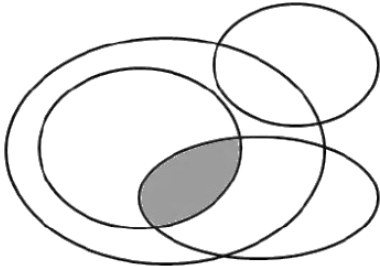# CSIR NET General Aptitude Questions Answers With Solutions

Q1. 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

Q2. 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

Q3. 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.

Q4. 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

Q5. 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?
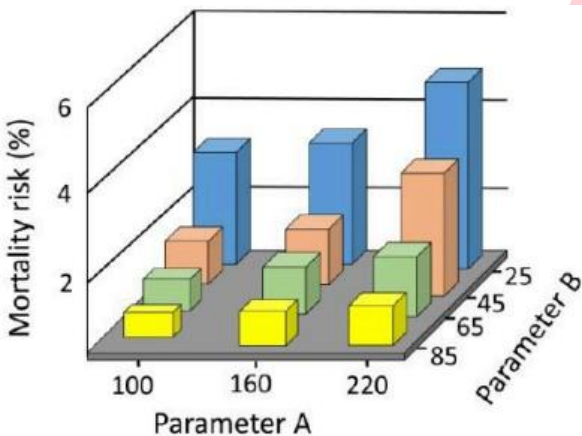(a) 24
(b) 36
(c) 72
(d) 144

Q6. The graph shows the distribution of lifespan (in years) for individuals from species 1 and species 2
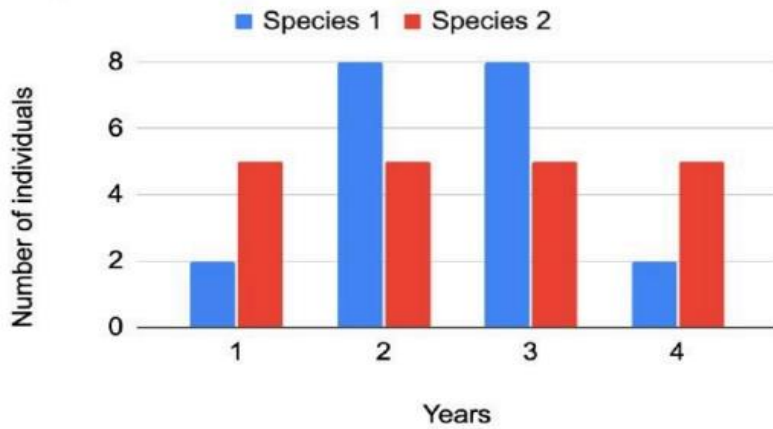
If μ and σ represent mean and standard deviation of the lifespan, respectively, then, which of the following statements is true?

(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) $\mu_1 = \mu_2 ; \sigma_1 < \sigma_2$

Q7. 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

Q8. 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

Q9. 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

Q10. 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

Q11. 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

Q12. The following spider diagram shows the marks obtained (out of 10) by three students in five tests.
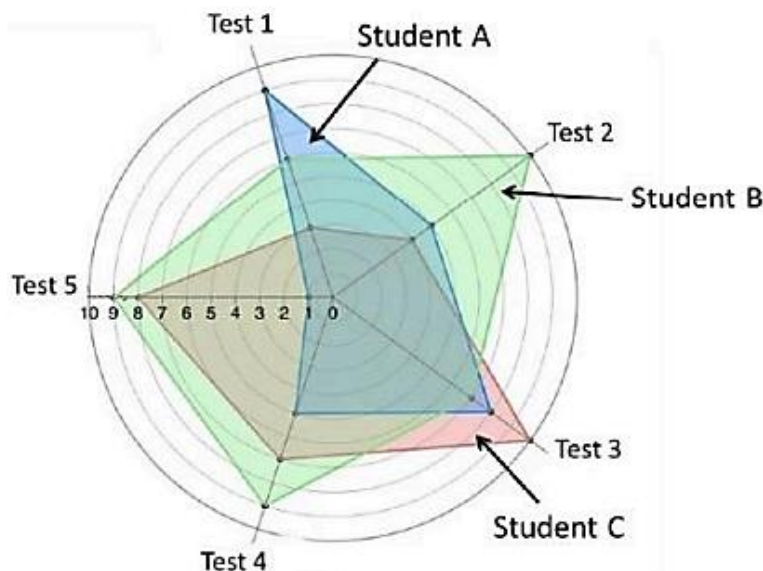
Which one of the following is INCORRECT?
(a) A scored more than C in total
(b) B scored the highest in total
(c) A never scored 10 marks in a test
(d) In Test 5, the combined marks of A and C are equal to the marks of B.

Q13. How many integers can divide 1184 leaving a remainder of 29?
(a) 8
(b) 5
(c) 7
(d) 9

Q14. 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

Q15. 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

Q16. The speed of a car travelling with variable acceleration along a straight line is shown in the figure.
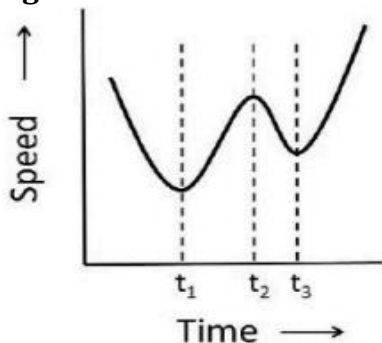
If a_1, a_2, a_3 are the accelerations at times t_1, t_2, t_3 respectively, then
(a) $a_1 = a_2 = a_3$
(b) $a_1 > a_2 > a_3$
(c) $a_2 > a_3 > a_1$
(d) $a_3 > a_2 > a_1$

Q17. 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

Q18. 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

Q19. 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

Q20. 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

Solutions

S1. 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.

S2. Ans.(c)

Sol. Steps to Solve:

1. **Chessboard details:**
   - The chessboard has 8 rows and 8 columns, forming 64 squares.
   - Each square has a side length of 5 cm.
2. **Internal edges:**
   - In each row, there are 7 internal edges (spaces between the squares).
   - There are 8 rows, so the total horizontal edges = 7 × 8 = 56.
   - 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.

S3. 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:**
   - Total marks of boys = 69b.
   - Total marks of girls = 72g.
   - 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:

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

$2g = b$.

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, $b = 2g$.
- **(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.

S4. Ans.(c)

Sol. Given:

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

Formula Used:

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

Solution:

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

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

Approximate $\pi \approx 3.14$: $s = \left(\frac{4}{3} \times 3.14 \times a^3\right)^{\frac{1}{3}}$

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

Take the cube root: s ≈ 1.6a

Final Answer:

The side length of the cube is approximately 1.6a.

Correct Option: (c) 1.6a

S5. 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:

$$\text{Number of cubes} = \frac{\text{Total area of sheet}}{\text{Surface area of one cube}}$$

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

S6. Ans.(d)

Sol. Observations from the Graph:

Step 1: **Mean ($\mu\backslash mu\mu$)**

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 ($\mu 1\backslash mu\_1\mu 1$):

The mean is calculated using the formula:

$\mu=\sum(x\cdot f)\sum f\mu=\sum f\sum(x\cdot f)$

For Species 1:

$\mu 1=(1\cdot 2)+(2\cdot 8)+(3\cdot 8)+(4\cdot 2)2+8+8+2\mu 1=5020=2.5\mu 1=2+8+8+2(1\cdot 2)+(2\cdot 8)+(3\cdot 8)+(4\cdot 2)$ $\mu 1=2050=2.5$

Species 2:

Updated frequencies for $f=5,5,5,5f = 5, 5, 5, 5f = 5,5,5,5$:

$\mu 2=(1\cdot 5)+(2\cdot 5)+(3\cdot 5)+(4\cdot 5)5+5+5+5\mu 2=5020=2.5\mu 2=5+5+5+5(1\cdot 5)+(2\cdot 5)+(3\cdot 5)+(4\cdot 5)$ $\mu 2=2050=2.5$

Thus, the mean lifespan for both species is the same:

$\mu 1=\mu 2=2.5\mu 1=\mu 2=2.5$

Step 2: **Standard Deviation ($\sigma\backslash sigma\sigma$)**

The standard deviation formula is:

$\sigma=\sum f\cdot(x-\mu)2\sum f\sigma=\sum f\sum f\cdot(x-\mu)2$

For Species 1:

$\sigma 1=(2\cdot(1-2.5)2)+(8\cdot(2-2.5)2)+(8\cdot(3-2.5)2)+(2\cdot(4-2.5)2)20\sigma 1=1320=0.65\approx 0.81\sigma 1$ $=20(2\cdot(1-2.5)2)+(8\cdot(2-2.5)2)+(8\cdot(3-2.5)2)+(2\cdot(4-2.5)2)$ $\sigma 1=2013=0.65\approx 0.81$

For Species 2:

$\sigma 2=(5\cdot(1-2.5)2)+(5\cdot(2-2.5)2)+(5\cdot(3-2.5)2)+(5\cdot(4-2.5)2)20\sigma 2=2520=1.25\approx 1.12\sigma 2$ $=20(5\cdot(1-2.5)2)+(5\cdot(2-2.5)2)+(5\cdot(3-2.5)2)+(5\cdot(4-2.5)2)$ $\sigma 2=2025=1.25\approx 1.12$

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

$\sigma 1<\sigma 2\sigma 1<\sigma 2$

Final Answer:

The correct option is (d):$\mu 1=\mu 2;\sigma 1<\sigma 2\mu 1=\mu 2;\sigma 1<\sigma 2$

S7. 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."

S8. 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**.

S9. 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.

S10. 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.

S11. 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.

S12. 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.

S13. 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**:

   $1155 = 3 \times 5 \times 7 \times 11$.

2. **Find the Total Divisors**:

   The total number of divisors is calculated by adding 1 to each exponent in the prime factorization and multiplying:

   $(1+1)(1+1)(1+1)(1+1) = 16$.

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.

S14. 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.

S15. 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**:
   - Half the population is male, and half is female.
   - Each female has two X chromosomes.
   - Each male has one X chromosome.
2. The total X chromosomes in the population are distributed as:
   - Two-thirds of X chromosomes come from females (since each female contributes 2 X chromosomes).
   - One-third of X chromosomes come from males (since each male contributes 1 X chromosome).

Solution:

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

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

Final Answer:

(c) 2/3.

S16. Ans.(a)

Sol. Reanalysis of the Graph:

From the given **speed vs. time graph**:

1. **At t_1**:
   - The slope of the graph at t_1 is **zero** (the curve is flat at its lowest point).
   - Therefore, $a_1 = 0$.
2. **At t_2**:
   - The slope of the graph at t_2 is **zero** (the curve is flat at its highest point).
   - Therefore, $a_2 = 0$.

3. **At t₃:**
   - o The slope of the graph at t₃ is **zero** (the curve is flat again).
   - o Therefore, a₃ = 0.

Conclusion:

The accelerations at all three points are equal, meaning a₁ = a₂ = a₃.

Final Answer:

(a) a₁= a₂= a₃.

S17. 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**.

S18. 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:Cquarter=14×2πr=πr2Cquarter=41×2πr=2πr

Distance traveled by the inner wheels (quarter-circle):Dinner=πr2Dinner=2πr

Distance traveled by the outer wheels (quarter-circle):Douter=π(r+2)2Douter=2π(r+2)

Difference in distances:Difference=Douter−DinnerDifference=Douter−Dinner

Difference=π(r+2)2−πr2Difference=2π(r+2)−2πr

Difference=πr2+2π2−πr2=2π2=πDifference=2πr+22π−2πr=22π=π

Final Answer:

(c) π.

S19. 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 cAc_AcA (outer ring) and cBc_BcB (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: cA<cBc_A < c_BcA<cB**

   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: cA=cBc_A = c_BcA=cB**

   o Both rings expand equally.

   o The **gap remains the same**, as the growth in their diameters is identical.

3. **Case 3: cA>cBc_A > c_BcA>cB**

   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 **cA<cBc_A < c_BcA<cB**, the **gap will decrease**, which matches statement A.

Final Answer:

(a) Only A.

S20. 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:
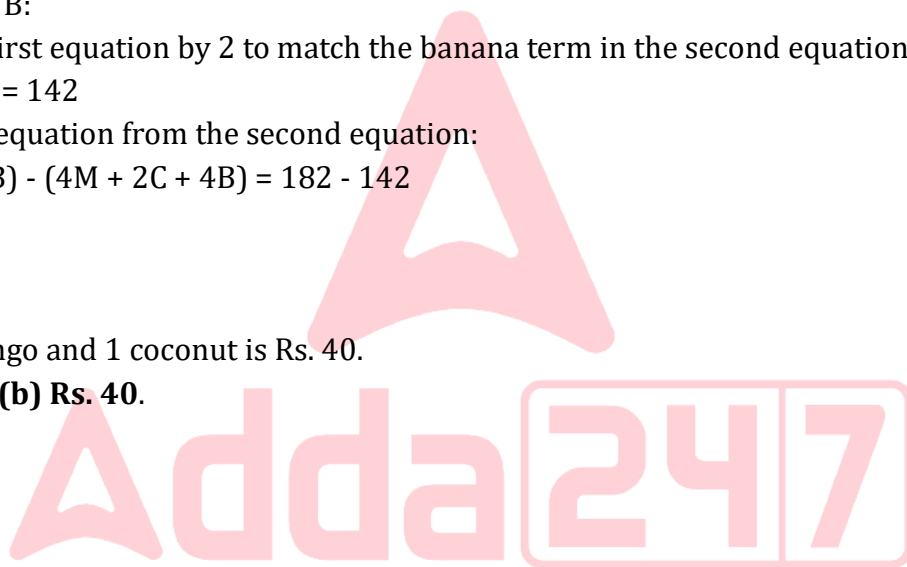 $(5M + 3C + 4B) - (4M + 2C + 4B) = 182 - 142$

Simplify:
$M + C = 40$

Final Answer:
The cost of 1 mango and 1 coconut is Rs. 40.
Correct Option: (b) Rs. 40.