## 100 Important PYP Based CSIR NET General Aptitude Questions with Detailed Solutions- Part 2

Q1. Two cards are drawn together at random from a deck of 52 playing cards. What is the probability to get one red and one black card?
(a) 13/51
(b) 26/51
(c) 13/102
(d) 13/204

Q2. ABCD is a square. EFGH is a rectangle inscribed within the square with its sides parallel to the diagonal AC of the square. The perimeter of the rectangle EFGH is 16. The side of the square is
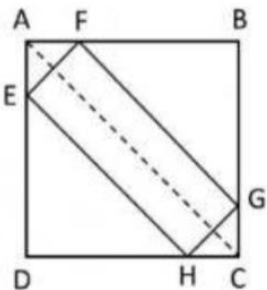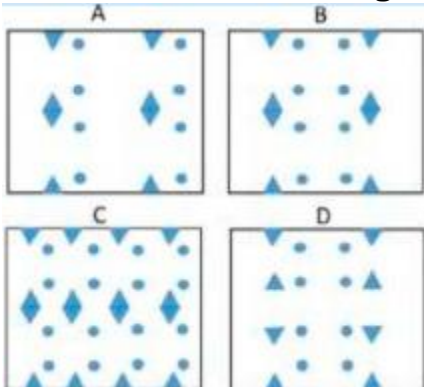

(a) 4
(b) 8
(c) 6
(d) 2

Q3. A square paper is folded twice to a square shape one-fourth in area to the original square. Then equilateral triangles and circles are cut as shown in the figure.

Which one of the following is a possible pattern on the fully unfolded paper?

(a) A
(b) B
(c) C
(d) D

Q4. Mary and Mike are married to each other. John is Mary;s brother while Douglas is Mike;s brother. In a gathering of 2 children of Mary and Mike, 3 of John and 2 of Douglas, the number of first-cousin pairs (sibling;s children are first-cousins to each other) is
(a) 3
(b) 16
(c) 10
(d) 21

Q5. The possible number of integers between 1000 and 10000 containing two 2's, one 0 and one 3 (for example, 2023 is such an integer) is
(a) 6
(b) 9
(c) 12
(d) 24

Q6. In a round-robin tournament (each team plays with all other teams once) between 8 teams, a win fetched 3 points and a draw. 1. After each team had played 4 matches, the total of the points of the teams was 34. The number of drawn games among those played till then was
(a) 7
(b) 2
(c) 6
(d) 14

Q7. Choose the option that will make the following statement correct: THE NUMBER OF TIMES THE LETTER 'I' OCCURS IN THIS SENTENCE IS
(a) FOUR
(b) FIVE
(c) SIX
(d) SEVEN

Q8. Given graph depicts the data of people going to gym and deaths per year in different cities. Which of the following can be definitely concluded from the graph?
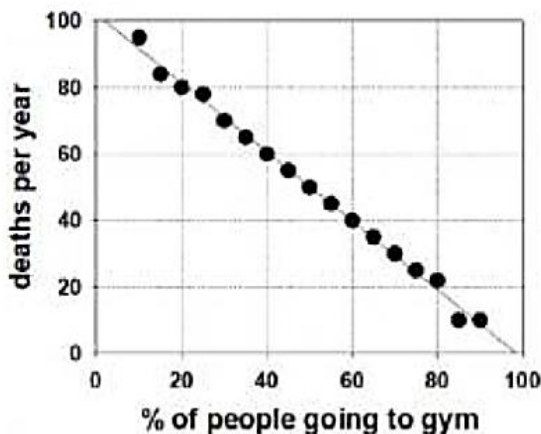
(a) Gym makes people fit and improves their health
(b) None will die if all go to gym
(c) Gym helps people to save their lives in cities
(d) In the city where on the average 50% people go to gym, 50 people die per year

Q9. If the difference between the two-digit numbers made from digits a and b is 27, the difference between a and b is
(a) 2
(b) 1
(c) 4
(d) 3

Q10. Two cylindrical candles A and B are of the same height. The radius of A is twice that of B. If A takes 120 minutes to completely burn, how long does B take to burn half its initial height?
(a) 60 min
(b) 30 min
(c) 15 min
(d) 10 min

Q11. P starts a business with an investment of Rs. 30 lakh. Two months later Q joined with Rs.90 lakh. Subsequently R joined with Rs. 180 lakh. The year-end profit of Rs. 1.2 crore was distributed in proportion of the investment and duration in the partnership. If the profit received by R was Rs. 60 lakh, how many months after Q. did R join?
(a) 3
(b) 4
(c) 5
(d) 7

Q12. A, B, C, D and E are members of a family. A is a doctor and wife of a lawyer. B is the brother of C and husband of a teacher. C is an engineer and daughter of the lawyer. Which of the following inferences can be definitely made?
(a) D is the lawyer
(b) E is the teacher
(c) A is the wife of D
(d) B is the son of A

Q13. Four villages A,B, C and D are connected in that order by a circular road. A car traveling with a uniform speed covers the distance between A and B in 43 minutes. B and C in 23 minutes, C and D in 19 minutes and D and A in 47 minutes. Which of the following will be closest to the time (in minutes) taken to travel from A to C with the same speed along a straight road?
(a) 42
(b) 66
(c) 45
(d) 21

Q14. If 6 students occupy a bench, one bench will be left completely unoccupied. If 5 students occupy each bench, instead, one student will not find a seat. The number of students is
(a) 30
(b) 31
(c) 36
(d) 42

Q15. A test consists of 20 questions and the students are awarded 4 marks for a correct answer, -1 mark for a wrong answer and 0 mark for an unattempted question. Which of the following could be a possible number of questions attempted by a student who secured 27 marks?
(a) 15
(b) 16
(c) 17
(d) 18

Q16. Suppose$72922381x2=3729322812x=3$. The value of x is
(a) -21
(b) -21.5
(c) -22
(d) -20.5

Q17. A and B are circles of unit radius. Their centres are marked by ×. The area of the shaded region is (hint: area of an equilateral triangle of unit side length is)
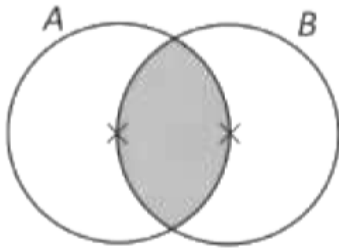
(a) $\dfrac{2\pi}{3} - \dfrac{\sqrt{3}}{2}$

(b) $\left(\dfrac{2\sqrt{3}}{4} - \pi\right)$

(c) $\dfrac{2\pi}{3} + \dfrac{\sqrt{3}}{2}$

(d) $\dfrac{2\pi}{3} - \dfrac{\sqrt{3}}{4}$

Q18. Which of the following is INCORRECT?
(a) 312 + 312 + 312 = 312 × 312 × 312321 + 321 + 321 = 321 × 321 × 321
(b) 413 + 413 + 413 + 413 = 413 × 413 × 413 × 413431 + 431 + 431 + 431 = 431 × 431 × 431 × 431
(c) 514 + 514 + 514 + 514 + 514 = 514 × 514 × 514 × 514 × 514541 + 541 + 541 + 541 + 541 = 541 × 541 × 541 × 541 × 541
(d) 616 + 616 + 616 + 616 + 616 + 616 = 616 × 616 × 616 × 616 × 616 × 616661 + 661 + 661 + 661 + 661 + 661 = 661 × 661 × 661 × 661 × 661 × 661

Q19. Which of the following correspond to x,y and z. respectively in the following square where sum of elements in each column, row, and diagonal is the same?

16	11	x
17	y	13
z	19	14

(a) (17,15,13)
(b) (18,15,12)
(c) (12.15.17)
(d) (17,16,14)

Q20. Three identical rings of radius 1 unit are stacked as shown in the figure. The length x is
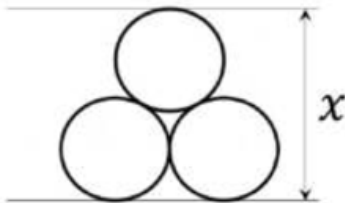
(a) 2+32+3
(b) 2+22+2
(c) 2+2232+232
(d) 3

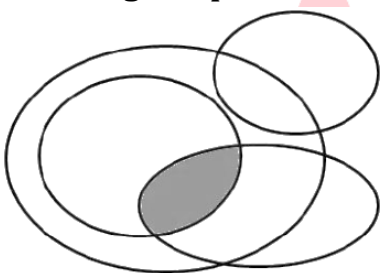**Q21. If Pencils are Erasers, some Erasers are Sharpeners, some Erasers are Crayons, no Crayons are Sharpeners but some Crayons are Pencils then in the given Venn diagram, which of the following is represented by the shaded area?**

(a) Pencils and Sharpeners but not Erasers and Crayons
(b) Pencils and Erasers but not Sharpeners and Crayons
(c) Pencils, Erasers, and Sharpeners but not Crayons
(d) Pencils, Erasers and Crayons but not Sharpeners

Q22. A chess board contains 64 squares of 5 cm size, in 8 rows and 8 columns, alternately black and white. What is the total length of edges (in m) between the squares in the chessboard?
(a) 2.8
(b) 3.2
(c) 5.6
(d) 6.4

Q23. In a class, boys secure 69% marks on the average while girls secure 72% marks on the average. If the average marks of the entire class is 70% which of the following statements is valid?
(a) The total number of students in the class is two times the number of girls.
(b) The total number of students in the class is three times the number of boys.
(c) The boys are two times the number of girls.
(d) The girls are two times the number of boys.

Q24. A ball of moulding clay, whose radius is a, is remoulded into a cube. What is the approximate length of the side of the largest cube that can be so made?
(a) 0.8a
(b) 1.2a
(c) 1.6a
(d) 2a

Q25. A cardboard sheet of size 60 cm × 60 cm is used to make hollow cubes having sides of 5 cm. What is the maximum number of cubes that can be made?
(a) 24
(b) 36
(c) 72
(d) 144

Q26. The graph shows the distribution of lifespan (in years) for individuals from species 1 and species 2
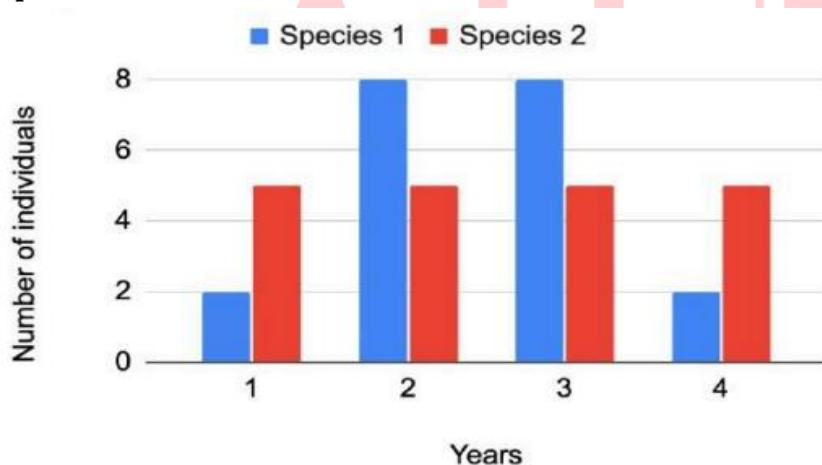
If μ and σ represent mean and standard deviation of the lifespan, respectively, then, which of the following statements is true?
(a) $\mu_1 > \mu_2 ; \sigma_1 > \sigma_2$
(b) $\mu_1 = \mu_2 ; \sigma_1 = \sigma_2$
(c) $\mu_1 = \mu_2 ; \sigma_1 > \sigma_2$
(d) $\mu_1 = \mu_2 ; \sigma_1 < \sigma_2$

Q27. The following graph shows the mortality risk of a disease with respect to parameters A and B.

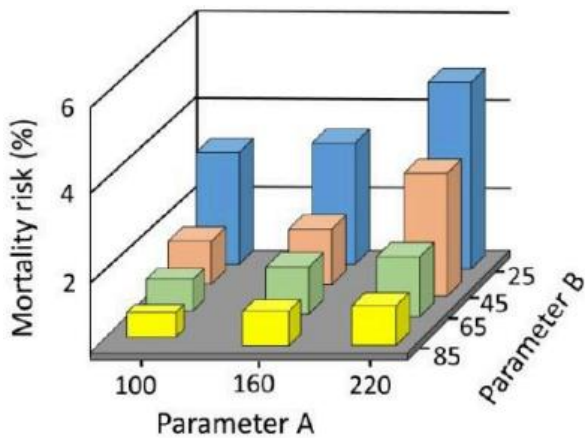**Which of the following combinations of parameters is associated with the lowest mortality risk?**
(a) The lowest value of A-B
(b) The lowest value of B-A
(c) The lowest values of both A and B
(d) The highest values of both A and B

Q28. The largest integer between 1 and 10^5 when written in words that does not contain the letter 'N' or 'n' in its name is
(a) 88
(b) 100000
(c) 88888
(d) 8

Q29. Three comparable brands of 1 litre cans of a liquid detergent are available in a shop with different offers as shown in the table.

Brand	List price (in Rs per can)	Offer
A	320	1/3rd extra
B	332	1 free for 3
C	300	20% discount

If 4 litres of detergent is to be purchased, then the best choice (based on unit price) would be
(a) A or B
(b) A or C
(c) B or C
(d) B

Q30. If liars always lie and truthful persons never, and in a group of 10 persons everyone calls all others liars, then the number of liars among the 10 is
(a) 10
(b) 9
(c) 5
(d) 1

Q31. The difference between a three-digit number (with non-repeating digits) and the same number in the reverse order is always divisible by

(a) 33

(b) 22

(c) 13

(d) 31

Q32. The following spider diagram shows the marks obtained (out of 10) by three students in five tests.
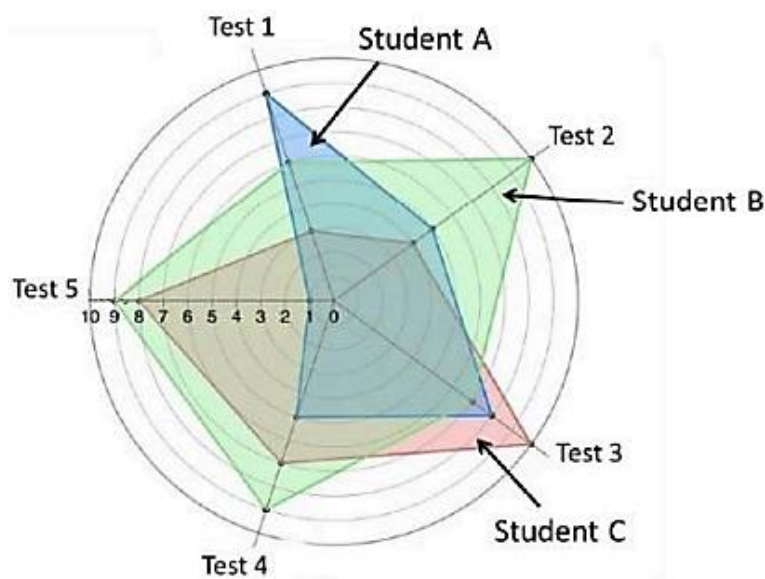
Which one of the following is INCORRECT?

(a) A scored more than C in total

(b) B scored the highest in total

(c) A never scored 10 marks in a test

(d) In Test 5, the combined marks of A and C are equal to the marks of B.

Q33. How many integers can divide 1184 leaving a remainder of 29?

(a) 8

(b) 5

(c) 7

(d) 9

Q34. A pen, pencil and an eraser together cost Rs. 21. The pen costs as much more than the pencil as the pencil does than the eraser. How much does the pencil cost?

(a) 5

(b) 7

(c) 9

(d) 11

Q35. Human females have two X chromosomes, each of which can be passed on to their son or daughter with equal probability. Human males have one X chromosome which is passed on to their daughters and one Y chromosome which is passed on to their sons. Assuming equal numbers of males and females in a population, if an X chromosome is randomly sampled from the population, what is the probability that it was inherited from a female of the previous generation?
(a) 1/3
(b) 1/4
(c) 2/3
(d) 3/4

Q36. The speed of a car travelling with variable acceleration along a straight line is shown in the figure.
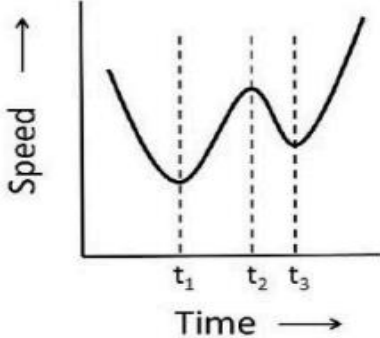
If a_1, a_2, a_3 are the accelerations at times t_1, t_2, t_3 respectively, then
(a) $a_1 = a_2 = a_3$
(b) $a_1 > a_2 > a_3$
(c) $a_2 > a_3 > a_1$
(d) $a_3 > a_2 > a_1$

Q37. In a family of two males and three females, A is the daughter of B and sister of C. E is the spouse of B and mother of D. C is not the brother of D. Which of the following statements is NOT correct?
(a) E is the mother of A
(b) D is the sister of C
(c) C is the daughter of B
(d) A is the sister of D

Q38. A car is moving along a bend in a road. The bend forms a large quarter circle. If the distance between the left and right wheels of the car is 2 m, then the difference between the distances travelled by the inner wheels and the outer wheels (in m) as it traverses the bend is
(a) 0
(b) 2
(c) π
(d) 2π

Q39. Two rings made of metals A and B with ring A having a larger diameter, are placed concentrically leaving an annular gap. The thermal expansion coefficients of the two metals are and . Identify the correct statement(s) from the following.

A. The gap will decrease if

$C_A < C_B.$

B. The gap will remain the same if

$C_A = C_B.$

C. The gap will increase if

$C_A < C_B.$

(a) Only A

(b) A and B

(c) Only C

(d) B and C

Q40. The cost of 2 mangoes, 1 coconut and 2 bananas is Rs 71, while the cost of 5 mangoes, 3 coconuts and 4 bananas is Rs 182. What is the cost of 1 mango and 1 coconut?

(a) It cannot be calculated

(b) Rs 40

(c) Rs 47

(d) Rs 53

Q41. When a student in Section A who scored 100 marks in a subject is exchanged for a student in Section B who scored 0 marks, the average marks of Section A falls by 4, while that of Section B increases by 5. Which of the following statements is true?

(a) A has the same strength as B

(b) A has 5 more students than B

(c) B has 5 more students than A

(d) The relative strengths of the classes cannot be assessed from the data

Q42. Which of the numbers A = 162^3 + 327^3 and B = 612^3 - 123^3 is divisible by 489?

(a) Both A and B

(b) A but not B

(c) B but not A

(d) Neither A nor B

Q43. At a spot S en-route, the speed of a bus was reduced by 20% resulting in a delay of 45 minutes. Instead, if the speed were reduced at 60 km after S, it would have been delayed by 30 minutes. The original speed, in km/h, was:

(a) 90

(b) 80

(c) 70

(d) 60

Q44. Three consecutive integers a, b, c add to 15. Then the value of $(a - 2)^2 + (b - 2)^2 + (c - 2)^2$ would be:
(a) 25
(b) 27
(c) 29
(d) 31

Q45. Price of an item is increased by 20% of its cost price and is then sold at 10% discount for Rs. 2160. What is its cost price?
(a) 1680
(b) 1700
(c) 1980
(d) 2000

Q46. Two semicircles of the same radii, centered at A and C, touching each other, are placed between two parallel lines, as shown in the figure. The angle BAC is:
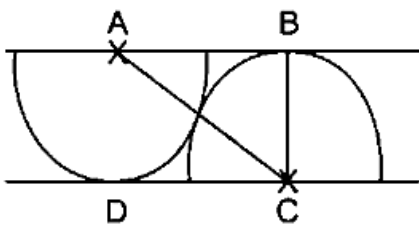
(a) 30°
(b) 35°
(c) 45°
(d) 60°

Q47. What is the largest number of father-son pairs that can exist in a group of four men?
(a) 3
(b) 2
(c) 4
(d) 6

Q48. Three friends having a ball each stand at the three corners of a triangle. Each of them throws their ball independently at random to one of the others, once. The probability of no two friends throwing balls at each other is:
(a) 1/4
(b) 1/8
(c) 1/3
(d) 1/2

Q49. The populations and gross domestic products (GDP) in billion USD of three countries A, B, and C in the years 2000, 2010, and 2020 are shown in the figures.

The decreasing order of per capita GDP of these countries in the year 2020 is:
(a) A, B, C
(b) A, C, B
(c) B, C, A
(d) C, A, B

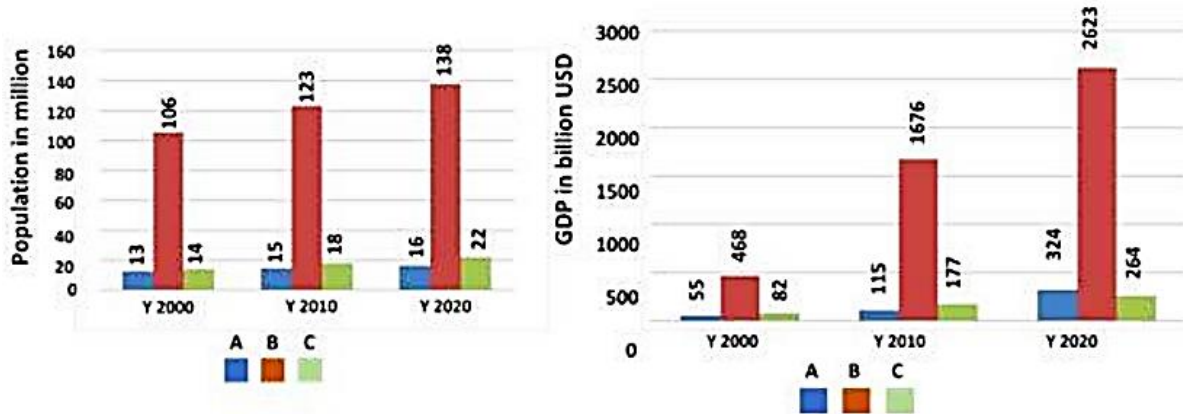**Q50. Consider two datasets A and B, each with 3 observations, such that both datasets have the same median. Which of the following MUST be true?**
(a) Sum of the observations in A = Sum of the observations in B.
(b) Median of the squares of the observations in A = Median of the squares of the observations in B.
(c) The median of the combined dataset = Median of A + Median of B.
(d) The median of the combined dataset = Median of A.

Q51. Three fair cubical dice are thrown independently. What is the probability that all the dice read the same?
(a) 1/6
(b) 1/36
(c) 1/216
(d) 13/216

Q52. Persons A and B have 73 secrets each. On some day, exactly one of them discloses their secret to the other. For each secret A discloses to B in a given day, B discloses two secrets to A on the next day. For each secret B discloses to A in a given day, A discloses four secrets to B on the next day. The one who starts, starts by disclosing exactly one secret. What is the smallest possible number of days it takes for B to disclose all his secrets?
(a) 5
(b) 6
(c) 7
(d) 8

Q53. In a buffet, 4 curries A, B, C, and D were served. A guest was to eat any one or more than one curry, but not the combinations having C and D together. The number of options available for the guest were:

(a) 3

(b) 7

(c) 11

(d) 15

Q54. Sum of all the internal angles of a regular octagon is ___ degrees.

(a) 360

(b) 1080

(c) 1260

(d) 900

Q55. If two trapeziums of the same height, as shown below, can be joined to form a parallelogram of area 2(a + b), then the height of the parallelogram will be:
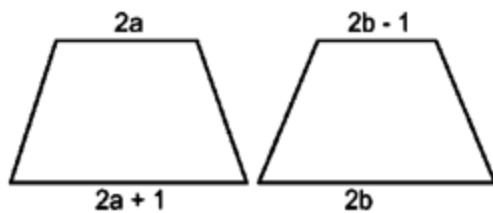
(a) 4

(b) 1

(c) 1/2

(d) 2

Q56. If the sound of its thunder is heard 1 second after a lightning was observed, how far away (in meters) was the source of thunder/lightning from the observer? (Given: speed of sound = x m/s, speed of light = y m/s)

(a) x^2 / y

(b) $xy / (y - x)$

(c) $xy / (x - y)$

(d) y^2 / x

Q57. A building has windows of sizes 2, 3, and 4 feet, and their respective numbers are inversely proportional to their sizes. If the total number of windows is 26, then how many windows are there of the largest size?

(a) 4

(b) 6

(c) 12

(d) 9

Q58. Given only one full 3-litre bottle and two empty ones of capacities 1 litre and 4 litres, all ungraduated, the minimum number of pourings required to ensure 1 litre in each bottle is:
(a) 2
(b) 3
(c) 4
(d) 5

Q59. A 50-litre mixture of paint is made of green, blue, and red colours in the ratio 5:3:2. If another 10 litres of red colour is added to the mixture, what will be the new ratio?
(a) 5:2:4
(b) 4:3:2
(c) 2:3:5
(d) 5:3:4

Q60. Twenty litres of rainwater having a 2.0 µmol/L concentration of sulfate ions is mixed with forty litres of water having 4.0 µmol/L sulfate ions. If 50% of the total water evaporated, what would be the sulfate concentration in the remaining water?
(a) 3 µmol/L
(b) 3.3 µmol/L
(c) 4 µmol/L
(d) 6.7 µmol/L

Q61. Two chords of a circle meeting at an angle 60° bisect each other. If the length of one chord is 10 cm, the length of the other chord (in cm) is
(a) $5\sqrt{3}$
(b) $10/\sqrt{2}$
(c) $10/\sqrt{3}$
(d) 10

Q62. BOTANY is to PLANTS as PHILOSOPHY is to _____
(a) REGULATIONS
(b) RELIGIONS
(c) IDEAS
(d) POLITICS

Q63. An ecologist catches 25 fish tags them and releases them back in the pond. She catches 30 fish on the next day, of which 10 carry the tag. Assuming that the fish in the pond remain unchanged and each fish has equal probability of being caught, what is the estimated number of fish in the pond?
(a) 30
(b) 75
(c) 150
(d) 300

Q64. An eagle is sitting at the top of a 100 m high vertical cliff and a mouse is at the base of the cliff. The mouse starts running away from the cliff on a level ground in a straight line at a speed 10 m/s. The eagle spots the mouse and dives at 45° to the ground at a speed of 20 m/s and captures the mouse. The time at which the eagle started the dive is

(a) around 3 s after the mouse started running.

(b) around 5 s after the mouse started running.

(c) around 7 s after the mouse started running.

(d) the same at which the mouse started running.

Q65. The graph depicts anti-predator calling behaviour in squirrels. Which one of the following conclusions can be drawn from the graph?
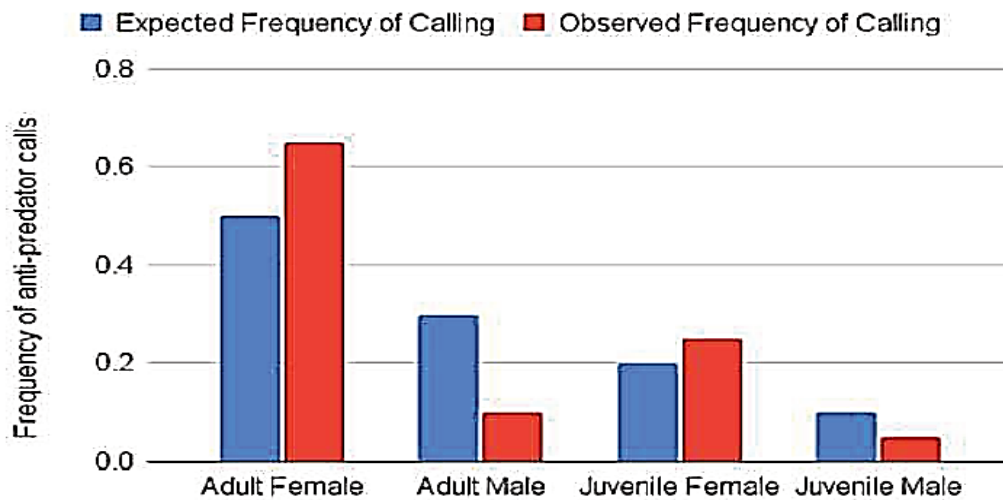
(a) Adult males are less likely to see a predator than adult females.

(b) Adult females make higher than expected anti-predator calls.

(c) There are more adult females than adult males.

(d) Juvenile males do not make anti-predator calls.

Q66. In a family, A is the son of P and brother of V. N is the sister of V. S is the nephew of V and B is the daughter-in-law of A. M is the mother of N. B is realted to M as the

(a) Granddaughter.

(b) Daughter-in-law.

(c) Grandson's wife.

(d) Mother

Q67. A boy taking about his age said "The day before yesterday I was 15, now I am 16 and next year I shall turn 18". Then

(a) he must have lied.

(b) he was making the assertion on 29th February.

(c) his birthday is on 29 February and he was making the assertion on 1st March.

(d) his birthday is on 31st December and he was making the assertion on 1st January.

Q68. A referndum on a proposal involved 3500 participants. Among the participants 1700 were men and the rest were women. 1450 participants, of whom 800 were men, voted against while 1500 participants voted in favour. 200 women abstained. How many women voted for the propsal?
(a) 800
(b) 650
(c) 950
(d) 550

Q69. Two vessels contain 3/8 L and 2/7 L of alcohol. Water is added to both vessels to make each solution measure 1L. When these solutions are mixed, the alcohol to water ratio would be approximately
(a) 16:21
(b) 1:4
(c) 1:2
(d) 1:3

Q70. In a five-floor building, a lawyer, a doctor, a teacher, an artist and an engineer occupy different floors. The artist has to go up three floors to meet the engineer, whereas the engineer has to come down four floors to visit the doctor. The lawyer lives just a floor above the teacher. The floors are occupied from the lowest to the topmost by
(a) artist, doctor, teacher, lawyer, engineer.
(b) Artist, doctor, teacher, engineer, lawyer.
(c) Doctor, artist, teacher, lawyer, engineer.
(d) Doctor, artist, lawyer, teacher, engineer.

Q71. The variation in the per carat price of diamond by caratage is shown in the graph.
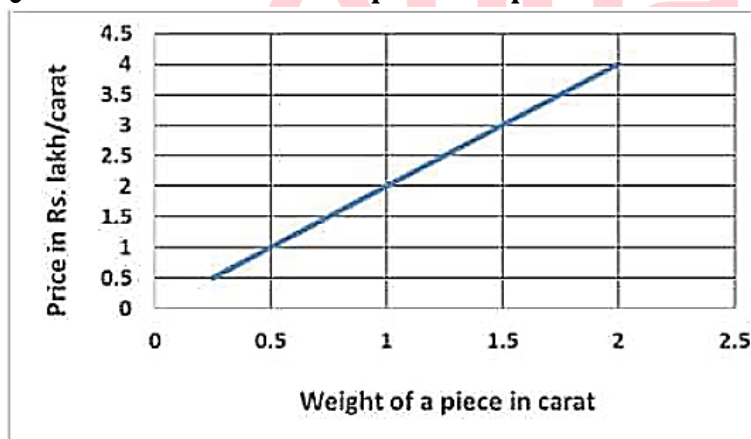
A person wants to buy 4 identical sized diamonds for Rs. 4.5 lakh. What is the largest size of one such diamond (in carat)?
(a) 0.5
(b) 0.75
(c) 1.125
(d) 0.625

Q72. In a leap year that began on a Tuesday, the third Saturday of March would fall on
(a) March 14
(b) March 15
(c) March 16
(d) March 21

Q73. The following dishes are offered in a restaurant.
Starter: Tomato Soup or Vegetable Salad or Chicken Soup
Main course: Chicken Biryani or Fish Biryani or Veg Biryani
Dessert: Gulabjamun or Rasagulla
A meal is prepared selecting one item from each category. What is the probability that a randomly drawn up menu is vegetarian?
(a) 1/3
(b) 5/8
(c) 2/9
(d) 1/2

Q74. Which of the following can be a perfect square if X and Y are decimal digits?
(a) 93XY215
(b) 7XY0625
(c) 613XY45
(d) XY21375

Q75. Two children A and B counted the number of chairs placed around a round table in the same direction, but starting at different chairs. A's 5th chair was B's 9th, while B's 3rd was A's 12th. The number of chairs was
(a) 13
(b) 14
(c) 15
(d) 21

Q76. Statistics of a certain test conducted to determine a disease are given in the table.

Category	Number of persons
True positive	8
False negative	3
False positive	2
True negative	12

The number of persons actually having the disease are
(a) 11
(b) 8
(c) 20
(d) 3

Q77. A wholesale shopkeeper purchased 200 identical watches and sold the first 50 at 10% profit, the next 50 at 20% profit, the next 50 at 25% profit and the last 50 at 40% profit. If his total profit was Rs 19000, at what total cost did he buy the watches?
(a) Rs 76000
(b) Rs 80000
(c) Rs 86000
(d) Rs 98000

Q78. The addition of a three-digit number and the number with the same digits in reverse order, is 1089. The middle digit of that number must be
(a) 9
(b) 8
(c) 0
(d) 4

Q79. Equality of which of the following quandtities in two data sets of the same size will ensure equality of their standard deviations?
(a) Their means.
(b) The sums of positive and negative deviations from the respective means.
(c) The averages of squares of all terms.
(d) The averages of squares of all terms and their means.

Q80. Beginning from April of a year, the rate of which a tree became taller increased linearly for 15 weeks when it was trimmed down. From then on, the rate decreased linearly for the next 15 weeks.
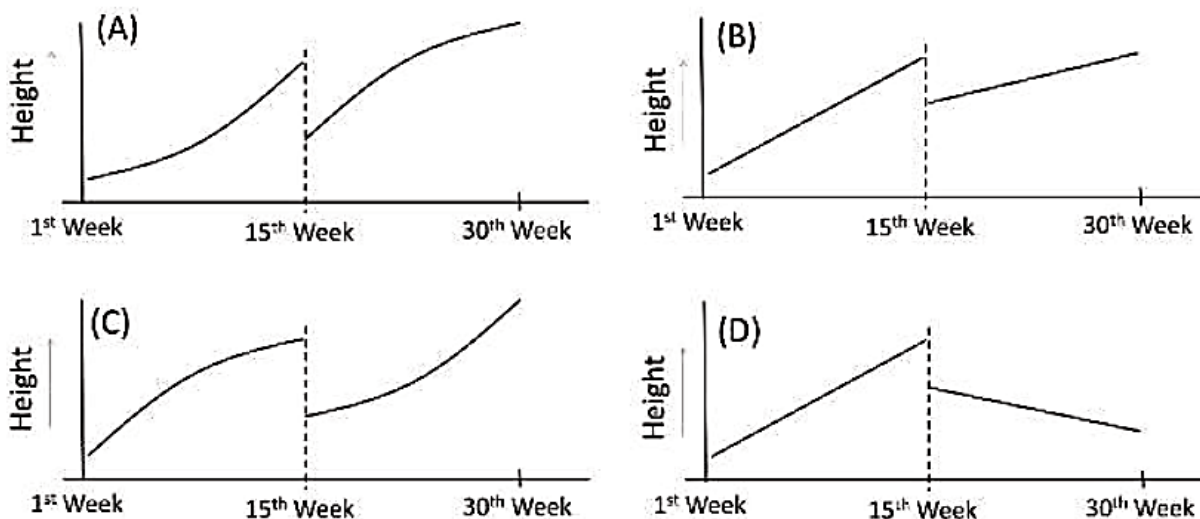
Which graph correctly shows the height of the tree against time during this period?
(a) A
(b) B
(c) C
(d) D

Q81. Which one of the following graphs represents the velocity vs time relation for the motion of a ball thrown upward and returning toward the ground, remaining in air for 10 seconds? (Ignore air resistance.)
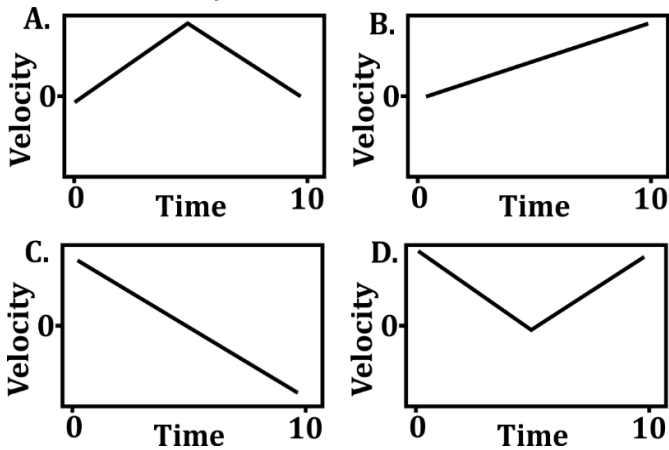
(a) A
(b) B
(c) C
(d) D

Q82. A fair coin is tossed 10 times. Let H and T be the number of heads and the number of tails, respectively. The maximum possible value of H x T is
(a) 15
(b) 20
(c) 25
(d) 30

Q83. Two 1.5 L bottles A and B are each filled with 1 L of water. 2 packets of ORS are dissolved in A and 1 packet in B. Then B is filled completely by pouring from A. The ORS concentrations in bottles A and B will be in the ratio
(a) 5.6
(b) 4:5
(c) 3:4
(d) 3:2

Q84. Chairs in 3 colours are placed around a round table such that no two neighbouring chairs have the same colour, and no two pairs of consecutive chairs (in the same direction) have colours in the same order. The maximum number of chairs that can be so placed is
(a) 6
(b) 7
(c) 8
(d) 9

Q85. In a puzzle of filling a grid, each row and column in the 9x9 grid, as well as each 3x3 sub-grid shown with heavy borders, must contain all the digits 1-9.

1	3		8			6		
		2			7	A	B	C
			1	2		D	7	9
2	8							
	9			3			1	
						2	3	
5	7			8	3			
		4			9			
	9			2			6	7

In the above partially filled grid, the number 3 appears in square marked
(a) D
(b) C
(c) B
(d) A

Q86. In a queue each woman is preceded and followed by exactly two men. Which of the following is a possible number of persons in the queue?
(a) 39
(b) 42
(c) 45
(d) 47

Q87. A family whose expenses are shown in the pie chart decides to save 20% more by cutting on certain expenses. What will be the consequent change in the angle of the pie for Savings in the chart?

Food, 12000; Medicine, 8000; Education, 20000; Clothing, 4000; Recreation, 3000; Tax, 10000; Pet, 5000; Saving, 15000; Incidentals, 6000; Travel, 7000

■ Food ■ Medicine ■ Education ■ Clothing ■ Recreation ■ Tax ■ Pet ■ Saving ■ Incidentals ■ Travel
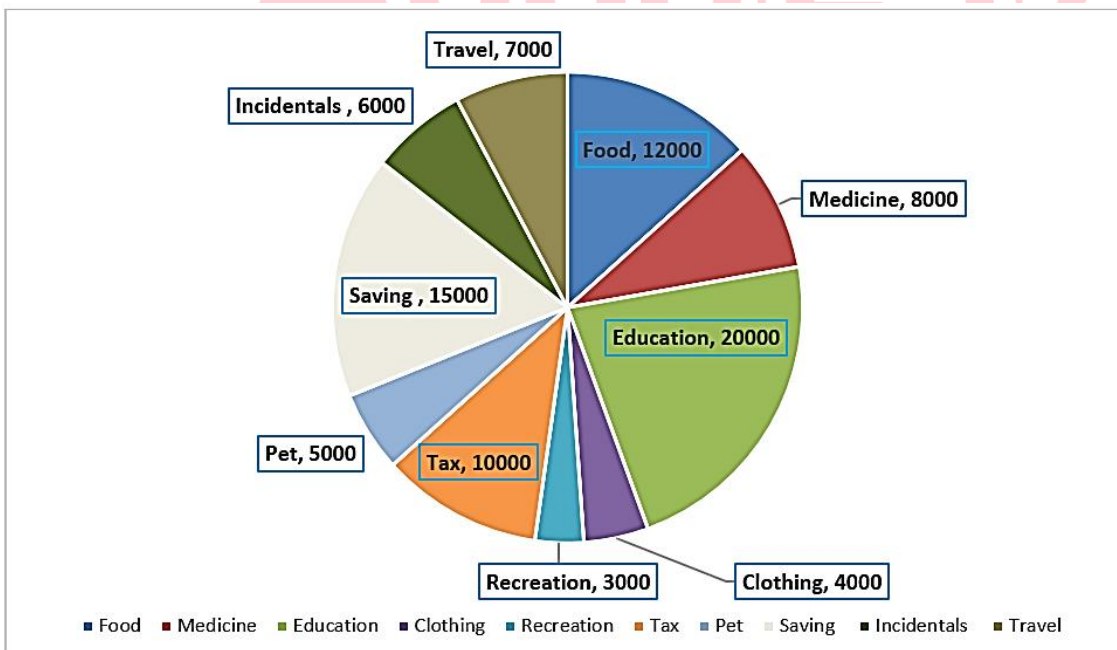
(a) 10°
(b) 12°
(c) 15°
(d) 18°

Q88. A person leaves for New Delhi, India from New York, USA by a 20 hour flight on a Monday at 6 am, spends 10 hrs in New Delhi and returns to New York by a 20 hour flight on the Wednesday of the same week at 8 am. Based on this, how much is the local time difference between New Delhi and New York?
(a) Cannot be determined
(b) 10 hours
(c) 12 hours
(d) 16 hours

Q89. The ratios of girls to boys in two sections in a class are 3:4 and 3:7 respectively. Their ratio in the entire class (when the two sections are combined) is 4:7. Which of the following can be the strength of the girls in the entire class?
(a) 36
(b) 42
(c) 45
(d) 48

Q90. If $9X^2 + 16Y^2 + 24$ is a perfect square, X and Y being integers, then the smallest possible non-negative value of X + Y is
(a) 0
(b) 1
(c) 2
(d) 3

Q91. The monthly production of a commodity increases by 50% (over the previous month) every even month and drops by 20% (over the previous month) every add month. If the monthly production at the close of March was 1 ton, the production at the end of September will be approximately
(a) 3.6 tons
(b) 2.2 tons
(c) 3.0 tons
(d) 1.7 tons

Q92. Which of the following graphs correctly shows the distance (in arbitrary units) between two longitudes 1º apart along the latitude being considered?

C.

D.
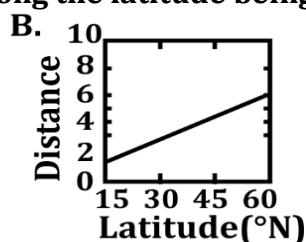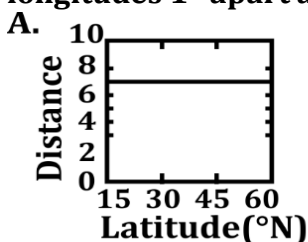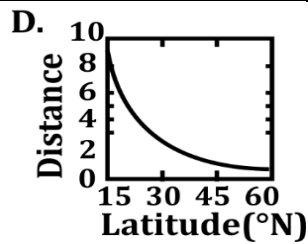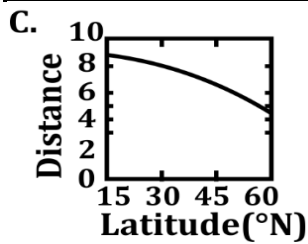
(a) A
(b) B
(c) C
(d) D

Q93. Which among the following integers can never be written as the sum of squares of three integers?
(a) 6
(b) 7
(c) 8
(d) 9

Q94. The product 1 ×2×3×4x... × 51 ends with
(a) 10 zeros
(b) 11 zeros
(c) 12 zeros
(d) 14 zeros

Q95. In the following finite sequence of integers, how many 9s are divisible by their immediate next terms?
8,3,4,9,3,5,9,5,9,9,9,4,5,9,5,6,3,3,5,7,2,3,9,9,8,9,3,9,1,9,4
(a) 3
(b) 4
(c) 5
(d) 6

Q96. Consider three configurations of steel wires for bearing a load
A 2 wires of 1 mm diameter each, together
B 1 wire of 2 mm diameter
C 4 wires of 1 mm diameter each, together
The correct comparison of the load bearing capability of the three configurations is
(a) A=B=C
(b) A<B=C
(c) A<C<B
(d) A B C

Q97. A bucket has 101 water at 15°c. How much water at 50°c should be added to get a mixture of temperature 40°C? (Assume no heat loss in mixing.)
(a) 15 L
(b) 20 L
(c) 25 L
(d) 30 L

Q98. Shyam buys a watch at a 10% discount on its maximum retail price (MRP). He sells it to Mohan for Rs. 3960 making a profit of 10%. What is the MRP (in Rs.) of the watch?
(a) 4040
(b) 4000
(c) 3960
(d) 4356

Q99. A flight of 13 steps from the ground to a platform of height 3 m is to be carpeted. The steps are all equal and have tread a and rise b. The staircase starts from a point on the ground horizontally 4 m away from the edge of the platform as shown.
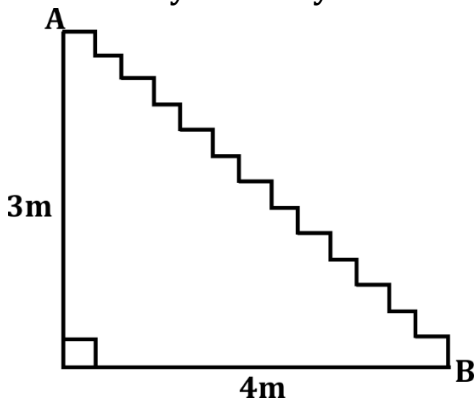
Assuming that the width of the carpet is adequate, what is the length of the carpet (in meter) needed to cover all the steps?
(a) 7
(b) 5
(c) $(3a + 4b)/\sqrt{13}$
(d) $\sqrt{13} (a+b)$

Q100. The floor shown in the figure is to be covered with square tiles.
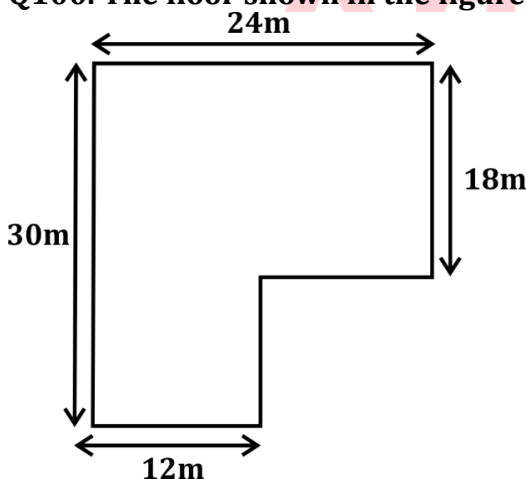
If all tiles are to be of the same size, what is the smallest number of tiles that will do the job?
(a) 14
(b) 6
(c) 32
(d) 16

Solutions

S1. Ans.(b)
Sol. Number of cards = 52
Number of black card = 26
Number of red card = 26
Way to get one red and one black card =26C126C1 x26C126C1
Probability =
26×2626×5126×5126×26 =26515126
Thus the correct answer is option (b)26515126

S2. Ans.(b)
Sol. Given :
The perimeter of rectangle EFGH is 16
Forumla Used :
Diagonal=(Length)2+(Width)2Diagonal=(Length)2+(Width)2
Perimeter=2×(Length+Width)
Solution :
Let the side of the square be Then the diagonal AC has length22 (by the Pythagorean theorem).
The perimeter of EFGH is given as 16, so
2×(Length+Width)=16⟹Length+Width=8
Let the sides of the rectangle parallel and perpendicular to the diagonal be x and, respectively. Thus:
x+y=8
From the equation x+y=8, we substitute y=8−x into the diagonal equation:
x2+(8−x)2x2+(8−x)2 = s22
Solving the above equation
x2−8x+32=s2x2−8x+32=s2
s=x2−8x+32s=x2−8x+32
The possible solutions for are
x=4−43orx=4+43x=4−43orx=4+43
Since must be a positive length and less than 8 (as x+y=8), the valid solution is:
x=4−43x=4−43
Using this, we will calculate ,the side of the square
The side length of the square is approximately s=8.
Thus, the side of the square ABCD is 8 units
Thus the correct answer is option (B) 8

S3. Ans.(d)
Sol. Given:-
A square paper is folded twice to a square shape one-fourth in area to the original square.
Solution:-
Then equilateral triangles and circles are cut.
From the above statement it is clear that the figure that contains equilateral triangle is right.
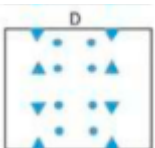
Only this figure contains equilateral triangle
Thus, the correct answer is **(D)**

S4. Ans.(b)
Sol. Given:-
Mary and Mike are married to each other.
Mary has 2 children and a brother, John, who has 3 children.
Mike has a brother, Douglas, who has 2 children.

Symbol in Diagram	Meaning
- / O	Female
+ / □	Male
=	Married Couple
—	Siblings
|	Difference Of Generation

Solution:
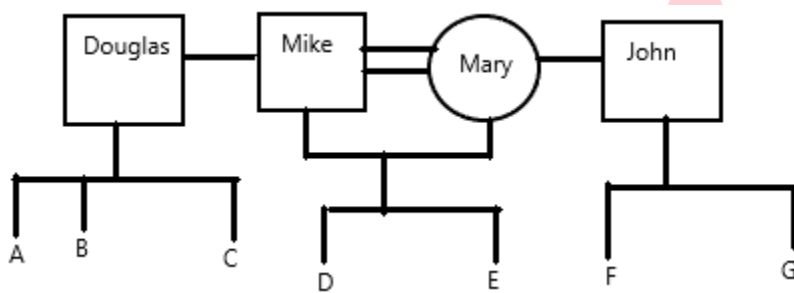
Mary and Mike's children: 2
John's children: 3
Douglas's children: 2
Mary and Mike's children with John's children:
Each of the 2 children of Mary and Mike is a first cousin to each of the 3 children of John.
Total pairs = 2×3=6.
Mary and Mike's children with Douglas's children:
Each of the
2 children of Mary and Mike is a first cousin to each of the 2 children of Douglas.
Total pairs = 2×2=4.
John's children with Douglas's children:
Each of the 3 children of John is a first cousin to each of the 2 children of Douglas.
Total pairs = 3×2=6.
Total number of first-cousin pairs = 6+4+6=16.
Thus, the correct answer is **(B) 16.**

S5. Ans.(b)
Sol. Given :
We are tasked with forming four-digit integers using the digits 2, 2, 0, and 3.

Solution :

The number must be a four-digit integer (cannot start with 0)

Each number must use exactly the given digits (two 2's, one 0, and one 3)

Total Permutations of Digits

The total number of permutations of the digits 2, 2, 0, 3 is given by:

Total permutations =4!2!2!4! =242224 = 12

The division by 2!2!2! accounts for the fact that the two 2's are indistinguishable.

If the number starts with 0, it is not a valid four-digit number. To find how many permutations start with 0:

3!2!2!3! =6226=3

Thus, there are 3 invalid cases where the number starts with 0

Valid permutations=12−3=9

Thus the correct answer is option **(b) 9**

S6. Ans.(d)

Sol. Given :

Total teams = 8

Points earn for win = 3

Points earn for draw = 1

total points scored by all teams is = 34

Solution :

Each team plays 4 matches, and there are 8 teams. However, each match involves 2 teams, so the total number of matches played so far is:8∗4228∗4 = 16

For a win: 3 points are awarded to the winning team, and the losing team gets 0 points.

For a draw: 1 point is awarded to each team, resulting in 2 points in total for that match.

Let the number of drawn games be

Each drawn match contributes 2 points (1 point per team), so the total points from draws is 2

The remaining 16− matches are wins, and each win contributes 3 points.

Therefore, the total points from wins is 3(16−)

Adding these together: 2x+3(16−x)=34

Solve for

2x+48−3x=34=>−x+48=34=>x=48−34=14.

 The number of drawn games is 14

Thus the correct answer is option **(d) 14**

S7. Ans.(b)

Sol. Given:-

THE NUMBER OF TIMES THE LETTER 'I' OCCURS IN THIS SENTENCE IS"

Solution:-

THE → 0 'I's

NUMBER → 0 'I's

OF → 0 'I's

TIMES → 1 'I'

THE → 0 'I's

LETTER → 0 'I's

'I' → 1 'I'

OCCURS → 0 'I's
IN → 1 'I'
THIS → 1 'I'
SENTENCE → 0 'I's
IS → 1 'I'
Total Count:
1+1+1+1+1=5
Thus, the correct answer is **(B) FIVE**

S8. Ans.(d)
Sol. The graph shows a negative linear correlation between the percentage of people going to the gym and the number of deaths per year. Let's analyze the options:
(a) Gym makes people fit and improves their health.
This cannot be definitively concluded from the graph. The graph only shows correlation, not causation. There could be other factors responsible for the decrease in deaths, such as better medical facilities or healthier lifestyles in general.
(b) None will die if all go to gym.
This cannot be definitively concluded either. While the trend in the graph suggests a decrease in deaths as gym attendance increases, it is unrealistic to claim that no one will die if everyone attends the gym. This is a hypothetical assumption.
(c) Gym helps people to save their lives in cities.
This is not definitive because the graph does not establish causation. The correlation could be influenced by other factors, such as socioeconomic conditions or access to healthcare.
(d) In the city where on the average 50% people go to gym, 50 people die per year.
This can be definitively concluded because the graph is linear and directly shows that when 50% of people go to the gym, the deaths per year are 50. This conclusion is based on the data presented in the graph.
Final Answer: (d) In the city where on the average 50% people go to gym, 50 people die per year.
Thus the correct answer is (d) In the city where on the average 50% people go to gym, 50 people die per year.

S9. Ans.(d)
Sol. Given:-
Two two-digit numbers made using the digit a and b.
The difference between these numbers is 27.
Formula Used:-
For a two-digit number, the general representation is:
Number= 10 × (tens digit)+(units digit).
Solution:-
10a+b (where a is the tens digit and b is the units digit).
10b+a (where b is the tens digit and a is the units digit).
Difference between these numbers:
(10a+b)−(10b+a)=27.
9a−9b=27
a−b= 3.
Thus, the correct answer is option **(D) 3**

S10. Ans.(a)
Sol. Relation Between Candle Volumes: The volume of a cylinder is proportional to the square of the radius.

Let the radius of B be so the radius of A is 2r.

The volumes of A and are:

Volume of A = $\pi(2r)2(2r)2h==4\pi r2r2h$ Volume of B = $\pi r2r2h$

Thus, A's volume is 4 times that of B.

Burning Rates: Since A burns completely in 120 minutes, its burning rate is:

Burning rate of A=VolumeofA120120Volume of A=$\pi r2h3030\pi r2h$

Given that B's volume is1441 of A's, its burning rate is:

Burning rate of B =$\pi r2h120120\pi r2h$

Burn Time for Half of B's Height: When B burns to half its height, its volume burned is:

Burned volume =$\pi r2h22\pi r2h$

Using B's burning rate:

Time taken =Burned volume Burning rate Burning rate Burned volume =12022120 = 60 minutes

S11. Ans.(d)
Sol. Given:-
P, Q, and R start a business with investments:

P=30lakh,

Q=90lakh, and

R=180lakh.

The year-end profit is

1.2crore=120lakh.

Profits are distributed in proportion to investment × time.

R's profit is 60 lakh.

Formula Used:-
Share of profit = Investment × Time (in months).

Solution:-
P = 12 months.

Q = 12−2=10months.

R = X where X is the time R was in the business.

The shares of profit for P, Q, and R are proportional to:

P:30×12 = 360

Q:90×10 = 900.

R:180×X = 180X.

Total profit share = 360+900+180t.

R's profit is =180X360+900+180X×120=60360+900+180X180X×120=60

180X360+900+180X=12360+900+180X180X=21

360 + 900 +180X =360X.

1260=180X

X = 7

Thus, the correct answer is **(D) 7**

S12. Ans.(d)
Sol. Given :-

Symbol in Diagram	Meaning
- / O	Female
+/ □	Male
=	Married Couple
—	Siblings
│	Difference Of Generation

Solution:-
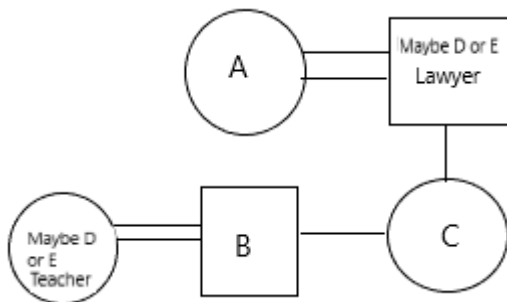
A is the wife of maybe D or E (Lawyer) And C is the daughter of lawyer and sister of B
Thus, the correct answer i**s (D)**
B is the son of A

S13. Ans.(a)
Sol. Given:-
Villages A,B,C, and D are connected by a circular road.
Times to travel between adjacent villages:
A→B=43 min
B→C=23 min
C→D=19 min
D→A=47 min
Formula Used:-
Distance Proportionality with Time:
The car travels with uniform speed, the time taken is proportional to the distance.
Straight-line time from A to C= k × straight-line distance from A to C,
k is the proportionality constant.
Solution:-
Total Travel Time Around the Circle: (A→B)+(B→C)+(C→D)+(D→A)=43+23+19+47=132 minutes.
Proportional Relationship:
A→B→C=43+23=66 min (along the circular road).
The straight distance from A→C forms the diameter of the circular road.
For a circular path, the straight distance (diameter) between opposite points is proportional to half the circular travel time.
Time for A→C along a straight road ≈ half of A→B→C.
Time from A→C=$\frac{66}{2}=\frac{4226}{6}$=42 min
Thus, the correct answer is **(A) 42 minutes.**

S14. Ans.(c)
Sol. Given :-
If 6 students occupy a bench, 1 bench is left unoccupied.
If 5 students occupy each bench, 1 student is left without a seat.
Solution:-
Number of students when 6 occupy a bench = 6 (x−1),where x is the total number of benches.
Number of students when 5 occupy a bench = 5x+1.
6 (x−1) = 5x + 1
6x−6=5x+1
6x−5x=1+6
x=7
Number of students=6 (x−1) =6(7−1)= 6 × 6 = **36**.
Thus, the correct answer is option **(C) 36.**

S15. Ans.(d)
Sol. Given :
Total Question = 20
Marks awarded for correct answer = 4
Marks awarded for wrong answer = -1
Marks awarded for unattempted question = 0
Solution:
To solve the problem, let the number of correct answers be C and the number of wrong answers be W. The student attempted C+W questions, and the unattempted questions are 20−(C+W)
The total marks equation = 4C−W=27
The total attempted questions = C+W=Attempted questions
Picking option (d) for
C+W=18, thenc20−18=2 unattempted questions. Substituting W=18−C intoc4C−W=27
4C−(18−C)=27
4C−18+C=27=>5C=45=>C=9
This gives W=18−9=9
Correct answers =C=9
Wrong answers = W=9
Marks scored 4C−W=4(9)−9=36−9=27
This satisfies the condition. Hence, Option (d) is valid.
Thus the correct answer is option (d) 18

S16. Ans.(b)
Sol. Formula used :
$(a^m)^n = a^{m·n}(a^m)^n = a^{m·n}$
Solution :
$729 = 3^6 3^6$ and $81 = 3^4 3^4$
Substitute these values into the equation:
$(3^6)^{\frac{2}{3}} · (3^4)^{x^2} = 3(3^6)^{\frac{3}{2}}{}^2 · (3^4)^{2x} = 3$
The equation becomes:
$3^{4·3^{2x}} = 3^3 3^{4·3^{2x}} = 3^3$
$x = -\frac{43}{2}^{2}−43$ = -21.5

S17. Ans.(a)
Sol. Given :
The two circles have Radius r=1.
Distance between centers =1 (which is the same as the radius)
Formula Used:
$2R^2(\frac{\pi}{3}-\frac{3}{4})(3\pi-43)$
Solution :
The total shaded area is the segment area:
Total Area $=2\times1^2(\frac{\pi}{3}-\frac{3}{4})=\frac{2\pi}{3}-\frac{3}{2}$ $2\times1^2(3\pi-43)=32\pi-23$
Thus the correct answer is option **(A)** $\frac{2\pi}{3}-\frac{3}{2}$ $32\pi-23$

S18. Ans.(d)
Sol. $3^{\frac{1}{2}}+3^{\frac{1}{2}}+3^{\frac{1}{2}}=3^{\frac{1}{2}}\times3^{\frac{1}{2}}\times3^{\frac{1}{2}}$ $3^{21}+3^{21}+3^{21}=3^{21}\times3^{21}\times3^{21}$
Left Side $=3^{1/2}+3^{1/2}+3^{1/2}=3\cdot3^{1/2}=3^{1/2+1}=3^{3/2}$ $3^{1/2}+3^{1/2}+3^{1/2}=3\cdot3^{1/2}=3^{1/2+1}=3^{3/2}$
Right side
$=3^{1/2}\times3^{1/2}\times3^{1/2}=3^{(1/2)+(1/2)+(1/2)}=3^{3/2}$ $3^{1/2}\times3^{1/2}\times3^{1/2}=3^{(1/2)+(1/2)+(1/2)}=3^{3/2}$ correct
$4^{\frac{1}{3}}+4^{\frac{1}{3}}+4^{\frac{1}{3}}+4^{\frac{1}{3}}=4^{\frac{1}{3}}\times4^{\frac{1}{3}}\times4^{\frac{1}{3}}\times4^{\frac{1}{3}}$ $4^{31}+4^{31}+4^{31}+4^{31}=4^{31}\times4^{31}\times4^{31}\times4^{31}$

Left Side $= 4^{1/3} + 4^{1/3} + 4^{1/3} + 4^{1/3} = 4 \cdot 4^{1/3} = 4^{(1+(1/3))} = 4^{(4/3)}$

Right side $= 4\left(\frac{1}{3}\right) + \left(\frac{1}{3}\right) + \left(\frac{1}{3}\right) + \left(\frac{1}{3}\right) = 4^{(4/3)}$ correct

$5^{\frac{1}{4}} + 5^{\frac{1}{4}} + 5^{\frac{1}{4}} + 5^{\frac{1}{4}} + 5^{\frac{1}{4}} = 5^{\frac{1}{4}} \times 5^{\frac{1}{4}} \times 5^{\frac{1}{4}} \times 5^{\frac{1}{4}} \times 5^{\frac{1}{4}}$

Left Side $= 5 \cdot 5^{1/4} = 5^{(4+1)/4} = 5^{5/4}$

Right side $=(5^{1/4})^5=5^{5/4}$ $(5^{1/4})^5=5^{5/4}$ correct
$6^{\frac{1}{6}} + 6^{\frac{1}{6}} + 6^{\frac{1}{6}} + 6^{\frac{1}{6}} + 6^{\frac{1}{6}} + 6^{\frac{1}{6}} = 6^{\frac{1}{6}} \times 6^{\frac{1}{6}} \times 6^{\frac{1}{6}} \times 6^{\frac{1}{6}} \times 6^{\frac{1}{6}} \times 6^{\frac{1}{6}}$
Left Side $=6\cdot6^{-(-6)}=6^{(6+(-6))}=6^{(\frac{7}{6})}$ $6\cdot6^{-(-6)}=6^{(6+(-6))}=6^{(67)}$
Right side $=(6^{(66)})=6$ $(6^{(66)})=6$ Incorrect
Thus, the correct answer is **(D)**

S19. Ans.(b)
Sol. Summing the row and comparing total
Choosing the option no.(b) (18,15,12)
16 + 11 + 18 = 45
17 + 15 + 13 = 45
12 + 19 + 14 = 45
Hence all condition satisfied
Thus the correct answer is option (b) (18,15,12)

S20. Ans.(a)
Sol. The three identical rings have a radius of 1 unit
The distance between the center of the top ring and the ground includes:
The radius of the bottom rings (1 unit)
The vertical distance between the center of the top ring and the line joining the centers of the bottom two rings
The centers of the three rings form an equilateral triangle, where each side equals 2 (the diameter of a ring)

h=32×2=3.h=23×2=3.

This is the vertical height of the equilateral triangle. The center of the top ring is at this height above the centers of the bottom two rings.

x=1+3+1=2+3x=1+3+1=2+3

Thus the correct answer is option **(A)**2+32+3

S21. Ans.(d)
Sol. Given Information:
1. **Pencils are Erasers**: All Pencils are included in the set of Erasers.
2. **Some Erasers are Sharpeners**: There is an overlap between Erasers and Sharpeners.
3. **Some Erasers are Crayons**: There is an overlap between Erasers and Crayons.
4. **No Crayons are Sharpeners**: Crayons and Sharpeners do not overlap at all.
5. **Some Crayons are Pencils**: Crayons and Pencils overlap.

Understanding the Shaded Region:

The shaded region lies in the intersection of **Pencils, Erasers, and Crayons**, but it excludes Sharpeners (since Crayons and Sharpeners do not overlap).

Validation of Options:

- **(a) Pencils and Sharpeners but not Erasers and Crayons**:

This is incorrect because the shaded region does not include Sharpeners, and Pencils are inherently part of Erasers.

- **(b) Pencils and Erasers but not Sharpeners and Crayons**:

This is incorrect because the shaded region includes Crayons as well.

- **(c) Pencils, Erasers, and Sharpeners but not Crayons**:

This is incorrect because Crayons are included in the shaded region, and Sharpeners are excluded.

- **(d) Pencils, Erasers, and Crayons but not Sharpeners**:

This is correct because the shaded region represents the intersection of Pencils, Erasers, and Crayons, while excluding Sharpeners.

Final Answer:

The shaded region represents the intersection of Pencils, Erasers, and Crayons, excluding Sharpeners.

S22. Ans.(c)
Sol. Steps to Solve:
1. **Chessboard details:**
   o The chessboard has 8 rows and 8 columns, forming 64 squares.
   o Each square has a side length of 5 cm.
2. **Internal edges:**
   o In each row, there are 7 internal edges (spaces between the squares).
   o There are 8 rows, so the total horizontal edges = 7 × 8 = 56.
   o Similarly, in each column, there are 7 internal edges. With 8 columns, the total vertical edges = 7 × 8 = 56.
3. **Total internal edges:**Adding horizontal and vertical edges, we get 56 + 56 = 112 edges.
4. **Length of each edge:**Each edge is 5 cm, which is 0.05 meters.
5. **Total length of edges:**Multiply the total number of edges by the length of each edge:

112 × 0.05 = 5.6 meters.

Final Answer:

The total length of edges shared between the squares on the chessboard is 5.6 meters.

S23. Ans.(c)

Sol. Given:

1. Boys score 69% marks on average.
2. Girls score 72% marks on average.
3. The overall average marks of the class are 70%.

Let the number of boys be **b** and the number of girls be **g**.

Steps to Solve:

1. **Total marks of boys and girls:**
   o Total marks of boys = 69b.
   o Total marks of girls = 72g.
   o Total marks of the class = 70(b + g).
2. **Set up the equation for average:** $69b+72g=70(b+g)$ 69b + 72g = 70(b + g) 69b+72g = 70(b+g).
3. **Simplify the equation:** Expand both sides:
$69b+72g=70b+70g$ 69b + 72g = 70b + 70g 69b+72g = 70b + 70g.

Rearrange terms:

$72g-70g=70b-69b$ 72g - 70g = 70b - 69b 72g − 70g = 70b − 69b.

$2g=b$ 2g = b 2g = b.

4. **Conclusion:** The number of boys is **two times** the number of girls.

Validation of Options:

- **(a)** The total number of students is two times the number of girls.

Incorrect. Total students = b + g = 2g + g = 3g.

- **(b)** The total number of students is three times the number of boys.

Incorrect. Total students = b + g = 2g + g = 3g, and g does not equal to b/3. $g \neq \frac{b}{3}$

- **(c)** The boys are two times the number of girls.

Correct. From the calculation, $b=2g$ b = 2g b = 2g.

- **(d)** The girls are two times the number of boys.

Incorrect. It's the opposite; boys are two times the number of girls.

Final Answer:

The boys are two times the number of girls.

S24. Ans.(c)

Sol. Given:

- Radius of the sphere = aaa
- Volume of a sphere = $V_{sphere}=\frac{4}{3}\pi r^3$ Vsphere=34πr3
- Side of the cube = sss
- Volume of a cube = s^3

Formula Used:

Equate the volumes: $\frac{4}{3}\pi a^3=s^3$ 34πa3=s3

Solution:

Start by equating the volumes: $\frac{4}{3}\pi a^3=s^3$ 34πa3=s3

Solve for sss: $s=\left(\frac{4}{3}\pi a^3\right)^{\frac{1}{3}}$ s=(34πa3)31

Approximate $\pi \approx 3.14$ π ≈ 3.14: $s=\left(\frac{4}{3}\times 3.14\times a^3\right)^{\frac{1}{3}}$ s=(34×3.14×a3)31

Simplify: $s=(4.1867\times a^3)^{\frac{1}{3}}$ s=(4.1867×a3)31

Take the cube root: s ≈ 1.6a

Final Answer:

The side length of the cube is approximately $1.6a$ 1.6a 1.6a.

Correct Option: (c) 1.6a

S25. Ans.(a)
Sol. Given:
1. Size of the cardboard sheet = 60 cm × 60 cm
Total area of the sheet = 60 × 60 = 3600 cm²
2. Side length of the hollow cube = 5 cm
Surface area of one cube = 6 × (side)² = 6 × 5² = 150 cm²
Formula Used:
The maximum number of cubes that can be made is:
Number of cubes=Total area of sheetSurface area of one cubeNumber of cubes=Surface area of one cubeTotal area of sheet
Solution:
1. Calculate the total area of the cardboard sheet:
Total area = 60 × 60 = 3600 cm²
2. Calculate the surface area of one hollow cube:
Surface area of one cube = 6 × 5² = 6 × 25 = 150 cm²
3. Find the number of cubes:
Number of cubes = Total area of sheet / Surface area of one cube
Number of cubes = 3600 / 150 = 24
Final Answer:
The maximum number of cubes that can be made is 24.
Correct Option: (a) 24

S26. Ans.(d)
Sol. Observations from the Graph:
Step 1: **Mean (μ\muμ)**
Species 1:
Using the same values as before:
- Lifespan (xxx) = 1,2,3,41, 2, 3, 41,2,3,4
- Frequencies (fff) = 2,8,8,22, 8, 8, 22,8,8,2
Mean (μ1\mu_1μ1):
The mean is calculated using the formula:
μ=∑(x·f)∑fμ=∑f∑(x·f)
For Species 1:
μ1=(1·2)+(2·8)+(3·8)+(4·2)2+8+8+2μ1=5020=2.5μ1=2+8+8+2(1·2)+(2·8)+(3·8)+(4·2) μ1=2050=2.5
Species 2:
Updated frequencies for f=5,5,5,5f = 5, 5, 5, 5f = 5,5,5,5:
μ2=(1·5)+(2·5)+(3·5)+(4·5)5+5+5+5μ2=5020=2.5μ2=5+5+5+5(1·5)+(2·5)+(3·5)+(4·5) μ2=2050=2.5
Thus, the mean lifespan for both species is the same:
μ1=μ2=2.5μ1=μ2=2.5
Step 2: **Standard Deviation (σ\sigmaσ)**
The standard deviation formula is:
σ=∑f·(x−μ)2∑fσ=∑f∑f·(x−μ)2

For Species 1:

σ1=(2·(1−2.5)2)+(8·(2−2.5)2)+(8·(3−2.5)2)+(2·(4−2.5)2)20σ1=1320=0.65≈0.81σ1
=20(2·(1−2.5)2)+(8·(2−2.5)2)+(8·(3−2.5)2)+(2·(4−2.5)2) σ1=2013=0.65≈0.81

For Species 2:

σ2=(5·(1−2.5)2)+(5·(2−2.5)2)+(5·(3−2.5)2)+(5·(4−2.5)2)20σ2=2520=1.25≈1.12σ2
=20(5·(1−2.5)2)+(5·(2−2.5)2)+(5·(3−2.5)2)+(5·(4−2.5)2) σ2=2025=1.25≈1.12

Thus, the standard deviation for Species 2 is greater than for Species 1:

σ1<σ2σ1<σ2

Final Answer:

The correct option is (d):μ1=μ2;σ1<σ2μ1=μ2;σ1<σ2

S27. Ans.(a)

Sol. Observations:

1. **Parameter A Values**: 100, 160, 220
2. **Parameter B Values**: 25, 45, 65, 85
3. The bars represent mortality risk percentages, with shorter bars indicating lower risks.

Step-by-Step Analysis:

1. From the graph, the **lowest bar** (indicating the lowest mortality risk) is located at:
   o Parameter A = 100
   o Parameter B = 85
2. The difference between A and B for this combination is:

A - B = 100 - 85 = 15

3. This value (15) is the **lowest value of A - B** across all parameter combinations.

Final Answer:

The correct option is **(a)**:

"The lowest value of A - B."

S28. Ans.(a)

Sol. Solution:

Step 1: Names of Numbers

Write out the names of numbers from 1 to 10^5 and identify where the letter **'N'** appears.

- Numbers **1 to 9**:
   o One, Two, Three, Four, Five, Six, Seven, Eight, Nine
   o Numbers containing 'N': One, Seven, Nine
- **Tens (10 to 90)**:
   o Ten, Twenty, Thirty, Forty, Fifty, Sixty, Seventy, Eighty, Ninety
   o Numbers containing 'N': Ten, Twenty, Thirty, Seventy, Ninety
- **Combination of Tens and Units (e.g., 21 to 99)**:
   o **Twenty-OneForty-Two**For example, , , etc.
   o Any number formed with tens that contain 'N' (e.g., Twenty, Ninety) will also have 'N'.

Step 2: Eliminate Numbers with 'N' or 'n'

From the above observations:

- **do not**Numbers that contain 'N' in their names are:

Four, Five, Eight, Forty, Fifty, Eighty

Step 3: Find the Largest Number
- **88**

The largest number without the letter 'N' or 'n' is .Its name is "Eighty-Eight," and neither "Eighty" nor "Eight" contains the letter 'N'.

Final Answer:

The correct option is **(a) 88**.

S29. Ans.(b)

Sol. Solution:

Brand A:
- **Price per can**: Rs. 320
- **Offer**: 1/3rd extra (i.e., you get 1.33 liters for the price of 1 liter).
- **Cost per liter**:

Cost per liter = 320 ÷ 1.33 ≈ 240.60.
- To purchase 4 liters:

Cans required = 4 ÷ 1.33 ≈ 3.01 cans.

Total cost = 3.01 × 320 ≈ Rs. 964.80.

Brand B:
- **Price per can**: Rs. 332
- **Offer**: 1 free can for every 3 cans purchased (i.e., you get 4 cans for the price of 3).
- **Cost per liter**:

Cost per liter = (3 × 332) ÷ 4 = Rs. 249.
- To purchase 4 liters:

4 cans are required.

Total cost = Rs. 996.

Brand C:
- **Price per can**: Rs. 300
- **Offer**: 20% discount on the price (i.e., effective price = 300 - (20% of 300) = Rs. 240).
- **Cost per liter**:

Cost per liter = Rs. 240.
- To purchase 4 liters:

4 cans are required.

Total cost = 4 × 240 = Rs. 960.

Comparison of Costs:
- Brand A: Rs. 964.80
- Brand B: Rs. 996
- Brand C: Rs. 960

Conclusion:

The lowest cost is for **Brand C**, but **Brand A** is also very close. Based on unit price, the best choice is **A or C**.

Correct Option: (b) A or C.

S30. Ans.(b)
Sol. Solution:
Assumptions:
1. **Liars** always lie (their statements are false).
2. **Truthful persons** always tell the truth (their statements are true).
3. Each of the 10 persons says, "Everyone else is a liar."

Step 1: Consider the Statements
- If a **truthful person** says, "Everyone else is a liar," this means **all 9 others** are indeed liars.
- If a **liar** says, "Everyone else is a liar," this statement is false, meaning **not everyone else is a liar** (there is at least one truthful person).

Step 2: Logical Analysis
1. If there is **1 truthful person**, their statement implies that all 9 others are liars. This is consistent because a truthful person always tells the truth.
   o In this case, the group consists of **1 truthful person and 9 liars**.
2. If there are **more than 1 truthful person**, their statements would contradict each other because they would claim that "everyone else is a liar," which cannot be true if there is more than 1 truthful person.
3. If there are **0 truthful persons**, then everyone is a liar, and their statements would contradict the definition of a liar (their statements must be false, but "everyone else is a liar" would then be true).

Step 3: Conclusion
The only consistent scenario is when there is **1 truthful person** and **9 liars** in the group.
Final Answer:
(b) 9 liars.

S31. Ans.(a)
Sol. Given:
- A three-digit number can be expressed as $100x+10y+z$, where x, y, and z are its digits.
- Its reverse can be expressed as $100z+10y+x$.
- We need to find what the difference between the number and its reverse is always divisible by.

Formula and Concept:
1. The difference between the original number and its reverse is:
$(100x + 10y + z) - (100z + 10y + x)$.
2. Simplify the difference to factorize and determine its divisibility.

Solution:
1. Start with the difference:
$(100x + 10y + z) - (100z + 10y + x)$.

Simplify:
$100x - x + 10y - 10y + z - 100z = 99x - 99z$.
2. Factorize:
$99(x - z)$.
3. The difference is always a multiple of 99.
The factors of 99 are 3, 11, and 33.
4. Therefore, the difference is always divisible by 33.

Final Answer:
(a) 33.

S32. Ans.(a)

Sol. Marks of Each Student (From the Diagram):

1. **Student A**:
   o Test 1 = 9
   o Test 2 = 5
   o Test 3 = 8
   o Test 4 = 5
   o Test 5 = 1

Total = 9 + 5 + 8 + 5 + 1 = 28

2. **Student B**:
   o Test 1 = 6
   o Test 2 = 10
   o Test 3 = 8
   o Test 4 = 9
   o Test 5 = 9

Total = 6 + 10 + 8 + 9 + 9 = 42

3. **Student C**:
   o Test 1 = 10
   o Test 2 = 9
   o Test 3 = 7
   o Test 4 = 3
   o Test 5 = 8

Total = 10 + 9 + 7 + 3 + 8 = 37

Verifying the Statements:

1. **Statement (a): A scored more than C in total.**
   o Total of A = 28, Total of C = 37.
   o Clearly, C scored **more than A**.
   o **This statement is INCORRECT.**

2. **Statement (b): B scored the highest in total.**
   o Total of B = 42, which is the highest among A, B, and C.
   o **This statement is CORRECT.**

3. **Statement (c): A never scored 10 marks in a test.**
   o From the data, A's highest score is 9.
   o **This statement is CORRECT.**

4. **Statement (d): In Test 5, the combined marks of A and C are equal to the marks of B.**
   o In Test 5:
   o Marks of A = 1, Marks of C = 8, Combined = 1 + 8 = 9.
   o Marks of B = 9.
   o $15 \neq 1015 \neq 109 = 9$
   o **This statement is CORRECT.**

Conclusion:

The **incorrect statement** is **(a)**. Based on the analysis, A scored higher than C in Tests is INCORRECT.

S33. Ans.(d)
Sol. Given:
- The number 1184 is to be divided by integers, leaving a remainder of 29.
- This implies the divisor ddd must divide 1184−29=11551184 - 29 = 11551184−29=1155.

Formula and Concept:
1. To find how many integers divide 1184 leaving a remainder of 29, we determine the divisors of 115511551155.
2. Only divisors greater than 29 are valid, as the remainder is 29.

Solution:
1. **Prime Factorization of 1155**:
1155=3×5×7×111155 = 3 \times 5 \times 7 \times 111155=3×5×7×11.
2. **Find the Total Divisors**:
The total number of divisors is calculated by adding 1 to each exponent in the prime factorization and multiplying:
$(1+1)(1+1)(1+1)(1+1)=16(1 + 1)(1 + 1)(1 + 1)(1 + 1) = 16(1+1)(1+1)(1+1)(1+1)=16$.
3. **List All Divisors of 1155**:
Divisors of 1155 are:
1, 3, 5, 7, 11, 15, 21, 33, 35, 55, 77, 105, 165, 231, 385, 1155.
4. **Exclude Divisors ≤ 29**:
Divisors greater than 29 are:
33, 35, 55, 77, 105, 165, 231, 385, 1155.
5. **Count Valid Divisors**:
There are 9 divisors greater than 29.

Final Answer:
(d) 9.

S34. Ans.(b)
Sol. Given:
- The total cost of a pen, pencil, and eraser is Rs. 21.
- The pen costs as much more than the pencil as the pencil does than the eraser.

Formula and Concept:
1. Let the cost of:
   o The eraser = x
   o The pencil = y
   o The pen = z
2. From the problem:
   o z - y = y - x (The pen costs as much more than the pencil as the pencil does than the eraser).
   o x + y + z = 21 (The total cost of the three items).

Solution:
1. From the equation z - y = y - x:
Rearrange to get:
z + x = 2y.
2. Substitute z + x = 2y into x + y + z = 21:
Replace z + x with 2y:
2y + y = 21.

3. Simplify:

3y = 21.

y = 7.

4. Substitute y = 7 into z + x = 2y:

z + x = 2(7) = 14.

5. Solve for x and z:

Using x + y + z = 21:

x + 7 + z = 21.

x + z = 14.

Thus, the cost of the **pencil** is Rs. 7.

Final Answer:

(b) 7.

S35. Ans.(c)

Sol. Given:

- Human females have two X chromosomes, each of which can be passed to their offspring with equal probability.
- Human males have one X chromosome (passed to daughters) and one Y chromosome (passed to sons).
- The population has an equal number of males and females.
- An X chromosome is randomly selected from the population, and we need to determine the probability that it came from a female in the previous generation.

Formula and Concept:

1. **Key observation**:
   o Half the population is male, and half is female.
   o Each female has two X chromosomes.
   o Each male has one X chromosome.
2. The total X chromosomes in the population are distributed as:
   o Two-thirds of X chromosomes come from females (since each female contributes 2 X chromosomes).
   o One-third of X chromosomes come from males (since each male contributes 1 X chromosome).

Solution:

1. Total X chromosomes in the population:
   o Let there be N males and N females in the population.
   o Total X chromosomes from females = $2N$.
   o Total X chromosomes from males = N.
   o Total X chromosomes in the population = $2N + N = 3N$.
2. Probability that a randomly chosen X chromosome came from a female:

$$P(X \text{ from female}) = \frac{\text{X chromosomes from females}}{\text{Total X chromosomes}} = \frac{2N}{3N} = \frac{2}{3}.$$

Final Answer:

(c) 2/3.

S36. Ans.(a)
Sol. Reanalysis of the Graph:
From the given **speed vs. time graph**:
1. **At t_1**:
   o The slope of the graph at t_1 is **zero** (the curve is flat at its lowest point).
   o Therefore, $a_1 = 0$.
2. **At t_2**:
   o The slope of the graph at t_2 is **zero** (the curve is flat at its highest point).
   o Therefore, $a_2 = 0$.
3. **At t_3**:
   o The slope of the graph at t_3 is **zero** (the curve is flat again).
   o Therefore, $a_3 = 0$.
Conclusion:
The accelerations at all three points are equal, meaning $a_1 = a_2 = a_3$.
Final Answer:
(a) $a_1 = a_2 = a_3$.

S37. Ans.(b)
Sol. Given:
- There are **two males** and **three females** in the family.
- A is the **daughter of B** and the **sister of C**.
- E is the **spouse of B** and the **mother of D**.
- C is **not the brother** of D.
Family Tree Analysis:
1. **B and E** are a married couple:
   o B is male (father).
   o E is female (mother).
2. **Children of B and E**:
   o A: Daughter of B and E.
   o C: Sibling of A and D. Since C is **not the brother** of D, C must be **female** (sister).
   o D: Another child of B and E. The gender of D is not specified directly.
3. **Gender breakdown**:
   o There are two males in the family.
- B (father) is one male.
- Therefore, D must be male to satisfy the condition of having two males.
Verification of Statements:
1. **Statement (a): E is the mother of A.**
   o This is correct, as E is explicitly stated as the mother of A.
2. **Statement (b): D is the sister of C.**
   o This is incorrect because D is male (to satisfy the condition of two males in the family).
3. **Statement (c): C is the daughter of B.**
   o This is correct, as C is explicitly stated as the sister of A and D, making her the daughter of B.
4. **Statement (d): A is the sister of D.**
   o This is correct, as A is explicitly stated as the sister of D.
Final Answer:
The **NOT correct** statement is **(b) D is the sister of C.**

S38. Ans.(c)
Sol. Given:
- The bend in the road is a quarter-circle.
- The distance between the left and right wheels of the car is 2 m.
- We need to calculate the difference in the distances traveled by the inner and outer wheels as the car moves along the quarter-circle.

Formula and Concept:
1. The **inner wheel** travels along the inner circle, and the **outer wheel** travels along the outer circle of the quarter-circle.
2. The difference in the distances traveled by the wheels is equal to the difference in the circumferences of the inner and outer circles for a quarter of a full circle.

Solution:

Let the radius of the inner circle be r. The radius of the outer circle is r + 2 (since the distance between the wheels is 2 m).

The circumference of a full circle is given by:

C = 2πr

For a quarter-circle, the circumference is: $C_{quarter} = \frac{1}{4} \times 2\pi r = \frac{\pi r}{2}$

Distance traveled by the inner wheels (quarter-circle): $D_{inner} = \frac{\pi r}{2}$

Distance traveled by the outer wheels (quarter-circle): $D_{outer} = \frac{\pi(r+2)}{2}$

Difference in distances: $Difference = D_{outer} - D_{inner}$

$Difference = \frac{\pi(r+2)}{2} - \frac{\pi r}{2}$

$Difference = \frac{\pi r}{2} + \frac{2\pi}{2} - \frac{\pi r}{2} = \frac{2\pi}{2} = \pi$

Final Answer:

(c) π.

S39. Ans.(a)
Sol. Given:
- Two concentric rings made of metals A and B, with ring A having a larger diameter.
- The thermal expansion coefficients of metals A and B are c_A (outer ring) and c_B (inner ring), respectively.
- We need to determine the behavior of the gap between the rings under thermal expansion.

Thermal Expansion Concept:

The change in diameter of each ring due to thermal expansion is proportional to its thermal expansion coefficient. The behavior of the gap depends on how much each ring expands.
1. **Case 1: $c_A < c_B$**
   o The inner ring (B) expands more than the outer ring (A).
   o This causes the **gap to decrease**, as the inner ring grows closer to the outer ring.
2. **Case 2: $c_A = c_B$**
   o Both rings expand equally.
   o The **gap remains the same**, as the growth in their diameters is identical.
3. **Case 3: $c_A > c_B$**
   o The outer ring (A) expands more than the inner ring (B).
   o This causes the **gap to increase**, as the outer ring moves further away from the inner ring.

Correct Explanation:

Since the question specifies that **$c_A < c_B$**, the **gap will decrease**, which matches statement A.

Final Answer:

(a) Only A.

S40. Ans.(b)
Sol. Given:
1. The cost of 2 mangoes, 1 coconut, and 2 bananas is Rs. 71:
2M + 1C + 2B = 71
2. The cost of 5 mangoes, 3 coconuts, and 4 bananas is Rs. 182:
5M + 3C + 4B = 182
3. We need to find the cost of 1 mango and 1 coconut (M + C).
Solution:
We will eliminate B (cost of bananas) to find M + C.
Step 1: Express the equations:
1. From the first equation:
2M + 1C + 2B = 71
2. From the second equation:
5M + 3C + 4B = 182
Step 2: Eliminate B:
1. Multiply the first equation by 2 to match the banana term in the second equation:
4M + 2C + 4B = 142
2. Subtract this equation from the second equation:
(5M + 3C + 4B) - (4M + 2C + 4B) = 182 - 142
Simplify:
M + C = 40
Final Answer:
The cost of 1 mango and 1 coconut is Rs. 40.
Correct Option: (b) Rs. 40.

S41. Ans.(b)
Sol. Given:
A student scoring 100 is exchanged with a student scoring 0.
The average marks of Section A fall by 4.
The average marks of Section B increase by 5.
Concept:
The total change in marks is divided equally among the total number of students in the class. To find the number of students, use the formula:
Number of students = Change in total marks / Change in average marks.
Solution:
Let the number of students in Section A be n.
The total marks of Section A decrease by 100 due to the exchange, and the average decreases by 4.
Therefore, the number of students in Section A is:
n = 100 / 4 = 25.
Let the number of students in Section B be m.
The total marks of Section B increase by 100 due to the exchange, and the average increases by 5.
Therefore, the number of students in Section B is:
m = 100 / 5 = 20.
Comparing the sizes of the two sections, Section A has 5 more students than Section B.
Answer: (b) **A** has 5 more students than **B**.

S42. Ans.(a)
Sol. Given:
1. A = $162^3 + 327^3$
2. B = $612^3 - 123^3$
3. $489 = 3 \times 163$

Concept: For a number to be divisible by 489, it must be divisible by both 3 and 163. We will check divisibility for A and B separately.

Solution:
Step 1: Check Divisibility of A = $162^3 + 327^3$

Divisibility by 3:
Both 162 and 327 are divisible by 3.
Their cubes, 162^3 and 327^3, are also divisible by 3.
Therefore, A = $162^3 + 327^3$ is divisible by 3.

Divisibility by 163:
When 162 is divided by 163, the remainder is 162.
When 327 is divided by 163, the remainder is 1.
Substitute these into A: A = $162^3 + 327^3$ becomes $(-1)^3 + 1^3$ modulo 163. $(-1)^3$ is -1, and 1^3 is 1. Adding these gives -1 + 1 = 0 modulo 163.
Since A is divisible by both 3 and 163, A is divisible by 489.

Step 2: Check Divisibility of B = $612^3 - 123^3$
Divisibility by 3:
Both 612 and 123 are divisible by 3.
Their cubes, 612^3 and 123^3, are also divisible by 3.
Therefore, B = $612^3 - 123^3$ is divisible by 3.

Divisibility by 163:
When 612 is divided by 163, the remainder is 123.
When 123 is divided by 163, the remainder is 123.
Substitute these into B: B = $612^3 - 123^3$ becomes $123^3 - 123^3$ modulo 163. This simplifies to 0 modulo 163.
Since B is divisible by both 3 and 163, B is divisible by 489.

Conclusion:
Both A and B are divisible by 489.
Answer: (a) Both A and B

S43. Ans.(d)
Sol. Given:
1. Original speed of the bus = v km/h.
2. Speed was reduced by 20%, so new speed = 0.8v km/h.
3. Delay caused when speed was reduced immediately = 45 minutes = 45/60 hours = 3/4 hours.
4. Delay caused if speed were reduced after 60 km = 30 minutes = 30/60 hours = 1/2 hours.

Concept:
The relationship between distance, speed, and time is given by: Time = Distance / Speed.
The delay caused is the difference between the time taken at reduced speed and the time taken at original speed.

Solution:

Given that the delay occurred because of a 20% reduction in speed, we know that the bus travelled the same distance at two different speeds.

We can equate the two distances using the equation: Distance = Speed x Time. Also, the difference in times taken in each scenario caused the delay.

Let's denote:

Original speed = v km/hr Reduced speed = 0.8v km/hr (because it was reduced by 20%) Distance from the initial point to S = x km Time taken to travel from the initial point to S at original speed,

$t1 = x/v$ hrs Time taken to travel from the initial point to S at reduced speed

$t2 = x/(0.8v)$ hrs The delay caused by the reduction in speed

$t2 - t1 = 45$ minutes = 45/60 hrs = 0.75 hrs From these observations, we have the equation:

$x/(0.8v) - x/v = 0.75$

$= x (1/(0.8v) - 1/v) = 0.75$

$= x (1/0.8 - 1)*1/v = 0.75$

$= x * 0.25/v = 0.75$

$= x = 3v$ (Let's call it equation 1)

Now, if the speed were reduced at 60 km after S, the total distance would be x + 60km.

The time taken for traveling this at the original speed = $(x+60)/v$ hrs and for reduced speed = $(x+60)/(0.8v)$ hrs.

The reduced speed delay = $[(x+60)/(0.8v)] - [(x+60)/v] = 30$ minutes

$= 30/60$ hours = 0.5 hours.

This gives us a new equation:

$(x+60)/(0.8v) - (x+60)/v = 0.5$

$= (x+60) (1/(0.8v) - 1/v) = 0.5$

$= 0.25(x+60)/v = 0.5$

$= x+60 = 2v$ (Let's call it equation 2)

Now we solve equations 1 and 2:

Equation 1 is x = 3v

Equation 2 is x + 60 = 2v

Substitute (3v) from equation 1 to equation 2:

$3v+60 = 2v$

$v = 60$ km/hr

So, the original speed is indeed 60 km/hr.

Hence, option (d) 60 is the answer.

S44. Ans.(c)

Sol. Given:

1. a, b, c are three consecutive integers.

2. Their sum is 15: a + b + c = 15.

3. We need to calculate $(a - 2)^2 + (b - 2)^2 + (c - 2)^2$.

Concept:

Consecutive integers can be written as a = x - 1, b = x, c = x + 1, where x is the middle integer. The sum of the integers is (x - 1) + x + (x + 1) = 3x.

Solution:
Step 1: Solve for x
Since a + b + c = 15, 3x = 15, x = 5.
Thus, the integers are: a = 4, b = 5, c = 6.
Step 2: Calculate $(a - 2)^2 + (b - 2)^2 + (c - 2)^2$
1. $(a - 2)^2 = (4 - 2)^2 = 2^2 = 4$.
2. $(b - 2)^2 = (5 - 2)^2 = 3^2 = 9$.
3. $(c - 2)^2 = (6 - 2)^2 = 4^2 = 16$.
Adding these: $(a - 2)^2 + (b - 2)^2 + (c - 2)^2 = 4 + 9 + 16 = 29$.
Conclusion:
The value is 29.
Answer: (c). 29

S45. Ans.(d)
Sol. Given:
Cost price of the item is denoted by CP.
Marked price (MP) is increased by 20% of the cost price, so
MP = CP + 20% of CP = 1.2 × CP.
The item is sold at a 10% discount on the marked price, so
the selling price (SP) = MP - 10% of MP = 90% of MP = 0.9 × MP.
Selling price (SP) = Rs. 2160.
Concept:
We use the relationships among cost price, marked price, and selling price to calculate the cost price (CP).
Solution:
Step 1: Write the relationship for SP
SP = 0.9 × MP. Substitute MP = 1.2 × CP: SP = 0.9 × 1.2 × CP.
SP = 1.08 × CP.
Step 2: Substitute SP = 2160
2160 = 1.08 × CP.
Step 3: Solve for CP
CP = 2160 ÷ 1.08 CP = 2000.
Conclusion:
The cost price of the item is Rs. 2000.
Answer: (d) 2000

S46. Ans.(a)
Sol. Given:
1. Two semicircles of equal radii are placed between two parallel lines.
2. Their centers are A and C.
3. The semicircles touch at point B.
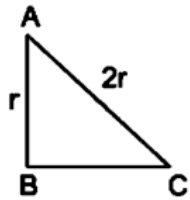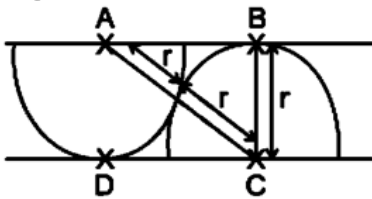4. AD and DC are radii perpendicular to the parallel lines.
Concept:
1. Points A and C are centers of the semicircles, and the line AC is the distance between the centers.
2. The angle BAC is formed by joining the points A, B, and C.
3. The geometry involves a right triangle, as the lines AD and DC are perpendicular to the parallel lines.

Sin ø = BC/AC

Sin ø = r/2r

Sin ø = 1/2

Sin ø = Sin 30

ø = 30

So, The angle BAC is 30o

S47. Ans.(a)

Sol. Concept and Explanation:

In a father-son relationship, one man acts as the father, and another as the son.

In a group of 4 men, every individual can either be a father or a son in a unique pair.

Analyzing the scenario:

1. If one man is the father of all three others, then this forms **3 father-son pairs.** Example: A is the father of B, C, and D.

2. If each man can form a pair with another (i.e., man A is the father of B, man C is the father of D), then only **2 father-son pairs exist.**

3. Beyond **3 pairs**, it's impossible to assign unique relationships because there are only 4 people in total, and overlapping relationships are not allowed.

Conclusion:

The **maximum number of father-son pairs** that can exist in a group of 4 men is **3**.

Answer: (a) 3

S48. Ans.(a)

Sol. Given:

1. There are 3 friends (A, B, C), each standing at the corners of a triangle.

2. Each friend randomly throws their ball to one of the other two.

3. We need to find the probability that no two friends throw balls to each other (no reciprocal throws).

Concept:

1. Total number of ways each friend can throw the ball: Each person has 2 choices (two others to throw to). Total possibilities = 2 × 2 × 2 = 8.

2. Favorable outcomes: We need to count cases where no two friends throw balls at each other (no reciprocal throws like A → B and B → A).

Solution:

Step 1: Total number of possibilities

Each of the 3 friends has 2 independent choices. So, the total number of outcomes is 2 × 2 × 2 = 8.

Step 2: Count favorable outcomes (no reciprocal throws)

For no reciprocal throws:

A throws to either B or C.

B throws to either A or C, but not back to A.

C throws to either A or B, but not back to B.

Using enumeration, favorable outcomes are:

1. A → B, B → C, C → A

2. A → C, C → B, B → A

There are **2 favorable outcomes.**

Step 3: Calculate probability

Probability = Number of favorable outcomes/Total number of outcomes Probability = 2/8 = 1/4.

Conclusion:

The probability of no two friends throwing balls at each other is **1/4**.

Answer: (a) 1/4

S49. Ans.(a)

Sol. Given Data for 2020:

Population (in millions):

A: 16 million

B: 138 million

C: 22 million

GDP (in billion USD):

A: 324 billion

B: 2623 billion

C: 264 billion

Concept:

Per capita GDP = Total GDP / Population.

We calculate the per capita GDP for each country in 2020.

Solution:

1. **For Country A:** GDP = 324 billion USD Population = 16 million Per capita GDP = 324 / 16 = 20.25 thousand USD.

2. **For Country B:** GDP = 2623 billion USD Population = 138 million Per capita GDP = 2623 / 138 ≈ 19.01 thousand USD.

3. **For Country C:** GDP = 264 billion USD Population = 22 million Per capita GDP = 264 / 22 = 12 thousand USD.

Decreasing Order of Per Capita GDP:

A (20.25) > B (19.01) > C (12).

Conclusion:

The decreasing order of per capita GDP is **A, B, C**.

Answer: (a) A, B, C

S50. Ans.(d)
Sol. Concept:
Median of transformed data: The median of a transformed dataset (like squaring the observations in this case) is not necessarily the same as the transformed median.
Median of combined datasets: When combining two datasets, the median of the combined dataset depends on every single observation, not just the medians of the constituent datasets.
Solution:
Sum of the observations in A= Sum of the observations in B:
This is not necessarily true. The median is the middle number when the observations are ordered from least to greatest, it doesn't have any relation to the sum of the observations. Two datasets could have the same median but different sums.
Median of the squares of the observations in A= Median of the squares of the observations in B:
Again, this is not necessarily true. Squaring the observations could change the relative order of the data, and thus it could change the median.
The median of the combined dataset = median of A+ median of B:
This is not necessarily true. The median of a combined dataset depends on the relative ordering of all of the observations, not just the medians of A and B. Adding two medians together does not give the median of the combined dataset.
The median of the combined dataset = median of A:
This is the ONLY true statement subject to the condition that both A and B have an equal number of observations and the median of A is equal to the median of B. When two datasets have the same number of observations and the same median, and you combine them, the median of the combined dataset will remain the same as the original median. This concept is also dependent on the assumption that the datasets A and B are such that any number in A doesn't exceed the median and any number in B isn't less than the median.
When working with the concept of the median, it's important to remember that the median is the middle value of a set when the set is ordered from least to greatest. It isn't affected by the absolute values of the other observations, only by their relative order.
Example to Verify:
Let A = [1, 5, 9] and B = [2, 5, 8].
Median of A = 5, Median of B = 5.
Combined dataset = [1, 2, 5, 5, 8, 9].
Median of combined dataset = (5 + 5) ÷ 2 = 5.
Thus, the median of the combined dataset equals the median of A (and B).
Conclusion:
Option **(d)** is correct: **The median of the combined dataset = median of A.**

S51. Ans.(b)
Sol. Concept:
A single die has 6 faces, each face has an equal probability of appearing on a throw, making it 1/6.
Solution:
When three dice are thrown, the total number of outcomes is the total outcomes for each die multiplied together.
That is, 6 outcomes for the first die,
6 for the second, and
6 for the third,
giving a total of **6^3 = 216 possible outcomes.**

The event of all three dice reading the same (for instance, all being 1s, 2s, etc.) has 6 possible outcomes: **(1, 1, 1), (2, 2, 2), (3, 3, 3), (4, 4, 4), (5, 5, 5), and (6, 6, 6).**
Therefore, the probability of all three dice reading the same is the number of successful outcomes divided by the total number of outcomes,
in this case,
=6/216
= 1/36.

S52. Ans.(a)
Sol. Solution:
According to the question -
Day 1: B discloses 1 secret to A.
Day 2: A, in return, discloses 4 secrets to B.
Day 3: B, in return for those 4 secrets, discloses 4 × 2 = 8 secrets to A.
Day 4: A, in return for those 8 secrets, discloses 8 × 4 = 32 secrets to B.
Day 5: A, in return for those 32 secrets, discloses 32 × 2 = 64 secrets to A.
At this point, B has revealed 1 + 8 + 64 = 73 secrets to A.
So, B got revealed 1 + 8 + 64 = 73 secrets (which is the total of his secrets).
It took 5 days in total for B to disclose all his secrets. Hence option (a) is correct.

S53. Ans.(c)
Sol. Concept:
Total combinations of 4 items (A, B, C, D) = 24−1=15 (excluding the empty set).
The combinations including **both C and D together** must be subtracted from the total.
Solution:
Step 1: Total possible combinations
Total combinations = 24 −1=15 (as each item can either be chosen or not).
These combinations include all subsets of {A, B, C, D} except the empty set.
Step 2: Remove combinations with C and D together
When **C and D are both included**, the remaining options are subsets of {A, B}.
Subsets of {A, B} = 22=4 (including the empty set).
These combinations are:
{C, D}, {A, C, D}, {B, C, D}, {A, B, C, D}.
Thus, 4 combinations include both C and D.
Step 3: Subtract combinations with C and D together
Total combinations = 15.
Combinations with C and D together = 4.
Valid combinations = 15−4=11.
Conclusion:
The number of valid options available for the guest is **11**.

S54. Ans.(b)
Sol. Concept:
A polygon is a closed figure with straight sides. Examples of polygons are triangles, quadrilaterals, pentagons, hexagons, and so on.

If you take a polygon, say, a triangle, you'll notice that it has three angles. The sum of the internal angles of a triangle is always 180 degrees. Now, if you add a side to the triangle and make it a quadrilateral, you can see that it can be divided into two triangles. Therefore, the sum of internal angles in a quadrilateral is **180×2 = 360 degrees.**

Every time you add a side (and therefore form an additional triangle), you're adding another 180 degrees to the sum of the internal angles.

This is what the formula (n-2) × 180, where 'n' is the number of sides, represents.

Solution:

The sum of all the internal angles of a polygon can be found using the formula (n−2) × 180 degrees, where n is the number of sides.

For an octagon, which has eight sides, the sum of all the internal angles is

(8−2) × 180 = 6 × 180 = 1080 degrees

Conclusion: The sum of all internal angles of a regular octagon is **1080 degrees**.
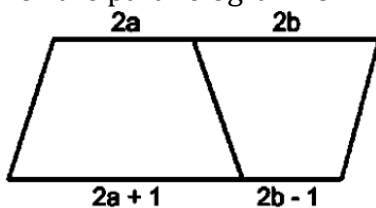
S55. Ans.(b)
Sol. Solution:
When we add both trapeziums, we form a parallelogram as shown in the figure.
Formula:
The area of a trapezium is given as: Area = (1/2) × height × (sum of parallel sides).
For the parallelogram formed by combining two trapeziums, its total area is already given as **2(a + b)**.

Calculation:
Parallel sides of the parallelogram:
Adding the bases of the two trapeziums: Parallel sides = (2a + 2b).
Area of the parallelogram: The formula for the area of a parallelogram is: Area = Base × Height.
Substituting values: 2(a + b) = (1/2) × height × (2a + 2b + 2a + 2b).
Simplify the terms: 2(a + b) = (1/2) × height × 4(a + b).
Further simplify: 2(a + b) = height × 2(a + b).
Solve for height: height = [2(a + b)] / [2(a + b)] = 1.
Conclusion:
The height of the parallelogram is **1**.

S56. Ans.(b)
Sol. Solution:
Concept: The source of thunder and lightning is the same. Lightning is observed almost instantly because the speed of light is much faster than the speed of sound. The time difference (1 second) is caused by the slower travel of sound.
Formula for distance: The distance to the source is the same for both light and sound. Distance traveled by sound = x × t (where t is the time taken by sound). Distance traveled by light = y × (t - 1) (where t - 1 is the time taken for light).

Equating distances: Since the distances are the same: x × t = y × (t - 1).
Solve for t: Expand the equation:
x × t = y × t - y. Rearrange terms: t × (y - x) = y. t = y / (y - x).
Calculate the distance: Substitute t into the formula for distance traveled by sound: Distance = x × t.
Distance = x × (y / (y - x)). Distance = xy / (y - x).
Conclusion:
The correct distance is xy / (y - x).

S57. Ans.(b)
Sol. Concept: The number of windows is inversely proportional to their sizes. This means:
Number of windows of size 2 feet is proportional to 1/2.
Number of windows of size 3 feet is proportional to 1/3.
Number of windows of size 4 feet is proportional to 1/4.
Let the proportional constant be k. Then:
Number of windows of size 2 = k / 2
Number of windows of size 3 = k / 3
Number of windows of size 4 = k / 4
Total number of windows: The total number of windows is 26. Hence, (k / 2) + (k / 3) + (k / 4) = 26
Simplify the equation: The least common multiple of the denominators (2, 3, and 4) is 12. Rewrite the equation: (6k / 12) + (4k / 12) + (3k / 12) = 26
Combine terms: (6k + 4k + 3k) / 12 = 26 13k / 12 = 26
Solve for k: Multiply both sides by 12: 13k = 312 k = 312 / 13 = 24
Calculate the number of windows of each size:
Number of windows of size 2 = k / 2 = 24 / 2 = 12
Number of windows of size 3 = k / 3 = 24 / 3 = 8
Number of windows of size 4 = k / 4 = 24 / 4 = 6
Conclusion: The number of windows of the largest size (4 feet) is 6.

S58. Ans.(b)
Sol. Solution:
Initial State:
3-litre bottle: Full (3 litres).
1-litre bottle: Empty (0 litres).
4-litre bottle: Empty (0 litres).
Step-by-Step Process to Get 1 Litre in Each Bottle:
Pour 3 litres from the 3-litre bottle into the 4-litre bottle.
3-litre bottle: Empty (0 litres).
4-litre bottle: 3 litres.
1-litre bottle: Empty (0 litres).
Pour 1 litre from the 4-litre bottle into the 1-litre bottle.
3-litre bottle: Empty (0 litres).
4-litre bottle: 2 litres.
1-litre bottle: Full (1 litre).
Pour 2 litres from the 4-litre bottle back into the 3-litre bottle.
3-litre bottle: 2 litres.
4-litre bottle: Empty (0 litres).
1-litre bottle: Full (1 litre).

Final State:
3-litre bottle: 1 litre remaining.
4-litre bottle: 1 litre.
1-litre bottle: 1 litre.
Total Pourings: Only **3 pourings** are required to achieve the desired state.
Answer: (b) 3

S59. Ans.(d)
Sol. Given:
1. Total mixture = 50 litres.
2. Original ratio of green:blue:red = 5:3:2.
3. Additional red colour = 10 litres.
Solution:
Step 1: Calculate the original quantities of each colour
Since the total volume of the mixture is 50 litres and the ratio is 5:3:2:
Green = (5/10) × 50 = 25 litres.
Blue = (3/10) × 50 = 15 litres.
Red = (2/10) × 50 = 10 litres.
Step 2: Add 10 litres of red
After adding 10 litres of red, the new quantities are:
Green = 25 litres.
Blue = 15 litres.
Red = 10 + 10 = 20 litres.
Step 3: Find the new ratio
The new ratio of green:blue:red is: Green = 25, Blue = 15, Red = 20.
To simplify:
Divide each quantity by the greatest common divisor (GCD), which is 5.
Green = 25 ÷ 5 = 5.
Blue = 15 ÷ 5 = 3.
Red = 20 ÷ 5 = 4.
The new ratio is 5:3:4.
Conclusion:
The new ratio of green, blue, and red is 5:3:4.
Answer: d. 5:3:4

S60. Ans.(d)
Sol. Solution:
Step 1: Total moles of sulfate ions before mixing
Rainwater: Volume = 20 L, concentration = 2.0 µmol/L Total moles from rainwater = 20 × 2.0 = 40 µmol
Water: Volume = 40 L, concentration = 4.0 µmol/L Total moles from water = 40 × 4.0 = 160 µmol
Total moles of sulfate ions = 40 + 160 = 200 µmol
Step 2: Total volume before evaporation
Total volume = 20 + 40 = 60 L
Step 3: Evaporation effect
50% of the water evaporates, so the remaining volume = 60/2 = 30 L
The total moles of sulfate ions remain the same (200 µmol) because evaporation removes only water, not solutes.

Step 4: New concentration after evaporation

Concentration = Total moles / Remaining volume

Concentration = 200 / 30 = 6.7 µmol/L

Conclusion:

The sulfate concentration in the remaining water is **6.7 µmol/L**.

Answer: (d) 6.7 µmol/L

S61. Ans.(d)

Sol. Solution:

Step 1: Understanding the Problem

Two chords of a circle bisect each other at an angle of 60°.

One chord has a length of 10 cm.

We need to determine the length of the other chord.

Step 2: Identifying the Property

When two chords of a circle bisect each other, they follow a specific geometric rule:

If two chords bisect each other at an angle θ, their lengths remain equal when the angle is 60°.

This is because, in a circle, if two chords are divided into equal halves and they intersect at an angle of 60°, the bisected parts are symmetric. Thus, their total lengths remain the same.

Step 3: Applying the Rule

Given that one chord has a total length of 10 cm, and both chords bisect each other at 60°, the second chord must also have the same length as the first chord.

Therefore, the second chord also measures 10 cm.

Final Answer:

The correct answer is (d) 10 cm.

Key Takeaways:

When two chords bisect each other at 60°, they always have equal lengths.

Since the given chord length is 10 cm, the second chord must also be 10 cm.

This is a fundamental property of intersecting chords in a circle when bisected at 60°.

Correct Answer: (d) 10

S62. Ans.(c)

Sol. Solution:

Botany deals with plants, focusing on their classification, structure, and functions.

Philosophy focuses on exploring fundamental concepts, beliefs, and **ideas** regarding existence, knowledge, and ethics.

Important Key Points:

1. **BOTANY** specifically relates to the scientific study of plants.

2. **PHILOSOPHY** relates to the study of abstract and fundamental **ideas** about life, reality, and knowledge.

Knowledge Booster:

REGULATIONS: These refer to rules or directives, not directly associated with philosophy.

RELIGIONS: While philosophy may sometimes address religion, it is not limited to religious topics.

POLITICS: Politics deals with governance and societal rules, which is a distinct domain from philosophy.

S63. Ans.(b)
Sol. Given:
First catch: 25 fish tagged.
Second catch: 30 fish.
Tagged fish in the second catch: 10.
We need to estimate the total number of fish in the pond (N).
Concept: The proportion of tagged fish in the second catch is equal to the proportion of tagged fish in the total population:
(Tagged fish in second catch) / (Total fish in second catch) = (Tagged fish in the population) / (Total fish in the population)
This gives us:
10 / 30 = 25 / N
Solution: Rearranging the equation to find N:
N = (25 × 30) / 10
N = 75
Answer: The estimated number of fish in the pond is **75**.
Correct Option: (b) 75

S64. Ans.(a)
Sol. Solution:
Step 1: Key observations
- Height of the cliff: 100 m.
- Speed of the mouse: 10 m/s.
- Speed of the eagle: 20 m/s, diving at an angle of 45° to the ground.
- The eagle's velocity can be broken into two components:
  - Horizontal velocity = 20 / √2 ≈ 14.14 m/s.
  - Vertical velocity = 20 / √2 ≈ 14.14 m/s.
Step 2: Time for the eagle to descend
The eagle takes time to cover the vertical height of 100 m. Time is calculated as:
Time = height / vertical velocity = 100 / 14.14 ≈ 7.07 seconds.
Step 3: Distance traveled by the mouse in this time
The mouse runs on level ground at a speed of 10 m/s. In 7.07 seconds, the mouse travels:
Distance = speed × time = 10 × 7.07 ≈ 70.7 meters.
Step 4: Matching the eagle's horizontal distance
The eagle must also cover the horizontal distance traveled by the mouse.
The horizontal distance covered by the eagle in 7.07 seconds is:
Distance = horizontal velocity × time = 14.14 × 7.07 ≈ 100 meters.
Step 5: Delay in the eagle's dive
If the eagle starts its dive immediately, it will overshoot the mouse. The eagle needs to delay its dive.
The required delay time is calculated as:
Delay = (distance difference) / mouse's speed.Delay = (100 - 70.7) / 10 ≈ 3 seconds.
Final Answer:
The eagle starts its dive approximately **3 seconds after the mouse starts running**.
Answer: **(a)**

S65. Ans.(b)
Sol. Analysis:
Step 1: Understanding the Graph
The graph presents the expected vs. observed frequency of anti-predator calls among different groups of squirrels:
Adult Female
Adult Male
Juvenile Female
Juvenile Male
Blue bars represent the expected frequency of calling.
Red bars represent the observed frequency of calling.
Step 2: Observing Trends in the Graph
Adult Females: The observed frequency (red bar) is higher than the expected frequency (blue bar), indicating they call more than expected.
Adult Males: The observed frequency is much lower than expected.
Juvenile Females: The observed frequency is slightly higher than expected.
Juvenile Males: The observed frequency is lower than expected but not zero.
Step 3: Evaluating the Answer Choices
(a) Adult males are less likely to see a predator than adult females.
The graph does not provide direct evidence of predator visibility for different groups, only their calling behavior.
Incorrect
(b) Adult females make higher than expected anti-predator calls.
The red bar (observed frequency) for adult females is significantly higher than the blue bar (expected frequency).
Correct Answer
(c) There are more adult females than adult males.
The graph does not show population numbers, only calling behavior.
Incorrect
(d) Juvenile males do not make anti-predator calls.
The observed frequency for juvenile males is low, but not zero, meaning they do call, just less frequently than expected.
Incorrect
Final Answer:
(b) Adult females make higher than expected anti-predator calls.

S66. Ans.(c)
Sol. Step 1: Analyzing Given Information
1. **A is the son of P** and **brother of V** → A and V are siblings.
2. **N is the sister of V** → So, **A, V, and N** are siblings.
3. **S is the nephew of V** → Since S is the nephew of V, **S must be the son of A or N**.
4. **B is the daughter-in-law of A** → This means **B is the wife of A's son**.
5. **M is the mother of N** → So, **M is the mother of A, V, and N**.
6. **We need to find how B is related to M.**

Step 2: Understanding the Relationship
- A, V, and N are siblings.
- M is the mother of A.
- A has a son (since B is his daughter-in-law).
- B is the wife of A's son, meaning she is **A's son's wife**.
- A is the son of M.
- This means **B is the wife of M's grandson**.

Thus, **B is the Grandson's wife of M**.

Final Answer:

(c) Grandson's wife.

S67. Ans.(d)
Sol. Solution:
The boy states:
1. **"The day before yesterday, I was 15."**
2. **"Now I am 16."**
3. **"Next year, I shall turn 18."**

This means that his birthday must have just occurred **yesterday**, allowing him to change his age from **15 to 16**.

Additionally, he claims that **next year he will turn 18**, meaning his birthday must be at the very end of the year. The only possible date that fits this condition is **31st December**.

Step-by-Step Verification:
- Suppose **today is 1st January**.
- His **birthday was yesterday (31st December)**.
- On **30th December**, he was **still 15**.
- On **31st December**, he turned **16**.
- On **next 31st December**, he will turn **17**.
- On **the following 31st December (next year), he will turn 18**.

Thus, his **birthday is on 31st December**, and he is making the statement on **1st January**.

Final Answer:

(d) His birthday is on 31st December and he was making the assertion on 1st January.

S68. Ans.(c)
Sol. Solution:
Step 1: Given Data
- **Total participants = 3500**
- **Men = 1700**
- **Women = 3500 - 1700 = 1800**
- **Participants who voted against = 1450** (of whom **800 were men**)
- **Participants who voted in favour = 1500**
- **Women who abstained = 200**

Step 2: Find Women Who Voted Against
- Total **participants who voted against = 1450**.
- Out of these, **800 were men**.
- So, **women who voted against = 1450 - 800 = 650**.

Step 3: Find Women Who Voted for the Proposal
- **Total women** = **1800**.
- **Women who abstained** = **200**.
- **Women who voted against** = **650**.
- So, **women who voted in favour** = **Total women - (Women against + Women abstained)**.

= **1800 - (650 + 200)**

= **1800 - 850**

= **950**.

Final Answer: (c) 950

S69. Ans.(c)
Sol. Solution:
Problem Restatement:
We have two vessels:

1. **First vessel** contains **3/8 L of alcohol** and water is added to make the total volume **1 L**.

2. **Second vessel** contains **2/7 L of alcohol** and water is added to make the total volume **1 L**. The question asks us to find the **alcohol to water ratio** when both solutions are mixed.

Step 1: Alcohol and water in each vessel

First vessel:

Alcohol = 3/8 L.

Water added = 1 - 3/8 = 5/8 L.

So, the first vessel contains:

Alcohol = 3/8 L

Water = 5/8 L

Second vessel:

Alcohol = 2/7 L.

Water added = 1 - 2/7 = 5/7 L.

So, the second vessel contains:

Alcohol = 2/7 L

Water = 5/7 L

Step 2: Total alcohol and total water in the mixed solution

When the two solutions are mixed, the total alcohol and total water are the sum of the alcohol and water from both vessels.

Total alcohol:

Total alcohol = 3/8 + 2/7

To add these, we need to find the least common denominator (LCD), which is 56:

3/8 = 21/56

2/7 = 16/56

Total alcohol = 21/56 + 16/56 = 37/56 L.

Total water:

Total water = 5/8 + 5/7

Again, we find the LCD, which is 56:

5/8 = 35/56

5/7 = 40/56

Total water = 35/56 + 40/56 = 75/56 L.

Step 3: Alcohol-to-water ratio

Now, we find the ratio of alcohol to water: Alcohol to water ratio = (37/56) / (75/56)

Simplifying: Alcohol to water ratio = 37/75.

This simplifies to approximately 1:2.

Conclusion:

The alcohol-to-water ratio in the mixed solution is approximately **1:2**.

S70. Ans.(c)

Sol. Solution:

Step 1: Analyze the given clues.

1. The **artist** has to go up **three floors** to meet the **engineer**.

This means the engineer is **three floors above** the artist.

2. The **engineer** has to come down **four floors** to visit the **doctor**.

This means the doctor is **four floors below** the engineer.

3. The **lawyer** lives **just one floor above** the **teacher**.

Step 2: Arrange based on the clues.

- Since the building has **five floors**, let us assume the floors are numbered from **1 to 5** (from bottom to top).
- Start with the engineer's position since it determines the others:
  - If the **engineer** is on the 5th floor, the **artist** (three floors below) must be on the 2nd floor.
  - The **doctor** (four floors below the engineer) must be on the 1st floor.
- The remaining positions (3rd and 4th floors) are occupied by the **teacher** and **lawyer**, respectively.
  - Since the **lawyer** is one floor above the **teacher**, the **teacher** must be on the 3rd floor and the **lawyer** on the 4th floor.

Step 3: Final arrangement.

From the lowest to the topmost floor:

1. **1st floor:** Doctor
2. **2nd floor:** Artist
3. **3rd floor:** Teacher
4. **4th floor:** Lawyer
5. **5th floor:** Engineer

S71. Ans.(b)

Sol. Solution:

Step 1: Understanding the Graph

The graph shows the price per carat of diamonds on the y-axis and the weight of a diamond in carats on the x-axis.

Observations from the graph:

A 1-carat diamond costs 2 lakh per carat.

A 2-carat diamond costs 4 lakh per carat.

The price per carat increases linearly with weight.

From this, we derive the price per carat formula:

Price per Carat = 2 × Weight (in carat).

Step 2: Determining the Maximum Possible Size

The person has 4.5 lakh to buy 4 identical diamonds.

The budget per diamond is 4.5 lakh ÷ 4 = 1.125 lakh per diamond.

Using the price formula:

Total Price of a Diamond = (Weight) × (Price per Carat).

Since Price per Carat = 2 × Weight, we set up the equation:

1.125 = Weight × (2 × Weight)

$1.125 = 2 \times Weight^2$

$Weight^2 = 1.125/2$

$Weight^2 = 0.5625$

Taking the square root:

Weight = 0.75 carat.

Step 3: Selecting the Correct Option

The largest possible diamond size is 0.75 carat, which corresponds to option (b).

S72. Ans.(b)
Sol. Solution:
Step 1: Starting Day of the Year
- A **leap year** starts on a **Tuesday**.
- **January 1 is a Tuesday**.

Step 2: Days in January and February
- **January has 31 days**.
  - January 1 is a **Tuesday**.
  - January 31 will then be a **Thursday** (because 31 days mean the 31st is 3 days ahead of Tuesday).
- **February has 29 days** in a leap year.
  - Since January 31 is **Thursday**, February 1 will be a **Friday**.
  - **February 29 will fall on a Friday**.

Step 3: Day of March 1
- Since **February 29 is a Friday**, **March 1 will be a Saturday**.

Step 4: Finding the Third Saturday in March
- **March 1 is a Saturday**.
  - The first Saturday in March will be **March 1**.
  - The second Saturday in March will be **March 8**.
  - The third Saturday in March will be **March 15**.

Final Answer:

The third Saturday of March falls on **March 15**, so the correct answer is:

(b) March 15.

S73. Ans.(c)
Sol. Given:

A meal is prepared by selecting one item from each category: starter, main course, and dessert.

We need to calculate the probability that the selected meal is vegetarian.

Step 1: Total possible meal combinations

Starters: 3 options (Tomato Soup, Vegetable Salad, Chicken Soup)

Main Course: 3 options (Chicken Biryani, Fish Biryani, Veg Biryani)

Desserts: 2 options (Gulabjamun, Rasagulla)

Total meal combinations = 3 × 3 × 2 = 18

Step 2: Vegetarian combinations
A vegetarian meal consists of a vegetarian starter, veg biryani as the main course, and any dessert.
Vegetarian starter options:
Tomato Soup
Vegetable Salad
Count: 2
Vegetarian main course options:
Veg Biryani
Count: 1
Dessert options:
Gulabjamun
Rasagulla
Count: 2
Total vegetarian combinations = (2 vegetarian starters)×(1 vegetarian main course)×(2 desserts) = 4
Step 3: Probability of a vegetarian meal
Probability = (Number of vegetarian combinations) / (Total combinations)
= 4 / 18
= 2 / 9
Answer:
The probability that a randomly drawn menu is vegetarian is 2/9.

S74. Ans.(b)
Sol. Solution:
Step 1: Understanding Perfect Squares
A number is a perfect square if:
Its last digit must be one of 0, 1, 4, 5, 6, or 9.
If it ends in 5, it must end in 25.
If it ends in 6, it must have an even digit before it.
If it ends in 00, it must be divisible by 400.
Step 2: Checking the Last Digits
Let's analyze the last few digits of each given option.
Option (a) 93XY215
Ends in 215, which does not follow the rule for a perfect square.
Not a perfect square.
Option (b) 7XY0625
Ends in 0625, which is a common ending for a perfect square, like $25^2 = 625$, $75^2 = 5625$, etc.
Possible perfect square.
Option (c) 613XY45
Ends in 45, which is not a valid ending for a perfect square.
Not a perfect square.
Option (d) XY21375
Ends in 375, which is not a valid ending for a perfect square.
Not a perfect square.

Step 3: Confirming Option (b)

0625 is a valid ending for a perfect square.

Some known perfect squares that end in 0625 include:

$25^2 = 625$

$75^2 = 5625$

$125^2 = 15625$

$175^2 = 30625$

$225^2 = 50625$

$275^2 = 75625$

Since 7XY0625 follows this pattern, it can be a perfect square.

Final Answer:

(b) 7XY0625

S75. Ans.(a)

Sol. Understanding the Problem

Two children, **A and B**, count the number of chairs around a **round table**, but they start counting from different chairs.

- **A's 5th chair is B's 9th chair**, meaning **B started counting 4 places ahead of A**.
- **B's 3rd chair is A's 12th chair**, meaning **A started counting 9 places ahead of B**.

We need to determine the total number of chairs around the table.

Step 1: Express the Relationship

Since the counting is in a **circular pattern**, the difference in their counting positions must be **consistent modulo N**, where **N is the total number of chairs**.

- **A's 5th chair is B's 9th chair**, meaning B is **4 steps ahead of A**.
  - Mathematically, the difference is **9 - 5 = 4**.
- **B's 3rd chair is A's 12th chair**, meaning A is **9 steps ahead of B**.
  - Mathematically, the difference is **12 - 3 = 9**.

Since the counting repeats after **N** chairs, the total number of chairs must be the **smallest number that satisfies this pattern**.

Step 2: Finding the Smallest Valid N

We now find **N**, the total number of chairs, by determining the **smallest number that is a multiple of both 4 and 9 but allows cyclic repetition**.

The simplest way is to check the sum of these shifts:

N = 4 + 9 = 13, which is a valid solution.

Step 3: Verifying the Answer

For **N = 13**, let's check if both conditions hold:

1. **A's 5th chair = B's 9th chair**
   - Since **B is 4 places ahead of A**, after 4 more positions, B reaches A's 5th chair, which is correct.
2. **B's 3rd chair = A's 12th chair**
   - Since **A is 9 places ahead of B**, moving 9 places forward from **B's 3rd chair** leads to A's **12th chair**, which is also correct.

Since N = 13 satisfies both conditions, this is the correct answer.

Final Answer: (a) 13

S76. Ans.(a)
Sol. Solution:
To determine the number of persons who actually have the disease, we need to consider:
True Positives (TP): People who actually have the disease and tested positive → 8
False Negatives (FN): People who actually have the disease but tested negative → 3
Since these two categories represent all people who actually have the disease, the total number of such persons is:
Total actual disease cases = True Positives + False Negatives
= 8 + 3 = 11
Final Answer: (a) 11

S77. Ans.(b)
Sol. Given:
Total number of watches = 200.
Selling details:
First 50 sold at 10% profit.
Next 50 sold at 20% profit.
Next 50 sold at 25% profit.
Last 50 sold at 40% profit.
Total profit = Rs 19,000.
Solution:
Step 1: Represent the cost price of one watch.
Let the cost price (C.P.) of one watch be Rs x.
Then, the total cost price of 200 watches = 200x.
Step 2: Calculate the selling price (S.P.) of each batch of 50 watches.
First 50 watches at 10% profit:
Selling price for 50 watches = 50 × x × 1.10 = 55x.
Next 50 watches at 20% profit:
Selling price for 50 watches = 50 × x × 1.20 = 60x.
Next 50 watches at 25% profit:
Selling price for 50 watches = 50 × x × 1.25 = 62.5x.
Last 50 watches at 40% profit:
Selling price for 50 watches = 50 × x × 1.40 = 70x.
Step 3: Total selling price of 200 watches.
Total selling price = 55x + 60x + 62.5x + 70x = 247.5x.
Step 4: Calculate the total profit.
Total profit = Total selling price - Total cost price.
Given that the total profit is Rs 19000:
247.5x - 200x = 19000.
47.5x = 19000.
x = 19000 / 47.5 = 400.
Step 5: Calculate the total cost price of the watches.
Total cost price = 200x = 200 × 400 = 80000.
Final Answer: (b) Rs 80000

S78. Ans.(a)
Sol. Solution:
Step 1: Define the Number
Let the three-digit number be represented as **xyz**, where:

- x is the hundreds digit,
- y is the tens digit,
- z is the units digit.

The number in numeric form is: **100x + 10y + z**.
The reverse of the number is: **100z + 10y + x**.
According to the problem: (100x + 10y + z) + (100z + 10y + x) = 1089.
Step 2: Simplify the Equation
Expanding the sum: 100x + 10y + z + 100z + 10y + x = 1089.
Combining like terms: (100x + x) + (100z + z) + (10y + 10y) = 1089.
This simplifies to: 101x + 101z + 20y = 1089.
Factoring out 101 from the first two terms: 101(x + z) + 20y = 1089.
Step 3: Solve for x + z
Since 101(x + z) must be a multiple of 101, dividing 1089 by 101 gives:
1089 ÷ 101 = 10.79.
Since this is not an integer, we check integer values for x + z that make the sum a multiple of 101.
From estimation: x + z = 9.
Now, substituting x + z = 9 into the equation:
101(9) + 20y = 1089.
909 + 20y = 1089.
20y = 180.
y = 9.
Step 4: Verify the Answer

- The middle digit of the number is y.
- We found y = 9.

Thus, the correct answer is:
Final Answer: (a) 9

S79. Ans.(d)
Sol. Solution:
The **standard deviation** of a data set is influenced by both the **mean** and the **deviations from the mean**, specifically how the values are spread around it. Standard deviation is computed using the variance, which takes into account the average of the squared differences between each data point and the mean.
Formula for Standard Deviation:
The standard deviation (σ) is calculated as:
Standard Deviation:$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2}$Standard Deviation:$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2}$
where:

- x_ix_ix_i are the individual data points,
- μ\mu$\mu$ is the mean of the data set,
- nnn is the number of data points.

The **variance** is the average of the squared differences from the mean.

Step 1: Understanding the Components

- The **mean** of a data set affects the squared deviations (the distance of data points from the mean).
- The **average of the squares of all terms** tells us about the spread or dispersion of the data points around the mean.

Thus, both the **mean** and the **average of the squares of all terms** (which is related to the variance) are needed to determine the standard deviation.

Step 2: Analyzing the Options

- **Option (a): Their means**

If the means are equal, it does **not** guarantee that the standard deviations are equal. The spread of data could still be different.

Incorrect.

- **Option (b): The sums of positive and negative deviations from the respective means**

The sum of the deviations from the mean is always **zero**, so this does not affect the standard deviation.

Incorrect.

- **Option (c): The averages of squares of all terms**

The **average of the squares of the terms** is directly related to the variance. However, **the mean** is also a crucial factor in calculating the standard deviation.

Incorrect by itself.

- **Option (d): The averages of squares of all terms and their means**

This is correct because both the **mean** and the **average of the squares of the terms** (which is related to the variance) are necessary to determine the standard deviation. If these two quantities are equal between two data sets, their standard deviations will be equal.

Correct.

Final Answer:

(d) The averages of squares of all terms and their means.

S80. Ans.(a)

Sol. Solution:

The problem describes how a tree's height changes over **30 weeks**:

1. **First 15 weeks:**
   - The **growth rate increases linearly**, meaning the tree grows at an **accelerating** pace.
   - This suggests a **curved upward** pattern in the graph.
2. **At the 15th week:**
   - The tree is **trimmed down**, causing a **sudden drop in height**.
3. **After trimming (next 15 weeks):**
   - The tree continues growing, but the **growth rate again increases linearly**, meaning it starts slow and picks up speed gradually.

**Step-by-Step Analysis of the Graphs:**

- **Graph (A):**
   - **First 15 weeks:** Shows **accelerating growth** (curved upward).
   - **At 15 weeks:** A **sudden drop in height** due to trimming.
   - **Next 15 weeks:** Growth resumes with an **increasing rate** (curved upward).
   - **Correct representation of the tree's growth.**
- **Graph (B):**
   - Shows a **steady growth rate after trimming**, but does not show an increasing rate afterward.

- **Graph (C):**
  o Shows the correct **initial acceleration** and trimming, but the second phase **does not show accelerating growth** correctly.
- **Graph (D):**
  o Shows a **decreasing growth rate after trimming**, which is incorrect.

Final Answer: (a) A
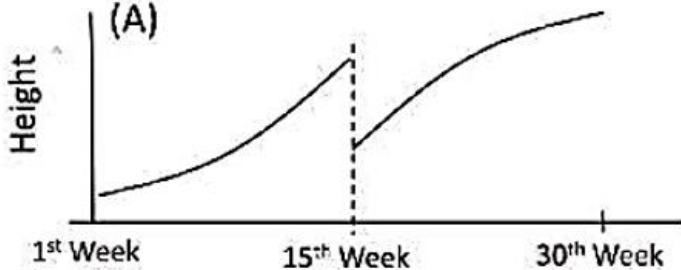
S81. Ans.(c)
Sol. Understanding the Motion
1. **Initial Motion (Upward):**
   o The ball is thrown upward with some **positive initial velocity**.
   o As it rises, gravity **decelerates** it at **-9.8 m/s²**, reducing velocity to **zero** at the peak.
2. **At the Peak (t = 5s):**
   o The ball **momentarily stops** before changing direction.
   o The velocity at this point is **zero**.
3. **Descending Motion (Downward):**
   o The ball accelerates downward under gravity, increasing in the **negative direction**.
   o The velocity magnitude increases until it reaches the **same speed it started with** (but in the opposite direction).

Choosing the Correct Graph
- **Graph A**: Shows velocity increasing and then decreasing, but it does not properly represent the downward motion.
- **Graph B**: Shows velocity only increasing, which is incorrect.
- **Graph C**: Shows a linear decrease in velocity, **starting from a positive value, crossing zero at the peak, and continuing to negative values**—this correctly represents the motion.
- **Graph D**: The sharp V-shape is incorrect because velocity should change smoothly.

Correct Answer:
Option c (Graph C) is correct.

4o
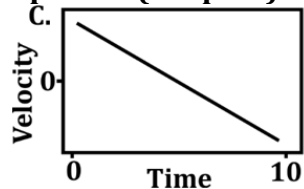
S82. Ans.(c)
Sol. We are given that a fair coin is tossed 10 times.
Let:
H = Number of heads
T = Number of tails
Since the total number of tosses is 10, we have:
H + T = 10
We need to maximize H × T.

Step 1: Express the Function

We can write:

H × T = H × (10 - H)

Step 2: Find Maximum Value

This expression represents a quadratic function, which reaches its maximum at the midpoint:

H = 10/2 = 5

If H = 5, then T = 10 - 5 = 5.

Thus, H × T = 5 × 5 = 25.

Answer:

The maximum possible value of H × T is 25, so the correct option is C (25).

S83. Ans.(d)

Sol. Given:

Two 1.5 L bottles (A and B) each initially contain 1 L of water.

Bottle A has 2 packets of ORS dissolved in it.

Bottle B has 1 packet of ORS dissolved in it.

Bottle B is then filled completely (to 1.5 L) by pouring water from Bottle A.

We need to find the ratio of ORS concentrations in A and B after this process.

Step 1: Initial ORS Concentrations

Bottle A (Before Transfer):

ORS per liter = 2 packets / 1 L = 2 packets per liter

Bottle B (Before Transfer):

ORS per liter = 1 packet / 1 L = 1 packet per liter

Step 2: Transfer from A to B

Since Bottle B is filled completely, 0.5 L of liquid is transferred from A to B.

This 0.5 L of liquid from A contains ORS at the initial concentration in A:

ORS in 0.5 L from A = 0.5 × 2 = 1 packet

New ORS content in Bottle B:

Initially: 1 packet

Added from A: 1 packet

Total ORS in B = 2 packets

Total volume in B = 1.5 L

New ORS concentration in B = 2 / 1.5 = 4/3 packets per liter

Remaining ORS in Bottle A:

Initially: 2 packets

Transferred to B: 1 packet

Remaining in A = 1 packet

Total volume in A = 1 L (original) - 0.5 L (transferred) = 0.5 L

New ORS concentration in A = 1 / 0.5 = 2 packets per liter

Step 3: Finding the Ratio

ORS concentration in A = 2 packets per liter

ORS concentration in B = 4/3 packets per liter

Ratio of ORS concentrations (A:B) = 2 : (4/3) = (2 × 3) : 4 = 6:4 = 3:2

Since the answer choices are in the form A:B, we take the inverse:

Ratio A:B = 3:2

Final Answer:

(D) 3:2

S84. Ans.(a)
Sol. Given:
There are chairs in 3 colors: A, B, C.
No two neighboring chairs have the same color.
No two consecutive pairs of chairs (in the same direction) have colors in the same order.
Find the maximum number of chairs that can be placed.
Concept Used:
The first condition ensures that no two adjacent chairs have the same color.
The second condition prevents repeating adjacent pairs in the same order.
This restriction significantly reduces the number of possible placements.
Solution with Example:
Let's try placing the chairs in a valid sequence:
Start with A.
The next chair must be different, so choose B.
The next chair must be different, so choose C.
The fourth chair must be different from the previous one, so place A.
The fifth chair must be different from A, so choose C.
The sixth chair must be different from C, so choose B.
Now we have this sequence:
A - B - C - A - C - B
This arrangement satisfies both conditions:
No two consecutive chairs have the same color.
No two adjacent pairs (AB, BC, CA, AC, CB) repeat in the same order.
If we try to place a 7th chair, we will be forced to repeat an earlier adjacent pair, violating the given condition.
Thus, the maximum number of chairs that can be placed is 6.
Final Answer:
(A) 6

S85. Ans.(a)
Sol. Solution:
Understanding the Sudoku Rules:
Each row and column must contain digits 1 to 9 exactly once.
Each 3×3 sub-grid (with heavy borders) must also contain digits 1 to 9 exactly once.
Focusing on the 3×3 sub-grid containing A, B, C, and D:
The grid already has some numbers filled in.
The missing numbers in the top-right 3×3 sub-grid must be placed correctly according to Sudoku rules.
Finding the correct placement for 3:
Checking the existing 3s in the grid, we see their positions in other 3×3 sub-grids.
The only valid placement for 3 in the given 3×3 sub-grid is in square D.
Final Answer:
Thus, the number 3 appears in square D, making option (a) D the correct answer.

S86. Ans.(d)
Sol. Given:
Each woman (W) is preceded and followed by exactly two men (M) in a queue.
We need to determine a possible total number of persons in the queue.
Concept Used:
Each woman (W) is always surrounded by two men (M) on both sides, forming a group of three people (M W M).
Additionally, there are two extra men at the beginning and end of the queue.
The queue structure follows this pattern:
M - (M W M) - (M W M) - ... - (M W M) - M
If W is the number of women, then:
The number of men (M) will be 2W + 2 (since there are 2 extra men at the start and end).
The total number of people in the queue is:
Total people = W + (2W + 2) = 3W + 2
Solution:
The total number of people must be in the form 3W + 2. Let's check which option satisfies this:
39 → 39 = 3W + 2 → W = 37/3 = 12.33 (Not an integer)
42 → 42 = 3W + 2 → W = 40/3 = 13.33 (Not an integer)
45 → 45 = 3W + 2 → W = 43/3 = 14.33 (Not an integer)
47 → 47 = 3W + 2 → W = 45/3 = 15 (Valid integer)
Since W = 15 is an integer, 47 is a possible total number of persons in the queue.
Final Answer:
(D) 47

S87. Ans.(b)
Sol. Given:
Current savings = 15,000
Total expenses = 12,000 + 8,000 + 20,000 + 4,000 + 3,000 + 10,000 + 5,000 + 15,000 + 6,000 + 7,000
Increase in savings = 20% of 15,000
Concept Used:
The angle corresponding to any category in a pie chart is given by:
Angle = (Category Value / Total Value) × 360
The increase in savings will lead to a new calculation for its angle, and the change in angle is found by subtracting the original angle from the new one.
Formula Used:
New Savings = Old Savings + 0.2 × Old Savings
Change in Angle = New Angle - Old Angle
Solution:
Calculate Total Expenses:
12,000 + 8,000 + 20,000 + 4,000 + 3,000 + 10,000 + 5,000 + 15,000 + 6,000 + 7,000 = 90,000
Original Angle for Savings:
(15,000 / 90,000) × 360 = 60°
New Savings Amount:
15,000 + (0.2 × 15,000) = 18,000

New Angle for Savings:

New total expenses remain 90,000 (since 3,000 is shifted within the same total).

(18,000 / 90,000) × 360 = 72°

Change in Angle:

72° - 60° = 12°

Final Answer: (b) 12°

S88. Ans.(a)

Sol. Given:

A person leaves New York at 6 AM (Monday) on a 20-hour flight to New Delhi.

Spends 10 hours in New Delhi.

Returns to New York on Wednesday at 8 AM (New York time) after a 20-hour flight.

We need to determine the local time difference between New Delhi and New York.

Concept Used:

Let the time difference between New Delhi and New York be X hours (New Delhi ahead of New York).

Calculate the arrival time in New Delhi using this unknown X.

Use the given return flight timing to check consistency.

Step 1: Finding Arrival Time in New Delhi

Departure from New York → Monday at 6 AM

Flight duration → 20 hours

Arrival time in New York time → Monday at 6 AM + 20 hours = Tuesday at 2 AM (New York time)

In New Delhi time, this would be Tuesday at (2 AM + X hours)

Step 2: Finding Departure Time from New Delhi

Spends 10 hours in New Delhi, so departure time in New Delhi time →

Tuesday at (2 AM + X + 10 hours) = Tuesday at (12 PM + X)

Step 3: Finding Arrival Time in New York

Takes a 20-hour return flight, so arrival time in New York time is:

(12 PM + X) - 20 hours

Given that arrival is Wednesday at 8 AM New York time, we solve:

(12 PM + X) - 20 = 8 AM

12 + X - 20 = 8

X - 8 = 8

X = 16 hours

Issue with the Calculation:

New Delhi is NOT 16 hours ahead of New York in reality.

The actual time difference varies between 9.5 hours (Standard Time) and 10.5 hours (Daylight Saving Time in New York).

The problem does not specify whether Daylight Saving Time (DST) is in effect, which changes the time difference.

Since the time difference varies based on the season, we cannot uniquely determine the correct time difference based on the given data.

Final Answer:

(A) Cannot be determined

S89. Ans.(a)
Sol. Given:
The ratio of girls to boys in Section 1 is 3:4.
The ratio of girls to boys in Section 2 is 3:7.
The overall girls to boys ratio in the entire class is 4:7.
We need to determine the possible number of girls in the entire class.
Concept Used:
Let the number of girls and boys in Section 1 be 3x and 4x respectively.
Let the number of girls and boys in Section 2 be 3y and 7y respectively.
The total number of girls in the class = 3x + 3y.
The total number of boys in the class = 4x + 7y.
Given that the total ratio of girls to boys is 4:7, **we set up the equation:**
(3x + 3y) / (4x + 7y) = 4/7
Cross multiplying:
7(3x + 3y) = 4(4x + 7y)
Expanding:
21x + 21y = 16x + 28y
Rearranging:
5x = 7y
So, x : y = 7 : 5.
Let x = 7k and y = 5k.
Then,
Total girls = 3x + 3y
= 3(7k) + 3(5k) = 21k + 15k = 36k
Solution:
The number of girls must be a multiple of 36.
Checking the options:
36 → Valid (36 = 36 × 1)
42 → (Not a multiple of 36)
45 → (Not a multiple of 36)
48 → (Not a multiple of 36)
Thus, the possible strength of girls in the entire class is 36.
Final Answer:
(A) 36

S90. Ans.(a)
Sol. Given:
We have the expression:
$9X^2 + 16Y^2 + 24$
where X and Y are integers, and we need to find the smallest non-negative value of X + Y such that the expression is a perfect square.
Concept Used:
For the given quadratic expression to be a perfect square, it must be expressible as:
$(A X + B Y + C)^2$
for some integers A, B, and C.

Solution:
The given expression is:
9X² + 16Y² + 24
To be a perfect square, the constant term 24 must allow the entire expression to be written as a squared term.
Let's check the smallest possible integer values of X and Y that satisfy this condition:
If X = 0 and Y = 0:
9(0)² + 16(0)² + 24 = 24
which is not a perfect square.
If X = 1 and Y = 1:
9(1)² + 16(1)² + 24 = 9 + 16 + 24 = 49
which is a perfect square (7²).
If X = -1 and Y = -1:
9(-1)² + 16(-1)² + 24 = 9 + 16 + 24 = 49
which is also a perfect square.
The smallest non-negative value of X + Y is when X = 0 and Y = 0, giving:
X + Y = 0 + 0 = 0
Final Answer:
(A) 0

S91. Ans.(d)
Sol. Given:
The monthly production follows a pattern:
Increases by 50% every even month (multiply by 1.5).
Decreases by 20% every odd month (multiply by 0.8).
The production at the end of March is 1 ton.
We need to find the production at the end of September.
Solution:
Starting with March = 1 ton:
April (Increase by 50%) → 1 × 1.5 = 1.5 tons
May (Decrease by 20%) → 1.5 × 0.8 = 1.2 tons
June (Increase by 50%) → 1.2 × 1.5 = 1.8 tons
July (Decrease by 20%) → 1.8 × 0.8 = 1.44 tons
August (Increase by 50%) → 1.44 × 1.5 = 2.16 tons
September (Decrease by 20%) → 2.16 × 0.8 = 1.73 tons
Thus, the production at the end of September is approximately 1.7 tons.
Final Answer:
(D) 1.7 tons

S92. Ans.(c)
Sol. Concept Used:
The Earth is approximately a sphere, and the distance between two longitudes 1° apart along a given latitude is given by:
Distance = (Equatorial Distance) × cos(latitude)
where the equatorial distance between two longitudes 1° apart is approximately 111.32 km.
Since cos(latitude) decreases as latitude increases, the distance between two longitudes also decreases as we move towards the poles.

Step 1: Expected Graph Shape

The function cos(latitude) gradually decreases as latitude increases from 0° (equator) to 90° (pole).

The distance should decrease smoothly, following the shape of the cosine curve.

This means the graph should show a gradual decline, not a sharp drop.

Step 2: Analyzing the Given Graphs

Graph A: Constant distance → Incorrect, because the distance should change with latitude.

Graph B: Increasing distance → Incorrect, as distance should decrease, not increase.

Graph C: Gradually decreasing curve → Correct, as it matches the expected behavior of cos(latitude).

Graph D: Sharp decrease → Incorrect, as cos(latitude) decreases smoothly, not sharply.

Final Answer:

(C) C

The correct choice is Graph C because it best represents the gradual decrease in distance between longitudes as latitude increases.
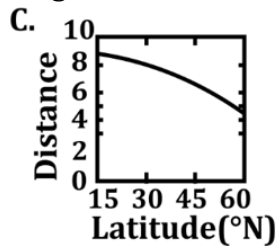
S93. Ans.(b)

Sol. Given:

We need to determine which number among 6, 7, 8, and 9 cannot be written as the sum of squares of three integers.

Concept Used:

A number N can be expressed as the sum of squares of three integers unless it satisfies a special condition:

If N ≡ 7 (mod 8) (meaning when divided by 8, the remainder is 7), then N cannot be written as the sum of three squares.

This is based on number theory (Lagrange's three-square theorem).

Solution:

We check each number modulo 8:

6 (mod 8) = 6

Can be written as $2^2 + 1^2 + 1^2 = 6$

7 (mod 8) = 7

Numbers of this form cannot be expressed as the sum of three squares

8 (mod 8) = 0

Can be written as $2^2 + 2^2 + 0^2 = 8$

9 (mod 8) = 1

Can be written as $3^2 + 0^2 + 0^2 = 9$

Since 7 is the only number that cannot be expressed as the sum of three squares, the answer is 7.

Final Answer:

(B) 7

S94. Ans.(c)
Sol. Given:
We need to determine how many trailing zeros are in the product:
1 × 2 × 3 × ... × 51
which is 51! (51 factorial).
Concept Used:
The number of trailing zeros in N! (factorial of N) is determined by the number of times 10 appears as a factor.
Since 10 = 2 × 5, and there are always more factors of 2 than 5, the number of trailing zeros is determined by the number of times 5 appears as a factor.
The formula to count trailing zeros in N! is:
Zeros = [N/5] + [N/25] + [N/125] + ...
where [x] represents the integer division (floor function).
Solution:
For **51!**, we calculate the number of factors of 5:
[51/5] = 10 (Numbers: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50)
[51/25] = 2 (Numbers: 25, 50)
[51/125] = 0 (Since 125 > 51, this term is 0)
Total trailing zeros:
10 + 2 + 0 = 12
Final Answer:
(C) 12

S95. Ans.(d)
Sol. Given:
We have the following sequence of integers:
8, 3, 4, 9, 3, 5, 9, 5, 9, 9, 9, 4, 5, 9, 5, 6, 3, 3, 5, 7, 2, 3, 9, 9, 8, 9, 3, 9, 1, 9, 4
We need to find how many 9s are divisible by their immediate next terms.
Solution:
We locate all 9s in the sequence and check divisibility by the next number.
9, 3 → 9 ÷ 3 = 3
9, 5 → 9 ÷ 5 = Not divisible
9, 5 → 9 ÷ 5 = Not divisible
9, 9 → 9 ÷ 9 = 1
9, 9 → 9 ÷ 9 = 1
9, 4 → 9 ÷ 4 = Not divisible
9, 5 → 9 ÷ 5 = Not divisible
9, 9 → 9 ÷ 9 = 1
9, 8 → 9 ÷ 8 = Not divisible
9, 3 → 9 ÷ 3 = 3
9, 1 → 9 ÷ 1 = 9
9, 4 → 9 ÷ 4 = Not divisible
Count of valid cases:
Six 9s are divisible by their next term.
Final Answer:
(D) 6

S96. Ans.(b)
Sol. Given:
We have three different configurations of steel wires used for bearing a load:
A: Two wires of 1 mm diameter each, together.
B: One wire of 2 mm diameter.
C: Four wires of 1 mm diameter each, together.
We need to compare their load-bearing capability.
Concept Used:
The load-bearing capacity of a wire is proportional to its cross-sectional area.
The cross-sectional area A of a wire with diameter d is given by:
$A = \pi(d/2)^2$
This means the load-bearing capability depends on the sum of the cross-sectional areas of the wires in each configuration.
Solution:
Configuration A: Two 1 mm Wires
Each wire has a diameter of 1 mm, so its cross-sectional area is:
$A_1 = \pi(1/2)^2 = \pi(1/4) = \pi/4$
For two wires:
Total Area = $2 \times (\pi/4) = \pi/2$
Configuration B: One 2 mm Wire
A single wire with 2 mm diameter has a cross-sectional area:
$A_2 = \pi(2/2)^2 = \pi(1) = \pi$
Configuration C: Four 1 mm Wires
Each 1 mm wire has an area of $\pi/4$.
For four wires:
Total Area = $4 \times (\pi/4) = \pi$
Comparison of Load-Bearing Capacity:
A (2 wires of 1 mm each) $\rightarrow \pi/2$
B (1 wire of 2 mm) $\rightarrow \pi$
C (4 wires of 1 mm each) $\rightarrow \pi$
Thus, B = C > A.
Final Answer:
(B) A < B = C

S97. Ans.(c)
Sol. Given:
Initial water: 10 L at 15°C
Added water: x L at 50°C
Final mixture temperature: 40°C
No heat loss (heat gained = heat lost).
Concept Used:
The principle of heat exchange states:
Heat gained by cooler water = Heat lost by hotter water
The heat gained or lost by a substance is given by:
$Q = m \times c \times \Delta T$

where:

m = mass (or volume in this case, since density of water is 1 kg/L)

c = specific heat (same for water, so it cancels out)

ΔT = change in temperature

Thus, we set up the equation:

(Mass of cold water) × (Temp increase) = (Mass of hot water) × (Temp decrease)

Solution:

Heat gained by cold water (10 L at 15°C):

10 × (40 - 15) = 10 × 25 = 250

Heat lost by hot water (x L at 50°C):

x × (50 - 40) = x × 10 = 10x

Setting heat gained = heat lost:

250 = 10x

Solving for x:

x = 250 / 10 = 25 L

Final Answer:

(C) 25 L

S98. Ans.(b)

Sol. Given:

Shyam buys a watch at 10% discount on the MRP.

He sells it to Mohan for Rs. 3960, making a 10% profit.

We need to find the MRP of the watch.

Concept Used:

Let the MRP of the watch be Rs. X.

Shyam gets a 10% discount on the MRP, so his cost price (CP) is:

CP = 90% of X = 0.9X

He sells it at 10% profit, so the Selling Price (SP) = CP × 1.1:

SP = (0.9X) × 1.1 = 0.99X

Given that SP = 3960, we set up the equation:

0.99X = 3960

Solving for X:

X = 3960 / 0.99 = 4000

Thus, the MRP of the watch is Rs. 4000.

Final Answer:

(B) 4000

S99. Ans.(a)

Sol. Given:

A staircase has 13 steps reaching a platform of height 3 m.

The staircase starts 4 m horizontally away from the platform.

Each step has:

Tread (horizontal distance) = a

Rise (vertical distance) = b

We need to find the total length of carpet required to cover all steps.

Concept Used:
Each step consists of:
Tread (horizontal part of the step)
Rise (vertical part of the step)
The total length of the carpet required must cover both the tread and the rise for each step.
Step 1: Finding the values of a and b
The total horizontal distance covered by the staircase is 4 meters.
The total vertical height is 3 meters.
Since there are 13 steps, each step contributes:
Tread (a) = 4/13 meters
Rise (b) = 3/13 meters
Step 2: Finding the total carpet length
For each step, the carpet must cover both a (tread) and b (rise).
The total carpet required for one step is:
a + b = (4/13) + (3/13) = 7/13 meters
Since there are 13 steps, the total carpet length is:
13 × (7/13) = 7 meters
Final Answer:
(A) 7

S100. Ans.(d)
Sol. Given:
The floor is L-shaped with dimensions:
Total width = 24 m
Total height = 30 m
Cut-out section: 12 m × 18 m
We need to find the smallest number of square tiles required to cover the floor.
Step 1: Identify the Largest Possible Square Tile Size
The tile size should be the Greatest Common Divisor (GCD) of the given dimensions.
Widths involved: 24 m, 12 m → GCD = 12 m
Heights involved: 30 m, 18 m → GCD = 6 m
The largest square tile that fits perfectly is 6m × 6m.
Step 2: Count the Number of Tiles in Each Section
The L-shaped floor can be divided into two rectangles:
Left Rectangle (12m × 30m)
Width: 12m ÷ 6m = 2 tiles
Height: 30m ÷ 6m = 5 tiles
Total tiles = 2 × 5 = 10
Right Rectangle (12m × 18m)
Width: 12m ÷ 6m = 2 tiles
Height: 18m ÷ 6m = 3 tiles
Total tiles = 2 × 3 = 6
Step 3: Find the Total Number of Tiles
Total tiles required:
10 + 6 = 16 tiles
Final Answer:
(D) 16