

The final answer should have been 63.

Hence, the correct answer is option B.

34. C

The given equation is $\frac{3}{x} + \frac{12}{y} = 4$

$$3y + 12x = 4xy$$

$$4xy - 3y - 12x = 0$$

Now, we try to split it into the product of two terms

$$(4x-3)(y-3) = 9 \text{ (When we add 9 to LHS, we also add it to RHS)}$$

Now 9 can be written as

$$1 \cdot 9 = 9 \text{ (} x = 1, y = 12 \text{)}$$

$$-1 \cdot -9 = 9 \text{ (} x = 1/2, y = 12 \text{) Not possible}$$

$$3 \cdot 3 = 9 \text{ (} x = 6/4, y = 6 \text{) Not possible}$$

$$-3 \cdot -3 = 9 \text{ (} x = 0, y = 0 \text{) Not possible}$$

$$9 \cdot 1 = 9 \text{ (} x = 3, y = 4 \text{)}$$

$$-9 \cdot -1 = 9 \text{ (} x = -6/4, y = 2 \text{) Not possible}$$

The only possible cases are 2. $(x, y) = (1, 12)$, and $(3, 4)$

35. **D**

$$7x + 4y = 7(2) + 4(3) = 26. \text{ Satisfying.}$$

$$9x + 12y = 9(2) + 12(3) = 54. \text{ Satisfying.}$$

$$5x - 2y = 4 = 5(2) - 2(3) = 4. \text{ Satisfying.}$$

$$-7x + 11y = -7(2) + 11(3) = 19. \text{ Not satisfying.}$$

$$4x + 7y = 4(2) + 7(3) = 29. \text{ Satisfying.}$$

36. **C**

Let regular tickets sold = r , premium tickets sold = p

We are given that $r + p = 600$ Equation 1

We also know that $rx + py = 4,80,000$ Equation 2

New case:

$$(r - 50)x + (p + 50)y = 4,80,000$$

Subtract (2) from this:

$$-50x + 50y = 0 \Rightarrow x = y$$

So both ticket types same price.

With 600 tickets = ₹4,80,000,

Price of one ticket = Rs. 800

Hence, the price of a premium ticket is Rs. 800

37. **C**

Let the equation of line L be $y = mx + c$.

The x-intercept of the line is given to be 2, and the x-intercept is the value of x at which the value of y is 0. So, the point $(2, 0)$ lies on the line.

Upon substitution of $(2, 0)$, we get,

$$0 = 2m + c$$

$$c = -2m$$

So, the equation is of the form $y = mx - 2m$

We are also given that $(6, 8)$ lies on the line. So, upon substitution, we get,

$$8 = 6m - 2m$$

$$m = 2$$

So, the equation of the line is $y = 2x - 4$

Out of the given options, only the point $(7, 10)$ lies on the line L.

Hence, the correct answer is option C.

38. D

Five years ago, a father was 25 years older than his son. Eight years from now, the ratio of their ages will be 8:3.

Let us assume the present age of father and son to be F and S, respectively.

Five years ago, a father was 25 years older than his son.

$$F - 5 = S - 5 + 25$$

$$F = S + 25$$

Now, eight years from now, the ratio of their ages will be 8:3.

$$\frac{F+8}{S+8} = \frac{8}{3}$$

$$3(F+8) = 8(S+8)$$

$$3F + 24 = 8S + 64$$

$$3F = 8S + 40$$

$$F = \frac{(8S+40)}{3} = S+25$$

$$8S + 40 = 3S + 75$$

$$5S = 35$$

$$S = 7$$

$$\text{Thus, } F = 32$$

Therefore, the ratio of their ages 23 years from now

$$(32+23):(7+23) = 55:30 = 11:6$$

39. E

Let Rahul's savings and Rohan's savings be x and y, respectively.

Let Rahul's expenditure and Rohan's expenditure be a and b, respectively.

Rohan's savings exceed Rahul's savings by the sum of their combined expenditures.

$$y = x + a + b$$

$$x + a = y - b \rightarrow 1$$

If twice Rahul's savings are added to Rohan's savings, the total equals four times Rohan's expenditure minus twice Rahul's expenditure.

$$2x + y = 4b - 2a$$

$$2x + 2a = 4b - y$$

Substituting the value of (x+a) from eq. 1 -

$$2(y - b) = 4b - y$$

$$y = 2b$$

Substituting the value of y in eq. 1, we will get $x = b - a$.

It is also known that Rohan's savings are five times that of Rahul's.

$$y = 5x$$

$$2b = 5(b - a)$$

$$5a = 3b$$

$$\frac{a}{b} = \frac{3}{5}$$

Thus, the ratio of Rahul's expenditure to Rohan's expenditure is 3 : 5.

40. D

Let Mira's present age = M, her brother's present age = B.

First condition: y years ago, Mira was three times her brother:

$$M - y = 3(B - y)$$

$$M - y = 3B - 3y$$

$$M - 3B + 2y = 0$$

$$M - 3B = -2y$$

Second condition: Seven years before that (y+7 years ago), Mira was five times her brother:

$$M - (y + 7) = 5[B - (y + 7)]$$

$$M - y - 7 = 5B - 5y - 35$$

$M - 5B + 4y + 28 = 0$
 $M - 5B + 4y = -28$
 Solving the two equations:
 From the first equation:
 $M - 3B = -2y$
 $M = 3B - 2y$
 Substitute into second equation:
 $(3B - 2y) - 5B + 4y = -28$
 $-2B + 2y = -28$
 $B = y + 14$
 Finding Mira's present age
 $M = 3B - 2y = 3(y + 14) - 2y = 3y + 42 - 2y = y + 42$
 Difference between present ages
 $M - B = (y + 42) - (y + 14) = 28$

41. D

Let the two-digit number be ab , and when it is interchanged, it becomes ba .
 We are given that ba is 36 less than ab .
 So,
 $10a + b - 10b - a = 36$
 $9a - 9b = 36$
 $a - b = 4$.
 The question asked is to calculate the value obtained by subtracting the digit in the tens place(a) from the digit in the units place(b).
 $b - a = -(a - b) = -(4) = -4$.
 Hence, the correct answer is option D.

42. C

Let us assume the number of sandwiches and burgers that are sold is S and B , respectively.
 Total number of sandwiches and burgers sold = 90
 $S + B = 90$ -----equation (1)
 The selling price of one sandwich = \$15
 The selling price of one burger = \$22
 Therefore, the revenue generated from selling S sandwiches and B Burgers = \$1560
 $15S + 22B = 1560$ -----equation (2)
 Multiplying equation (1) by 22 and subtracting it from equation (2), we get
 $22S + 22B = 1980$
 $15S + 22B = 1560$
 $7S = 420$
 Therefore, $S = 60$ and $B = 30$

43. B

Let the cost of Headphones, Speakers, and Mobile Phones be H , S , and M , respectively.
 The total cost of 2 headphones, 3 speakers, and 2 mobile phones is Rs 47,000.
 $2H + 3S + 2M = 47000 \rightarrow 1$
 It is also known that the combined price of 1 headphone and 1 speaker is Rs 6,500, while the combined cost of 1 speaker and 1 mobile phone is Rs 19,000.
 $H + S = 6500$
 $S + M = 19000$
 Substituting these values in eq. 1 -
 $2(H + S) + (S + M) + M = 47000$
 $2(6500) + (19000) + M = 47000$

$$32000 + M = 47000$$

$$M = 15000$$

Thus, the cost of a Mobile Phone is Rs 15,000.

44. **B**

Let the roots be a and b.

$$\text{sum of the roots} = a + b = -(- (2n + 1)) = 2n + 1$$

$$\text{Product of the roots} = n^2 - 4$$

We need to find the minimum value of $a^2 + b^2$

$$\text{We know that: } a^2 + b^2 = (a + b)^2 - 2ab$$

$$\text{Replacing the value of } a + b \text{ and } ab, \text{ we get: } a^2 + b^2 = (2n + 1)^2 - 2(n^2 - 4)$$

$$a^2 + b^2 = 4n^2 + 4n + 1 - 2n^2 + 8$$

$$a^2 + b^2 = 2n^2 + 4n + 9$$

In a quadratic equation $ax^2 + bx + c = 0$, minimum value is derived at $x = -\frac{b}{2a}$

On comparing, the minimum value of $2n^2 + 4n + 9$ will be at $x = -\frac{4}{2 \times 2} = -1$

Putting $n = -1$, we get the lowest value 7.

45. **B**

The value of $\left| \frac{a}{b} - \frac{b}{a} \right|$ can be calculated as,

$$\left| \frac{a}{b} - \frac{b}{a} \right| = \left| \frac{(a^2 - b^2)}{ab} \right| = \left| \frac{(a + b)(a - b)}{ab} \right|$$

In the quadratic equation $x^2 - 8x + 10 = 0$,

$$a + b = -\frac{(-8)}{1} = 8$$

$$ab = \frac{10}{1} = 10$$

$$(a + b)^2 - (a - b)^2 = 4ab$$

$$(a - b)^2 = (a + b)^2 - 4ab$$

$$|a - b| = \sqrt{(a + b)^2 - 4ab}$$

$$|a - b| = \sqrt{(8)^2 - 4(10)} = \sqrt{64 - 40} = \sqrt{24}$$

$$\left| \frac{a}{b} - \frac{b}{a} \right| = \left| \frac{(a + b)(a - b)}{ab} \right| = \left| \frac{(8)(\sqrt{24})}{10} \right| = \frac{8}{5}\sqrt{6}$$

Hence, the correct answer is option B.

46. **E**

We need to find for how many integral values of a does the graph of this quadratic equation will not touch the x-axis.

A graph will intersect x - axis if D is greater than or equal to zero.

So, in case when it does not touch the x-axis, so $D < 0$

$$2(a - 1)x^2 + 2(a - 2)x - (a + 3) = 0$$

$$D = [2(a - 2)]^2 + 4(2)(a - 1)(a + 3) < 0$$

$$4(a - 2)^2 + 8(a - 1)(a + 3) < 0$$

$$4a^2 - 16a + 16 + 8a^2 + 16a - 24 < 0$$

$$12a^2 < 8$$

$$a^2 < \frac{8}{12}$$

$$\text{Thus, } a \in \left(-\sqrt{\frac{2}{3}}, \sqrt{\frac{2}{3}}\right)$$

Thus, only one value of a will satisfy this condition, that is when $a = 0$

47. **D**

$x^2 - kx + 24 = 0$. Let a and b be the roots of the equation.

Therefore, the sum and the product of the roots of the equation are $a + b = k$ and $ab = 24$.

The roots of the equations are unique integer values. Therefore, a and b should be integers.

We know $ab = 24$. Therefore -

$a = 1$ and $b = 24$ or $a = 24$ and $b = 1$ can be the possible roots. Thus, $a + b = 25$. Therefore, k can be 25.

$a = 2$ and $b = 12$ or $a = 12$ and $b = 2$ can be the possible roots. Thus, $a + b = 14$. Therefore, k can be 14.

$a = 3$ and $b = 8$ or $a = 8$ and $b = 3$ can be the possible roots. Thus, $a + b = 11$. Therefore, k can be 11.

$a = 4$ and $b = 6$ or $a = 6$ and $b = 4$ can be the possible roots. Thus, $a + b = 10$. Therefore, k can be 10.

Thus, the value of k can never be 15.

48. **B**

The first student made a mistake in the constant term, but copied the coefficient of x correctly. It means the sum of the roots is correct.

Hence, the sum of the correct roots $= 9 + (-4) = 5$

The second student made a mistake in the coefficient of x, but copied the constant term correctly. It means the product of the roots is correct.

Correct Product $= 12 \times (-2) = -24$.

We know that the quadratic equation: $x^2 + (\text{sum of the roots})x + \text{product of the roots}$

Hence, the quadratic equation: $x^2 + 5x - 24 = 0$

Minimum value of a quadratic equation is when $x = -\text{coefficient of } x / (2 * \text{coefficient of } x^2)$

So, the minimum value of the quadratic equation will be at $x = -\frac{5}{2}$

49. **D**

The equation given is,

$$\frac{2x - 1}{3x + 5} = 2x$$

$$2x - 1 = 2x(3x + 5)$$

$$2x - 1 = 6x^2 + 10x$$

$$6x^2 + 8x = -1 \quad \text{---(1)}$$

$$\text{The value asked to calculate is } 3x^2 + 4x + 5 = \frac{1}{2}(6x^2 + 8x) + 5$$

Substituting the value from (1), we get,

$$3x^2 + 4x + 5 = \frac{1}{2}(6x^2 + 8x) + 5 = -\frac{1}{2} + 5 = \frac{9}{2} = 4.5$$

Hence, the correct answer is option D.

50. C

We need to find the number of integral values that n can take such that the quadratic equation $3x^2 - 8x + |n| = 0$ has real roots.

For the roots of a quadratic equation to be real, the discriminant should be greater than or equal to zero.

$$\text{So, } 8^2 - 4 \times 3 \times |n| \geq 0$$

$$|n| \leq \frac{64}{12}$$

So ' n ' can take integral values from -5, -4, ...0, 1, 2, ...5

Thus, the number of integral values ' n ' can take is 11.

51. A

Let the sum be ₹ P and the rate of interest be $r\%$ p.a.

After 5 years, amount = $2P$

$$\text{So, } 2P = P + \frac{P \times r \times 5}{100}$$

$$\text{or, } 2P - P = \frac{P \times r \times 5}{100}$$

$$\text{or, } P = \frac{P \times r \times 5}{100}$$

$$\text{or, } r = \frac{100}{5} = 20\% \text{ p.a.}$$

Now let after ' t ' years further, sum becomes four times its initial value .

$$\text{So, } 4P = P + \frac{P \times (t + 5) \times 20}{100}$$

$$\text{or, } 3P = \frac{P \times (t + 5) \times 20}{100}$$

$$\text{or, } 15 = t + 5$$

$$\text{or, } t = 10 \text{ years.}$$

52. A

[.] $\rightarrow$ Greatest Integer Function.

$$\text{No of trailing zeroes for } 100! = \left[\frac{100}{5^1} \right] + \left[\frac{100}{5^2} \right] + \left[\frac{100}{5^3} \right]$$

$$= 20 + 4 + 0 = 24.$$

$$\text{So, } t = 24.$$

$$\text{No of trailing zeroes in } (27!)^{24} = (\text{No of trailing zeroes in } 27!) \times (24)$$

$$= \left(\left[\frac{27}{5^1} \right] + \left[\frac{27}{5^2} \right] \right) \times (24)$$

$$= (6) \times (24)$$

$$= 144.$$

53. A

Beaker A:

Total Volume = 10 L

Acid = 20% of 10 L = 2 L

Water = 10 L - 2 L = 8 L

Beaker B:

Total Volume = 15 L

Acid = 60% of 15 L = 9 L

Water = 15 L - 9 L = 6 L

Total Acid in tank (before adding more) = 2 L (from A) + 9 L (from B) = 11 L.

Total Volume in tank (before adding more) = 10 L (from A) + 15 L (from B) = 25 L.

The initial concentration of the mixed solution is $(11 \text{ L} / 25 \text{ L}) = 44\%$.

Let 'x' be the liters of pure acid added to the tank.

New amount of Acid = $(11 + x)$ L

New Total Volume = $(25 + x)$ L

$(11 + x) / (25 + x) = 0.5$

Upon solving, we get $x = 3$

54. D

Let the initial sum be ₹x.

Now, half of the capital ($= ₹x/2$) was invested at $r\%$ p.a.

One-tenth of the capital ($= ₹x/10$) was invested at 25% p.a.

So, remaining capital = $x - \frac{x}{2} - \frac{x}{10} = \frac{2}{5}x$

So, remaining capital ($= ₹2x/5$) was invested at 12.5% p.a.

So, total interest after 10 years from all these investments

$$= \frac{x}{2} \times \frac{r}{100} \times 10 + \frac{x}{10} \times \frac{25}{100} \times 10 + \frac{2x}{5} \times \frac{12.5}{100} \times 10$$

And this is equal to the initial sum i.e. ₹x

$$\text{So, } \frac{x}{2} \times \frac{r}{100} \times 10 + \frac{x}{10} \times \frac{25}{100} \times 10 + \frac{2x}{5} \times \frac{12.5}{100} \times 10 = x$$

$$\text{or, } \frac{r}{20} + \frac{1}{4} + \frac{1}{2} = 1$$

$$\text{or, } \frac{r}{20} = 1 - \left(\frac{1}{4} + \frac{1}{2} \right)$$

$$\text{or, } r = 20 \left(1 - \frac{3}{4} \right) = 20 \times \frac{1}{4} = 5$$

So, the value of $r = 5$

55. B

Let the Cost Price (CP) be \$x dollars.

We are told that the percentage profit is numerically equal to the cost price. Hence, we can say, profit percentage = $x\%$

So, the profit = CP * Profit Percentage = $x \times \frac{x}{100}$

Selling price = CP + Profit

$$144 = x + \frac{x^2}{100}$$

$$144 = \frac{100x + x^2}{100}$$

$$x^2 + 100x - 14400 = 0$$

$$(x + 180)(x - 80) = 0$$

We get $x = -180$ or 80 .

Cost price can not be negative. Hence, $x = \$80$

Alternative Solution:

We can use options. The cost price can never be \$100 and \$120 because then the profit will be double and more than double, respectively, which will cross \$144. Out of the three

56. C

Let the selling price of the item be S.

A shopkeeper earns a profit of x% on selling an item.

$$S = 90 \left(1 + \frac{x}{100}\right) \rightarrow 1$$

If he raises the selling price by Rs. 18, his profit becomes 2x%.

$$S + 18 = 90 \left(1 + \frac{2x}{100}\right) \rightarrow 2$$

Subtracting eq. 1 from eq. 2 -

$$18 = 90 \left(\frac{x}{100}\right)$$

$$90 \times x = 1800$$

$$x = 20$$

57. C

Let the original Cost Price be C, and the original Selling Price be S. The original profit is $P = S - C$.

Condition 1: If the cost price were decreased by 10% and the selling price were increased by 10%, the new profit would be \$60 more than the original profit.

According to this condition:

$$\text{New Cost Price: } C' = C - 0.10C = 0.9C$$

$$\text{New Selling Price: } S' = S + 0.10S = 1.1S$$

$$\text{New Profit: } P' = S' - C' = 1.1S - 0.9C$$

The new profit is \$60 more than the original: $P' = P + 60$.

$$1.1S - 0.9C = (S - C) + 60$$

$$0.1S + 0.1C = 60$$

Multiplying by 10, we get our first equation: $S + C = 600$.

Condition 2: If both the cost price and selling price were decreased by 20%, the new profit would be \$40 less than the original profit.

According to this condition:

$$\text{New Cost Price: } C'' = C - 0.20C = 0.8C$$

$$\text{New Selling Price: } S'' = S - 0.20S = 0.8S$$

$$\text{New Profit: } P'' = S'' - C'' = 0.8S - 0.8C = 0.8(S - C) = 0.8P$$

The new profit is \$40 less than the original: $P'' = P - 40$.

$$0.8P = P - 40$$

$$0.2P = 40$$

$$P = 200.$$

Since $P = S - C$, our second equation is $S - C = 200$.

$$\text{Eq 1: } S + C = 600$$

$$\text{Eq 2: } S - C = 200$$

Solving this, we get $S = \$400$ and $C = \$200$

58. B

Let the Marked Price (MP) be \$100.

The article is sold at 80% of its MP. Selling Price (SP) = $0.80 \times \$100 = \$80$.

Now, this SP of \$80 resulted in a 10% loss. This means \$80 is 90% of the Cost Price.

$$CP \times (1 - 0.10) = SP$$

$$CP \times 0.90 = \$80$$

$$\text{So, } CP = 800/9$$

Now, we are asked for the profit if sold at the Marked Price (\$100).

$$\text{Profit} = MP - CP = 100 - 800/9 = 100/9$$

$$\text{Profit \%} = \frac{\frac{100}{9}}{\frac{800}{9}} \times 100 = 12.5\%$$

59. E

Let the Cost Price (CP) be \$100.

The item is marked up by 50%. So, Marked Price (MP) = \$100 × 1.50 = \$150.

The desired final profit is 10%.

So, Target Selling Price (SP) = \$100 × 1.10 = \$110.

The discount is the difference between the Marked Price and the target Selling Price.

Discount Amount = MP - SP = \$150 - \$110 = \$40.

The discount percentage is calculated based on the Marked Price.

Discount % = $(40/150) \times 100 = 80/3 = 26.67\%$

60. D

Let us assume the cost price of one orange is \$ 1, and Pramod has 100 oranges.

The cost price of 100 oranges is equal to \$100.

Pramod sells 40% of his oranges at a 30% profit and the remaining 60% at 10% below the cost price, earning a net profit of A%.

40 % of oranges = 40 oranges

Selling price of 1 orange = $1 \times \left(1 + \frac{30}{100}\right) = \$1.3$

Selling price of 40 oranges = $1.3 \times 40 = \$52$

Selling price of one of the remaining oranges = $1 \times \left(1 - \frac{10}{100}\right) = \$0.9$

Selling price of 60 oranges = $60 \times 0.9 = \$54$

Total selling price = $\$52 + \$54 = \$106$

Profit % = $\left(\frac{106 - 100}{100}\right) \cdot 100 = 6\%$

Similarly, if he sells 60% of the oranges at a 20% profit and the remaining 40% at a 10% profit, his net profit becomes B%

60 % of oranges = 60

Selling price of 1 orange = $1 \times \left(1 + \frac{20}{100}\right) = \$1.2$

Total selling price of 60 oranges = $1.2 \times 60 = \$72$.

Selling price of one of the remaining oranges = $1 \times \left(1 + \frac{10}{100}\right) = \$1.1$

The selling price of 40 oranges = $1.1 \times 40 = \$44$.

Total selling price = \$116

Profit % = $\left(\frac{116 - 100}{100}\right) \cdot 100 = 16\%$

A = 6 and B = 16

Therefore, A:B = 6:16 = 3:8

61. D

Let the marked price of 1 apple be Rs 10.

Rahul bought 10 apples and got an additional 6 apples for free. This means that Rahul got 16 apples at the price of 10 apples.

Therefore, the shopkeeper sold 16 apples at Rs 100. Thus, the selling price of the apple will be $\text{Rs } 100 \div 16 = \text{Rs. } 6.25$ per apple.

Discount = $\frac{MP - SP}{MP} \times 100 = \frac{10 - 6.25}{10} \times 100 = 37.5\%$

62. E

Let the cost price of a chocolate cupcake = C, and the cost price of a vanilla cupcake = V

Total cost price of chocolate cupcakes = $12C$

Total cost price of vanilla cupcakes = $8V$

Selling price of chocolate cupcakes = $12C(1 - 0.10) = 12C \cdot 0.90 = 10.8C$

Selling price of vanilla cupcakes = $8V(1 + 0.25) = 8V \cdot 1.25 = 10V$

We are given that Overall there is no profit and no loss. Hence, the total cost price = total selling price.

$$10.8C + 10V = 12C + 8V$$

$$10V - 8V = 12C - 10.8C$$

$$2V = 1.2C$$

$$V = 0.6C$$

Cost price ratio of vanilla : chocolate = $V : C = 0.6 : 1 = 3 : 5$

63. **E**

Let the CP of each mango be 1 rupee, and there are 100 mangoes.

She sells 20% of them at a 30% profit. This means that she sells 20 mangoes at $1 \left(1 + \frac{30}{100}\right) = 1.3$ rupees.

There are 80 mangoes left, and we are told that 25% of these are damaged and sold at a loss of 30%.

The number of damaged mangoes is $\frac{25}{100} \times 80 = 20$ and the are sold at $1 \left(1 - \frac{30}{100}\right) = 0.7$ rupees.

The total amount made from selling 40 mangoes = $20 \cdot 1.3 + 20 \cdot 0.7 = 26 + 14 = 40$.

The number of mangoes left = $100 - 40 = 60$

The overall profit is given to be 60%, so the total SP can be calculated as $100 \left(1 + \frac{60}{100}\right) = 160$.

So, the remaining 60 mangoes must be sold at $160 - 40 = 120$ rupees.

SP for each of those 60 mangoes = $\frac{120}{60} = 2$ rupees.

CP of each mango = 1 rupee.

So, the profit at which the remaining mangoes are sold = $\frac{SP - CP}{CP} \times 100 = \frac{2 - 1}{1} \times 100 = 100\%$

Hence, the correct answer is option E.

64. **A**

Ronaldo invested ₹50,000 at 10% simple interest per annum for 5 years.

Amount he will get at the end of 5 years = $50000 + 50000 \cdot 0.1 \cdot 5 = 50000 + 25000 = ₹75000$

Interest earned by Ronaldo in 5 years = ₹ 25000

Now, this amount is again reinvested for the next 3 years at 4% simple interest per annum,

Amount he will get at the end of 8 years because of this investment (25000) = $25000 + 25000 \cdot 0.04 \cdot 3 = 25000 + 3000 = 28000$

Therefore, the total amount accumulated at the end of 8 years = $50000 + 28000 = ₹78000$

65. **A**

Let us calculate the interest earned by Sam in 2 years

Principal = \$10,00,000

Rate of interest = 18% per annum, compounding annually.

Time = 2 years

$$\text{Interest} = 1000000 (1.18)^2 - 1000000$$

$$13,92,400 - 10,00,000 = 3,92,400$$

Let us calculate the interest earned by Altman in 2 years

Principal = \$10,00,000

Rate of interest = 20% per annum, simple interest.

Time = 2 years

$$\text{Interest} = \frac{10,00,000 (20) (2)}{100} = 4,00,000$$

The difference in interest earned by them = 400000 - 392400 = \$7,600

66. **D**

The Compound Interest formula is -

$A_n = A \left[1 + \frac{R}{100} \right]^n$, where A_n represents the amount after n years, R represents the rate of interest and n represents the number of years.

The amount grows to Rs 36,000 in 1 year and Rs 43,200 in 2 years.

$$36000 = A \left[1 + \frac{R}{100} \right] \rightarrow 1$$

$$43200 = A \left[1 + \frac{R}{100} \right]^2 \rightarrow 2$$

Dividing eq. 2 by eq. 1 -

$$\frac{6}{5} = 1 + \frac{R}{100}$$

$$R = 20\%$$

67. **D**

Let the principal amount be A , and the rate of interest be R .

Compound interest formula $\rightarrow A_n = A \left(1 + \frac{R}{100} \right)^n$

An amount grows to 16 times its original value in 14 years.

$$16A = A \left(1 + \frac{R}{100} \right)^{14}$$

Taking the square root of both sides

$$4 = \left(1 + \frac{R}{100} \right)^7$$

We have to find the time at which the amount becomes 4 times the original value.

$$4A = A \left(1 + \frac{R}{100} \right)^n$$

$$\left(1 + \frac{R}{100} \right)^7 = \left(1 + \frac{R}{100} \right)^n$$

$$n = 7 \text{ years}$$

68. **B**

Total weight = 10 kg

Water = 98% of 10 = 9.8 kg

Non-water (pulp/solids) = 2% of 10 = 0.2 kg

Let the new total weight = W .

Water = 90% of W = $0.9W$.

Solids = 10% of W = $0.1W$.

But solids remain unchanged = 0.2 kg.

$$0.1W=0.2$$

$$W = 2\text{kg}$$

So, the new weight of the stack is 2kg.

Hence, the correct answer is option B.

69. **C**

Let the amount replaced = x litres

Total = 90 litres

Juice : Water = 1 : 4

Quantity of Juice initially : $(1/5)*90 = 18$ litres

Quantity of Water initially : $(4/5)*90 = 72$ litres

Let the amount of mixture removed and replaced be x litres.

When x litres of the mixture is removed:

Juice removed = $x/5$

Water removed = $4x/5$

Then, we add x litres of pure juice.

Final quantities:

$$\text{Juice} = 18 - \frac{x}{5} + x = 18 + \frac{4x}{5}$$

$$\text{Water} = 72 - \frac{4x}{5}$$

We are told that in the final mixture, juice = water:

$$18 + \frac{4x}{5} = 72 - \frac{4x}{5}$$

$$\frac{8x}{5} = 54$$

$$x = 33.75 \text{ liters}$$

70. **B**

Assuming the volume of milk and water = $3x$ and $7x$

After removing 30 litres of solution, the milk removed will be $30*3/10 = 9$ litres, and the water removed will be $30-9=21$ litres

So the ratio = $(3x-9+30)/(7x-21) = 7:3$

$$\Rightarrow 3(3x+21)=7(7x-21)$$

$$\Rightarrow x = 21/4$$

The total volume = $10x = 10*21/4 = 52.5$ litres

71. **E**

20 litres of the honey solution are mixed with 30 litres of the coffee solution. Therefore, the total solution will be 50 litres.

Honey solution contains 40% pure honey and 60% water. Thus, 20 litres of honey solution will have 8 litres of pure honey and 12 litres of water.

Let the amount of pure coffee in the coffee solution be x litres, then the amount of water in the coffee solution will be $30-x$ litres.

After mixing, the amount of water in the final solution will be $= 12 + (30-x) = 42 - x$ litres.

It is given that the concentration of water in the final mixture is 54%

$$\frac{42 - x}{50} = \frac{54}{100}$$

$$x = 15 \text{ litres}$$

Therefore, the concentration of pure coffee in the coffee solution = $\frac{15}{30} \times 100 = 50\%$

72. A

A container holds 140 litres of a solution of milk and water.

Let the amount of water be a litres and milk be $(140 - a)$ litres.

One-fifth of the solution is removed and replaced with pure water. Thus, 28 litres of the solution is removed and replaced with 28 litres of pure water. Therefore, the amount of water in the final solution will be -

$$a - \frac{1}{5} \times a + 28 = \frac{4a}{5} + 28$$

After this replacement, the quantity of water in the solution becomes 80 litres.

$$\frac{4a}{5} + 28 = 80$$

$$a = 65 \text{ litres.}$$

Original amount of milk in the solution = $(140 - a) = (140 - 65) = 75$ litres.

73. E

Since the ratio of copper, zinc, and nickel in the alloy is given to be 4:7:9, let us assume that the weights of copper, zinc and nickel are $4x$, $7x$ and $9x$, respectively, in 50 pounds of the alloy.

$$4x + 7x + 9x = 50$$

$$20x = 50$$

$$x = 2.5$$

So, the amounts of copper, zinc, and nickel are $4 * 2.5 = 10$, $7 * 2.5 = 17.5$ and $9 * 2.5 = 22.5$, respectively.

Twice the weight of zinc = $2 * 17.5 = 35$ pounds

Combined weight of copper and nickel = $10 + 22.5 = 32.5$ pounds

Difference = $35 - 32.5 = 2.5$ pounds.

Hence, the correct answer is option E.

74. C

Total volume = 60 L.

Initial Acid = 20% of 60 L = $0.20 \times 60 = 12$ L.

Initial Water = $60 - 12 = 48$ L.

Let x be the litres of pure acid added.

New amount of acid = $12 + x$.

New total volume = $60 + x$.

The new solution should be 40% acid.

so, $(12 + x)/(60 + x) = 0.40$

Solving for x : $12 + x = 0.4(60 + x)$

$$12 + x = 24 + 0.4x$$

$$0.6x = 12$$

$$x = 20 \text{ liters}$$

75. D

A 720 kg mixture contains salt, sugar, and glucose in the ratio 2:3:4.

The mass of sugar in the given mixture = $\frac{3}{2 + 3 + 4} \times 720 = 240$ Kgs

Now, we add sugar to the mixture, so let us assume the quantity of sugar added is equal to K kg.

After adding sugar, the new ratio of salt, sugar, and glucose becomes 4:9:8

Therefore, the sugar quantity in the mixture will be $\frac{240 + K}{720 + K} = \frac{9}{4 + 9 + 8}$

$$7(240 + K) = 3(720 + K)$$

$$4K = 480$$

$$K = 120 \text{ Kgs}$$

76. **B**

70% of the population is aged 30 years or older. This means that 30% of the population is younger than 30 years of age.

It is given that 55% of the population is aged 50 years or younger, and 30% of the population is younger than 30 years of age.

This means that $(55 - 30)\%$ of the population is 30 years or older and 50 years or younger. Therefore, 25% of the population falls between the ages of 30 and 50 (both inclusive).

77. **B**

Let the number of balls in Box 2 be x .

$$\text{So, number of red balls in Box 1} = \frac{40}{100} \times 90 = 36$$

$$\text{Number of red balls in Box 2} = \frac{70}{100} \times x = 0.7x$$

$$\text{Hence, total number of red balls} = 36 + 0.7x$$

$$\text{Total number of balls, combining both the boxes} = 90 + x$$

It is given, combining both boxes, 60% of the balls are red, so:

$$36 + 0.7x = 0.6(90 + x)$$

$$\text{or, } 36 + 0.7x = 54 + 0.6x$$

$$\text{or, } 0.7x - 0.6x = 54 - 36$$

$$\text{or, } 0.1x = 18$$

$$\text{or, } x = 180$$

$$\text{So, total number of red balls in Box 2} = 0.7 \times 180 = 126$$

78. **D**

Let us assume the transfer fee in 2020 to be P .

$$\text{In 2021, the transfer fee became } P \left(1 + \frac{25}{100} \right) = 1.25P$$

$$\text{In 2022, the transfer fee became } 1.25P \left(1 + \frac{40}{100} \right) = 1.25 \times 1.4P = 1.75P$$

$$\text{In 2023, the transfer fee became } 1.75P \left(1 - \frac{20}{100} \right) = 1.75 \times 0.8P = 1.4P.$$

The change in transfer fee from 2020 to 2023 can be calculated as,

$$\text{Percentage} = \frac{1.4P - P}{P} \times 100 = 40\%$$

Hence, the correct answer is option D.

79. **E**

The average of a , b , and c is 7, and the average of b , c , and d is 8.

$$a + b + c = 21 \rightarrow 1$$

$$b + c + d = 24 \rightarrow 2$$

Subtracting eq. 1 from eq. 2 -

$$d - a = 3$$

Using the Hit-and-Trial method, we will get the values of $d = 10$ and $a = 7$.

80. C

Let us assume that the original number is $100N$.

When this number is increased by 37.5%, the number will become $137.5N$

When this number is decreased by 22.5%, the number will become $77.5N$

The difference between these two is given as 60

$$137.5N - 77.5N = 60$$

$$60N = 60$$

$$N = 1$$

Therefore, the original number is $100N = 100 \times 1 = 100$

When this number is increased by 20% = $100 \times 1.2 = 120$

81. C

Let the total population in the town be $100x$.

50% of the population is men, 40 are women, and the rest are children. This means that there are $50x$ men in the town, 40 women, and $(100x - 50x - 40) = (50 - 40x)$ are children.

All women are literate, 80% of men are illiterate, and 60% of children are literate. This means that all women are literate, 20% of men are literate, and 60% of children are literate, resulting in a total literate population of 136.

$$\frac{1}{5} \times 50x + 40 + \frac{3}{5} (50x - 40) = 136$$

Solving this will give us $x = 3$

So, the total population will be = $100x = 300$

Literate population = 136. Therefore, Illiterate population = 164.

The difference between the literate and illiterate populations is $164 - 136 = 28$.

82. C

$A : B = 4 : 5$. This can also be written as $A : B = 28 : 35$

$A : C = 7 : 6$. This can also be written as $A : C = 28 : 24$

$C : D = 8 : 9$. This can also be written as $C : D = 24 : 27$

$\rightarrow A : B : C : D = 28 : 35 : 24 : 27$

Let $A = 28x$, $B = 35x$, $C = 24x$, and $D = 27x$

$$A - D = 4 \rightarrow 28x - 27x = 4 \rightarrow x = 4$$

Therefore, the value of $B - C = 35x - 24x = 11x = 11 \times 4 = 44$.

83. D

Let the total number of books be $100x$.

25% of them are non-fiction, which means 75% of them are fiction.

$$\text{Number of fiction books} = \frac{75}{100} \times 100x = 75x$$

Out of the fiction books, 80% are damaged, which means that 20% of the fiction books are not damaged.

$$\text{Number of books that are fiction and not damaged} = \frac{20}{100} \times 75x = 15x$$

$$\text{The percentage of the books that are both fiction and not damaged} = \frac{15x}{100x} \times 100 = 15\%$$

Hence, the correct answer is option D.

84. B

Let total members = T

Girls = $0.2T$ and Boys = $0.8T$

Boys who play cricket = $0.40 \times 0.80T = 0.32T$
 Boys who don't play = $0.80T - 0.32T = 0.48T$
 Girls who play = one-fourth of boys who don't play = $(1/4) \times 0.48T = 0.12T$
 Girls who don't play = $0.20T - 0.12T = 0.08T$
 Total non-players = $0.48T + 0.08T = 0.56T$
 $0.56T = 560$
 $T = 1000$
 Total boys = $0.8 \times 1000 = 800$

85. D

Let us assume there are 100 employees in the company.
 Men = 40% = 40
 Women = 60% = 60
 70% of men play regularly = $40 \times 0.7 = 28$ men's
 46% of total employees play regularly = 46 employees
 Total employees who play regularly = Men who play regularly + Women who play regularly
 $46 = 28 + \text{Women who play regularly}$
 Therefore, Women who play regularly = $46 - 28 = 18$
 Thus, % of women = $18/60 = 30\%$

86. E

42% people in the survey didn't like prototype A.
 Thus, 58% surveyed people liked prototype A.
 6% of the surveyed people liked both prototypes.
 Therefore, 52% of the surveyed people liked only prototype A.

87. D

We can use the union Formula:
 $P(\text{English or Telugu}) = P(E) + P(T) - P(E \cap T)$
 We know that $P(E) = \frac{2}{3}$, $P(T) = \frac{1}{5}$, and $P(E \cap T) = \frac{1}{10}$

$$P(E \cup T) = \frac{2}{3} + \frac{1}{5} - \frac{1}{10} = \frac{20}{30} + \frac{6}{30} - \frac{3}{30} = \frac{23}{30}$$

88. C

Let the 6 consecutive integers in the set P be $n, n + 1, n + 2, n + 3, n + 4, n + 5$
 In Set Q, all these elements are added.
 When 3 is added to all the elements, we get $n + 3, n + 4, n + 5, n + 6, n + 7, n + 8$
 When 3 is subtracted from all the elements, we get $n - 3, n - 2, n - 1, n, n + 1, n + 2$
 We know that a set consists of only distinct elements,
 So, combining all these values, the set Q consist of $n - 3, n - 2, n - 1, n, n + 1, n + 2, n + 3, n + 4, n + 5, n + 6, n + 7, n + 8$.
 Total number of elements in Set Q = 12.
 Hence, the correct answer is option C.

89. C

$12 = 2^2 \times 3$
 So to form one factor of 12, we need two factors of 2 and one factor of 3. The number of times 12 can divide 100! is limited by the availability of these prime factors.
 So, the number of factors of 3 in 100!:

$$\left\lfloor \frac{100}{3} \right\rfloor + \left\lfloor \frac{100}{9} \right\rfloor + \left\lfloor \frac{100}{27} \right\rfloor + \left\lfloor \frac{100}{81} \right\rfloor = 33 + 11 + 3 + 1 = 48$$

Number of factors of 2 in 100!:

$$\left\lfloor \frac{100}{2} \right\rfloor + \left\lfloor \frac{100}{4} \right\rfloor + \left\lfloor \frac{100}{8} \right\rfloor + \left\lfloor \frac{100}{16} \right\rfloor + \left\lfloor \frac{100}{32} \right\rfloor + \left\lfloor \frac{100}{64} \right\rfloor = 50 + 25 + 12 + 6 + 3 + 1 = 97$$

We have 48 factors of 3, so we can make at most 48 factors of 12.

We have 97 factors for 2. So, for 2^2 , we have 48 factors.

Since we have 48 factors of both the components, the highest power of 12 that can divide 100! is 48.

90. **B**

Prime Factorisation of 28

$$12 = 2^2 * 7$$

The maximum power of 2 that divides 360! is:

$$\Rightarrow \left\lfloor \frac{360}{2} \right\rfloor + \left\lfloor \frac{360}{2^2} \right\rfloor + \left\lfloor \frac{360}{2^3} \right\rfloor + \left\lfloor \frac{360}{2^4} \right\rfloor + \left\lfloor \frac{360}{2^5} \right\rfloor + \left\lfloor \frac{360}{2^6} \right\rfloor + \left\lfloor \frac{360}{2^7} \right\rfloor + \left\lfloor \frac{360}{2^8} \right\rfloor + \dots$$

$$\text{Number of 2s in } 360! = 180 + 90 + 45 + 22 + 11 + 5 + 2 + 1 = 356$$

Similarly, the maximum power of 7 that divides 360! is:

$$\Rightarrow \left\lfloor \frac{360}{7} \right\rfloor + \left\lfloor \frac{360}{7^2} \right\rfloor + \left\lfloor \frac{360}{7^3} \right\rfloor + \dots$$

$$\text{Number of 7s in } 360! = 51 + 7 + 1 = 59$$

Therefore, the power of 28 in 360! = 59

Thus, the highest value is 59 such that 360! when divided by 28^{59} is an integer

91. **B**

Speed of Ram = 50 kmph, and Speed of Rahim = 40 kmph

Let's assume they reached Agra after t hours.

Total distance covered by Rahim = $40t$

Ram took a 1-hour break; therefore, he travelled for $(t - 1)$ hours at 50 kmph.

Total distance covered = $50(t - 1)$

Both are travelling from Kota to Agra; thus, they must be travelling the same distance, and this distance will be equal to the distance between Kota and Agra.

$$40t = 50t - 50$$

$$t = 5 \text{ hours}$$

$$\text{Distance between Kota and Agra} = 40t = 40 * 5 = 200 \text{ km.}$$

92. **E**

We will solve this question using the concept of relative motion.

Length of the track = 420 m

Let the speed of A and B be x m/s and y m/s, respectively.

If A and B are moving in opposite directions, then they will meet again after 30 seconds.

Therefore, the speeds will be added.

$$x + y = \frac{420}{30} = 14 \rightarrow 1$$

If they are moving in the same direction, then they will meet again after 70 seconds.

Therefore, the relative speed will be the difference between their speeds.

$$|x - y| = \frac{420}{70} = 6$$

$$\text{Case 1: } x - y = 6 \rightarrow 2$$

Adding eq. 1 and eq. 2, we will get $\rightarrow x = 10$ and $y = 4$. Thus, the speed of A will be 10 m/s, and the speed of B will be 4 m/s.

$$\text{Case 2: } x - y = -6 \rightarrow 3$$

Adding eq. 1 and eq. 3, we will get $\rightarrow x = 4$ and $y = 10$. Thus, the speed of A will be 4 m/s,

and the speed of B will be 10 m/s.

Considering both cases, the speed of A can be either 4 m/s or 10 m/s, and the speed of B can be either 10 m/s or 4 m/s.

Time taken by A to cover the entire path = $420/10$ or $420/4 \rightarrow$ Either 42 seconds or 105 seconds.

Time taken by B to cover the entire path = $420/4$ or $420/10 \rightarrow$ Either 105 seconds or 42 seconds.

Distance covered by A in 50 seconds = Either 4×50 or 10×50 = Either 200 m or 500 m

Distance covered by B in 50 seconds = Either 10×50 or 4×50 = Either 500 m or 200 m

The difference between the distances covered by A and B will be 300 m. Thus, this statement is definitely TRUE.

93. C

Let Ravi's walking speed = v m/s and the belt's speed = b m/s.

Case 1: Walking against the belt:

Effective speed = $v - b$

$$300/(v-b) = 150$$

$$v - b = 2$$

Case 2: Walking with the belt

Effective speed = $v + b$

$$300/(v+b) = 50$$

$$v + b = 6$$

Adding the two equations:

$$2v = 8$$

$$v = 4 \text{ m/s}$$

Time to cover 300m if belt stops = $300/4 = 75$ seconds

94. B

Let the total amount of work = $\text{LCM}(20, 30, 60) = 60$ units

$$\text{Work rate of A} = \frac{60}{20} = 3 \text{ units/day}$$

$$\text{Work rate of B} = \frac{60}{30} = 2 \text{ units/day}$$

$$\text{Work rate of C} = \frac{60}{60} = 1 \text{ unit/day}$$

So, on the first and second day, only A is working, and on the 3rd day, all three of them are working.

Work done on day 1 = 3 units

Work done on day 2 = 3 units

Work done on day 3 = $3 + 2 + 1 = 6$ units

This keeps repeating every 3 days. So, the total work done in 3 days = $3 + 3 + 6 = 12$ units.

The total work needed is 60 units.

$$\text{Time taken} = \frac{60}{\frac{12}{3}} = 5 \times 3 = 15 \text{ days.}$$

Hence, the correct answer is option B.

95. D

Speed of Tejas Train = 162 km/h or $162 \times 5/18 = 45$ m/s

Similarly, speed of Duronto = 90 km/h or $90 \times 5/18 = 25$ m/s

When Trains are moving in opposite directions, the relative speed will be = $45 + 25 = 70$ m/s

Time taken by trains to cross each other = 20 seconds

The length of Tejas and Duronto Combined will be equal to $70 \times 20 = 1400$ meters.

Also, if Tejas takes 15 seconds to pass a pole.

Length of Tejas = $45 \times 15 = 675$ meter

Therefore, the length of Duronto = $1400 - 675 = 725$ meters.

Thus, the difference in the lengths of the two trains = $725 - 675 = 50$ meters.

96. C

Let the efficiency of each pipe be x , and assume the tank's capacity is 90 litres.

3 pipes can fill 50% of a tank in 4.5 hours.

$$3 \times x \times 4.5 = 45$$

$$x = \frac{10}{3} \text{ litres/hour}$$

Thus, the efficiency of each pipe is $10/3$ litres per hour.

We need to determine the time it takes for 9 pipes to fill the entire tank. Let it be T hours.

$$9 \times \frac{10}{3} \times T = 90$$

$$T = 3 \text{ hours.}$$

97. C

Let the time taken by the policeman to catch the thief be t hours.

A policeman notices the thief running away one hour later. Therefore, the distance covered by the thief in 1 hour will be $= 40 \times 1 = 40$ km.

Now both are moving in the same direction, with an initial gap of 40 km

Applying the concept of relative motion -

$$t = \frac{40}{60 - 40} = 2 \text{ hours.}$$

98. B

Volume of cistern = 500 litres

$$E_A = 20 \frac{\text{litre}}{\text{hr}} \text{ \& } E_B = 30 \frac{\text{litre}}{\text{hr}}$$

Pipe C can empty the cistern completely in 50 hours :

$$E_C = \left(\frac{-500}{50} \right) \frac{\text{litre}}{\text{hr}} = -10 \text{ litre/hr.}$$

Let the total time required to fill the cistern be " t " hours :

1. Amount of water filled by Pipe A = $20(t)$ litres.

2. Pipe B is turned on after 5 hours : Amount of water filled by Pipe B = $30(t - 5)$ litres.

3. Pipe C is turned on after 3 more hours after B : Amount of water emptied by Pipe C = $10(t - 8)$ litres.

So, effectively : $20(t) + 30(t - 5) - 10(t - 8) = 500$

$$40(t) - 150 + 80 = 500$$

$$40(t) = 570$$

$$t = 14.25 \text{ hours}$$

Therefore, the total time it takes to fill the cistern = 14 hours 15 minutes.

99. A

Total time = $30 \times 60 = 1800$ seconds

First 20 minutes = $20 \times 60 = 1200$ seconds

Speed for first 20 minutes = 1 m/s

Distance travelled in the first 20 minutes = $1 \text{ m/s} \times 1200\text{s} = 1200\text{m}$

Total distance = 2100m

Distance left = $2100\text{m} - 1200\text{m} = 900\text{m}$

Time left = $1800 - 1200 = 600\text{s}$

Speed for last 10 minutes = $\frac{900}{600} = 1.5\text{m/s}$

Increase in speed = $\frac{1.5 - 1}{1} \times 100 = 50\%$

Hence, the correct answer is option A.

100. C

Six men and fifteen women can finish a project in 6 days.

It is given that men are contributing 40% of the total work.

Therefore, women contribute to 60% of the total work.

15 women working for 6 days can finish 60% of the work.

Therefore, 15 women working for 1 day can finish 10% of the work.

Let us assume the work done by 1 woman in 1 day is 1 unit.

Therefore, 15 women working 1 unit of work everyday is 10% of work. = 15 units.

Therefore, the total work units = 150 units.

Six men finish 40% of the work in 6 days = 60 units

Therefore, six men finish work in 1 day = 10 units

Work done by one man in one day = $10/6 = 5/3$ units

If ten women and ten boys can complete the same project in 10 days

Let us assume work done by one boy in one day = B units

$10W + 10B = 15$ units of work every day.

$10 + 10B = 15$

$10B = 5$

Therefore, the work done by one boy in a day = 0.5 units

Therefore, twenty boys alone complete the project in $150/20 \times 0.5 = 150/10 = 15$ days.

101. D

Total Outcomes = {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT} = 8

Favourable Outcomes = At least 2 heads, which means either 2 heads or 3 heads = {HHH, HHT, HTH, THH} = 4

Probability = Favourable / Total

$$P = \frac{4}{8} = \frac{1}{2}$$

102. A

Let the 11 friends be A, B, C, D, E, F, G, H, I, J, and K.

Chitra, Deepak, and Esha are always together, and Aditya and Bipro are never together, This means that C, D, E are always together and A and B are never together.

Total number of ways for arranging them, when CDE are together = $9! \times 3!$

Total number of ways for arranging them, when CDE are together and AB are also together = $8! \times 3! \times 2!$

Total number of ways when Chitra, Deepak, and Esha are together, and Aditya and Bipro are never together = (Total number of ways for arranging them, when CDE are together) - (Total number of ways for arranging them, when CDE are together and AB are also together)
= $9! \times 3! - 8! \times 3! \times 2!$

$$= 8! \times 3! \times (9 - 2)$$

$$= 8! \times 3! \times 7$$

103. E

The sum of the numbers on their top faces exceeds 10; therefore, the sum will be either 11 or 12.

The sum can be 11, when the numbers are (5,6), (6,5). The sum can be 12 when the numbers on the dice are (6,6). Thus, the number of favourable outcomes is 3.

$$\text{Total Outcomes} = 6 \times 6 = 36$$

$$P = \frac{\text{Favourable}}{\text{Total}}$$

$$P = \frac{3}{36} = \frac{1}{12}$$

104. C

We know that the number of ways to arrange n distinct objects in a circle is $(n-1)!$

The total number of people is 10 (5 men and five women).

$$\text{Total Arrangements} = (10-1)! = 9!$$

For no two women to sit together, the men must be seated first to create gaps for the women.

Arranging the five men. The number of ways to arrange five men around a circular table is $(5-1)! = 4!$.

Now, arranging the five women. Seating the five men makes five distinct gaps between them. So, we must place one woman in each gap.

Therefore, the number of ways to arrange five women in these five available gaps is a linear permutation, which is $5!$.

$$\text{Total Favourable Arrangements} = (\text{Ways to arrange men}) \times (\text{Ways to arrange women}) = 4! \times 5!$$

$$\text{Probability: } \frac{(4! \times 5!)}{9!} = \frac{1}{126}$$

105. E

Tushar has 58 mobile phones in his shop.

Working condition phones = 50

Damaged phones = 8

$$\text{The number of ways of selecting two phones from 58 mobile phones} = {}^{58}C_2$$

$$\text{The number of ways of selecting two working phones from 50 mobile phones} = {}^{50}C_2$$

$$\text{Therefore, the probability that both selected phones are in working condition} = \frac{{}^{50}C_2}{{}^{58}C_2} =$$

$$\frac{50 \times 49}{58 \times 57} = \frac{1225}{1653}$$

106. C

The last ball drawn has to be black.

This means while the drawing the first 17 balls, 7 black balls and 10 white balls have to be picked.

$$\text{Now, number of ways of drawing 7 black balls from given 8 black balls} = {}^8C_7 \text{ ways} = 8 \text{ ways.}$$

$$\text{Also, number of ways of drawing 10 white balls from 10 white balls} = {}^{10}C_{10} \text{ ways} = 1 \text{ way.}$$

$$\text{So, total number of ways of drawing 7 black and 10 white balls} = 8 \times 1 = 8 \text{ ways.}$$

$$\text{Also, total number of ways of drawing first 17 balls from the given 18 balls} = {}^{18}C_{17} = 18 \text{ ways.}$$

$$\text{So, required probability} = \frac{8}{18} = \frac{4}{9}.$$

107. C

Given : Red balls = 3
Blue balls = 4

Now if two balls are drawn out without replacement and required condition is that both the balls are of different colours :

Case I : {Red, Blue} in order .

1. Probability to pick the red ball first = $\frac{3}{7}$

2. Probability to pick the blue ball in 2nd draw = $\frac{4}{7-1} = \frac{2}{3}$

$$\text{Hence, the probability} = \frac{3}{7} \times \frac{2}{3} = \frac{2}{7} \rightarrow \text{Eq(1).}$$

Case II : {Blue, Red} in order

1. Probability to pick the blue ball first = $\frac{4}{7}$

2. Probability to pick the red ball in 2nd draw = $\frac{3}{7-1} = \frac{1}{2}$

$$\text{Hence, the probability} = \frac{4}{7} \times \frac{1}{2} = \frac{2}{7} \rightarrow \text{Eq(2).}$$

$$\text{Therefore, the total probability} = \left(\frac{2}{7} + \frac{2}{7} \right) = \frac{4}{7}$$

108. D

We are given the condition that there should be more men than women. This is possible in three ways: (3 men, 2 women), (4 men, 1 woman), or (5 men, 0 women).

Case 1 (3 men, 2 women): The number of ways is $({}^6C_3) * ({}^8C_2) = 20 * 28 = 560$.

Case 2 (4 men, 1 woman): The number of ways is $({}^6C_4) * ({}^8C_1) = 15 * 8 = 120$.

Case 3 (5 men, 0 women): The number of ways is $({}^6C_5) * ({}^8C_0) = 6 * 1 = 6$.

The total number of ways is the sum of all cases: $560 + 120 + 6 = 686$. The correct answer is D.

109. A

When all letters of the word "DANCE" are arranged in a dictionary, then we will first have all the words with the letter A, then with letter C, then with D, then with E, and at last with N. We have to continue this pattern for all the letters in the word.

A -> We have D, N, C, and E left. Thus, there are 4! words that can be formed. -> Total = 24 words.

C -> We have D, N, A, and E left. Thus, there are 4! words that can be formed. -> Total = 24 words.

D -> We have C, N, A, and E left. -> DA -> We have N, C, and E left.

DAC -> We have N and E left. Thus, there are 2! words that can be formed. -> Total = 2 words.

DAE -> We have N and C left. Thus, there are 2! words that can be formed. -> Total = 2 words.
 DAN -> We have E and C left. -> DANC -> We have E left -> DANCE
 Thus, the rank of the word "DANCE" will be = 24 + 24 + 2 + 2 + 1 = 53rd.

110. C

To count the number of permutations of "n" objects such that no object appears in its original position.

The above is given by **Derangements** ($!n$) is given by :

$$!n = n! \left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \dots + (-1)^n \frac{1}{n!} \right)$$

Given : $n = 5$ (houses / letters)

$$\text{So, } !5 = 5! \left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \frac{1}{5!} \right)$$

$$D_5 = 120 \left(\frac{1}{2} - \frac{1}{6} + \frac{1}{24} - \frac{1}{120} \right)$$

$$D_5 = 44$$

Therefore, Option C is the answer.

111. B

For arranging the seat such that no two women sit together, we should first seat the men and then place the women in the gaps between them.

Arranging the 4 men : The number of ways to do this is $(4-1)! = 3! = 6$ ways.

Placing the men creates 4 empty seats (gaps) between them.

We can now arrange the 4 women in these 4 available seats. The number of ways to do this is $4! = 24$ ways.

The total number of arrangements: $6 * 24 = 144$.

112. A

The probability of drawing a green ball is $\frac{5}{16}$, and the likelihood of drawing a blue ball is $\frac{1}{4}$

$$P(R) = 1 - P(G) - P(B)$$

$$P(R) = 1 - \frac{5}{16} - \frac{1}{4}$$

$$P(R) = \frac{7}{16}$$

Let the total number of balls be T. It is given that there are 21 red balls.

$$P(R) = \frac{21}{T} = \frac{7}{16}$$

$$T = 48 \text{ balls}$$

113. C

The word LEADER has 6 letters. The letter 'E' is repeated twice.

Total arrangements = $6!/2! = 360$

Now, we can find the number of words that can be arranged such that all the vowels are together and subtract that from 360 to find the desired answer.

Arrangements where vowels are together: Treat the three vowels (E, A, E) as a single block.

Now we are arranging 4 items: (EAE), L, D, R.
 The number of ways to arrange these 4 items is $4! = 24$.
 Within the vowel block (EAE), the letters themselves can be rearranged. There are 3 letters with 'E' repeated twice, so the number of arrangements is $3!/2! = 3$
 Total arrangements with all the vowels together = $24 \times 3 = 72$.
 Arrangements where all the vowels are NEVER together: Never Together = Total - Together = $360 - 72 = 288$.

114. C

The total number of ways to place 5 letters in 5 mailboxes is $5! = 120$.
 Now, we need to find the number of arrangements where exactly 2 letters are in the correct mailboxes.
 First, choose which 2 letters go into the correct mailboxes. This can be done in ${}^5C_2 = 10$ ways.
 The remaining 3 letters must all be placed in the wrong mailboxes. The number of derangements of 3 items (D_3) is 2.
 The number of favorable outcomes is the product of these two steps: $10 \times 2 = 20$.
 The probability is the ratio of favorable outcomes to the total number of outcomes: $20 / 120 = 1/6$.

115. A

The order of the 5 teams can be determined in $5!$ ways.
 The order within each team can be determined in $2!$ ways, as there are 2 members in each team.
 Since there are 5 teams, all the members of each team can be arranged in $(2!)^5$ ways.
 The total number of ways the performance can be done is $5! \times (2!)^5 = 120 \times 32 = 3840$
 Hence, the correct answer is option A.

116. C

In-order for the mission to get succeeded, at least 2 out of 5 has to hit the target.
 We can find the probability of mission to be successful = $1 - P(\text{failure of mission})$.

$$\begin{aligned} P(X \geq 2) &= 1 - [P(X = 0) + P(X = 1)] \\ &= 1 - \left(\left(\frac{1}{2} \right)^5 + {}^5C_1 \left(\frac{1}{2} \right)^1 \left(\frac{1}{2} \right)^4 \right) \\ &= 1 - 6 \left(\frac{1}{2} \right)^5 \\ &= 0.8125 \end{aligned}$$

Therefore, Option C is the answer.

117. E

The probability of any specific side of the die is $1/6$.
 Roll 1: Value = \$0
 Roll 2 (prime): Value = +\$2
 Roll 3 (prime): Value = +\$3
 Roll 4 (composite): Value = -\$4

Roll 5 (prime): Value = +\$5

Roll 6 (composite): Value = -\$6

Expected Value = $(1/6 * \$0) + (1/6 * \$2) + (1/6 * \$3) + (1/6 * -\$4) + (1/6 * \$5) + (1/6 * -\$6)$

= $(1/6) * (0 + 2 + 3 - 4 + 5 - 6)$

= $(1/6) * (10 - 10)$

= $(1/6) * 0 = \$0$.

118. C

We have to place A & B adjacent to each other in a circular arrangement .

Out of 6 places available on a circular table, Lets first fix "A"'s place at one position . (any place out of 6 vacant, as all are equivalent) .

Case I : Placing "B" to the left of A .

1. The rest of {C,D,E,F} has to be placed in 4 remaining seats , which can be done in 4! different ways.

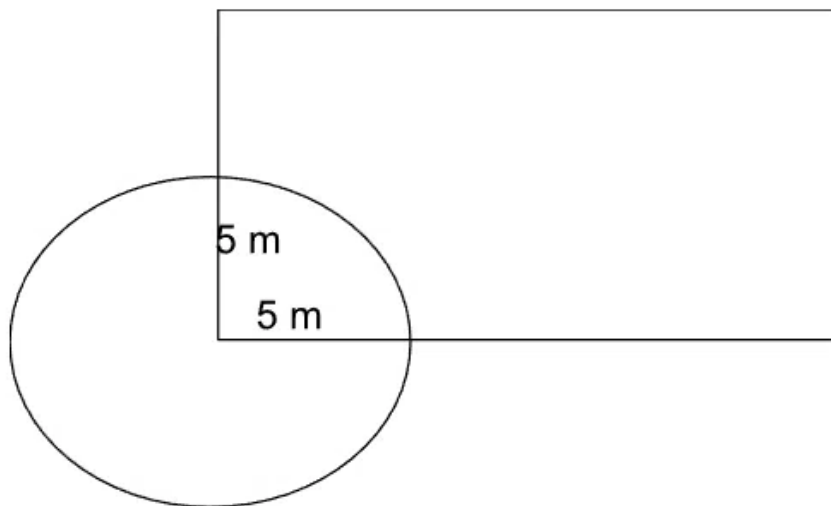
Case II : Placing "B" to the right of A

1. The rest of {C,D,E,F} has to be placed in 4 remaining seats , which can be done in 4! different ways.

Therefore, total no of ways = $2(4!) = 48$ ways.

119. C

As the goat is tied at corner of square field with a rope of length of 5 metres, let us first visualise the area that can be covered by goat :



So, the goat can have a trajectory whose area is a circle with radius 5 metres (rope length). As it is tied to the corner of field, the corner would be centre of the circle .

Hence, the area inside field which goat can cover = $\frac{1}{4}\pi (5^2) = \frac{25\pi}{4}$.

And the total area of grass field = $l^2 = 5^2 = 25 m^2$

$$\begin{aligned}\text{Therefore, the probability} &= \frac{\text{grazing field}}{\text{total field}} = \frac{25\pi}{4(25)} \\ &= \frac{\pi}{4} \\ &= 0.78\end{aligned}$$

120. B

Case 1: A red ball is transferred from X to Y.

The probability of drawing a red ball from X is $\frac{3}{8}$.

Bag Y now contains 5 red and 2 blue balls (7 total).

The probability of drawing a red ball from Y is now $\frac{5}{7}$.

The probability of this entire scenario is $(\frac{3}{8}) * (\frac{5}{7}) = \frac{15}{56}$.

Case 2: A blue ball is transferred from X to Y.

The probability of drawing a blue ball from X is $\frac{5}{8}$.

Bag Y now contains 4 red and 3 blue balls (7 total).

The probability of drawing a red ball from Y is now $\frac{4}{7}$.

The probability of this entire scenario is $(\frac{5}{8}) * (\frac{4}{7}) = \frac{20}{56}$.

The total probability of drawing a red ball from Bag Y : $\frac{15}{56} + \frac{20}{56} = \frac{35}{56} = \frac{5}{8}$.

The correct answer is B.

121. C

It is given that no player gets more than 7 balls.

Let us assume player 1 got $(7 - a)$ balls, player 2 got $(7 - b)$ balls, and player 3 got $(7 - c)$ balls, where a , b , and c are greater than or equal to 0.

$$(7 - a) + (7 - b) + (7 - c) = 15$$

$$a + b + c = 6$$

$$\text{Total number of ways} = {}^{n+r-1}C_{r-1} = {}^{6+3-1}C_{3-1} = {}^8C_2 = 28 \text{ ways.}$$

122. C

The outcomes of a fair dice = $\{1, 2, 3, 4, 5, 6\}$.

Let the outcomes on both the dices be X & Y .

$$\text{Min value of } X + Y = 2.$$

$$\text{Max value of } X + Y = 12.$$

The Prime number possibilities as a sum = $\{2, 3, 5, 7, 11\}$

Case I : Sum = 2

$$(X, Y) = \{(1, 1)\} \rightarrow \text{Possibilities} = 1.$$

Case II : Sum = 3

$$(X, Y) = \{(1, 2), (2, 1)\} \rightarrow \text{Possibilities} = 2.$$

Case III : Sum = 5

$$(X, Y) = \{(1, 4), (2, 3), (3, 2), (4, 1)\} \rightarrow \text{Possibilities} = 4.$$

Case III : Sum = 7

$$(X, Y) = \{(1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)\} \rightarrow \text{Possibilities} = 6.$$

$(X, Y) = \{(5, 6), (6, 5)\} \rightarrow$ Possibilities = 2.

Therefore, the probability = $\frac{1 + 2 + 4 + 6 + 2}{6 \times 6} = \frac{15}{36} = \frac{5}{12}$.

123. C

sasasa

We can imagine each subject as a single block.

We have a Mathematics block (M), a Physics block (P), and a Chemistry block (C). The first step is to arrange these three blocks. The number of ways of arranging 3 blocks is $3! = 3 \times 2 \times 1 = 6$ ways.

Now, we can arrange the books within each block.

The 4 different mathematics books can be arranged within their block in $4! = 4 \times 3 \times 2 \times 1 = 24$ ways.

The 3 different physics books can be arranged within their block in $3! = 3 \times 2 \times 1 = 6$ ways.

The 3 different chemistry books can be arranged within their block in $3! = 3 \times 2 \times 1 = 6$ ways.

Total Arrangements = $6 \times 24 \times 6 \times 6 = 5,184$.

The correct answer is C.

124. E

We roll Blue and Green dice and condition on the product being 12.

First list all ordered outcomes (B,G) with product 12 (faces 1-6): $\{B \times G = 12\}$

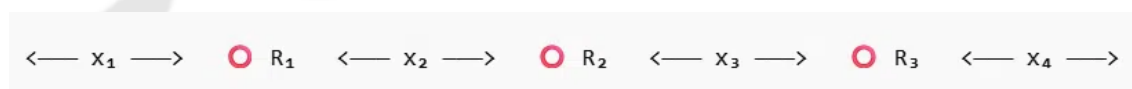
1. $(B, G) = (2, 6) \rightarrow$ Both are even numbers.
2. $(B, G) = (3, 4) \rightarrow$ Exactly one number is even.
3. $(B, G) = (4, 3) \rightarrow$ Exactly one number is even.
4. $(B, G) = (6, 2) \rightarrow$ Both are even numbers.

Therefore, Probability that exactly one of the two dices shows an even number = $\frac{2}{4} = \frac{1}{2}$.

125. C

As the player throws three rings :

1. Let R_1, R_2, R_3 be rings .
2. Let X_1, X_2, X_3, X_4 be gaps around three rings .



As out of 10 articles, three are taken by three rings, Hence rest of the 7 articles has to be from X_1, X_2, X_3 & X_4 .

$$\rightarrow X_1 + X_2 + X_3 + X_4 = 7$$

As we know that Rings must not be adjacent, we can conclude that the minimum value of both X_2 & X_3 is

$$X_4 = 5$$

$$X_1 + X_2' + X_3' +$$

Number of non-negative integral solutions = $n + r - 1_{C_{r-1}} = 5 +$

$$4 - 1_{C_{4-1}} = 8_{C_3}$$

$$= \frac{8 \times 7 \times 6}{6}$$
$$= 56$$