CAT 2025 Slot 2 QA Question Paper with Solutions

Time Allowed :40 Minutes	**Maximum Marks :**66	**Total Questions :**22

General Instructions

Read the following instructions very carefully:

1. The total duration of the QA section is **40 minutes**.
2. Each correct answer carries **+3 marks**.
3. For multiple-choice questions (MCQs), **−1 mark** will be deducted for each wrong answer.
4. There is **no negative marking** for Type-in-the-Answer (TITA) questions.
5. Once the allotted time for a section ends, you will automatically move to the next section. You cannot go back to a previous section.
6. All answers must be entered on the computer screen using the mouse and keyboard. Rough sheets will be provided.
7. The use of calculators, mobile phones, or any other electronic device is strictly prohibited. An on-screen basic calculator will be provided.

1. A and B can complete a work in 12 days and 18 days respectively. They start together, but A leaves after 4 days. How many more days will B take to finish the remaining work?
(A) 6 days
(B) 8 days
(C) 10 days
(D) 12 days
Correct Answer: (B) 8 days

Solution:
Step 1: Determine the efficiency of A and B.

Let the total work be the LCM of 12 and 18, which is 36 units.

Efficiency of A $= \frac{36}{12} = 3$ units/day.

Efficiency of B $= \frac{36}{18} = 2$ units/day.

Combined efficiency $= 3 + 2 = 5$ units/day.

Step 2: Calculate the work done before A leaves.

They work together for 4 days.

Work done in 4 days = 5 units/day $\times$ 4 days = 20 units.

Step 3: Calculate the remaining work.

Remaining Work = Total Work - Work Done.

Remaining Work = $36 - 20 = 16$ units.

Step 4: Calculate the time taken by B to finish the remaining work.

B works alone on the remaining 16 units with an efficiency of 2 units/day.

Time taken = $\frac{16}{2} = 8$ days.

Conclusion:

B will take 8 more days to finish the work.

> Quick Tip
>
> Using the LCM method (Total Units of Work) is often faster and less prone to fraction errors than the $1/x$ method for time and work problems.

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2. N is a 3-digit number with non-zero digits. No digit is a perfect square and only 1 of the digits is a prime number. What is the number of factors of the smallest such number possible?

(A) 6

(B) 8

(C) 9

(D) 12

Correct Answer: (B) 8

Solution:

Step 1: Identify the allowed set of digits.

The digits must be non-zero: $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$.

The digits cannot be perfect squares. Perfect squares are $1(1^2)$, $4(2^2)$, and $9(3^2)$.

Removing these, the allowed digits are $\{2, 3, 5, 6, 7, 8\}$.

Step 2: Classify the allowed digits as Prime or Composite.

Primes: $\{2, 3, 5, 7\}$.

Non-Primes (Composites): $\{6, 8\}$.

Step 3: Construct the smallest number N.

We need a 3-digit number N such that exactly one digit is Prime and the other two are Non-Primes. To find the smallest number, we prioritize the smallest digits for the leftmost positions (hundreds place).

Try starting with the smallest allowed digit, 2:

Digit $1 = 2$. (This is a Prime).

Since we need "only 1" prime digit, the remaining two digits must be Non-Primes.

The available Non-Primes are $\{6, 8\}$. To minimize the number, we choose the smallest available value for both remaining positions.

Digit $2 = 6$.

Digit $3 = 6$.

Resulting Number $N = 266$.

Check: 2 is Prime. 6 is not Prime. 6 is not Prime. No digit is a square. Condition satisfied.

(Note: Any number starting with a non-prime, like 6, would be at least 600, which is greater than 266).

Step 4: Find the number of factors of 266.

Find the prime factorization of 266:

$266 = 2 \times 133$.

$133 = 7 \times 19$.

So, $266 = 2^1 \times 7^1 \times 19^1$.

The number of factors is calculated by adding 1 to each exponent and multiplying them:

Number of factors $= (1 + 1)(1 + 1)(1 + 1)$.

Number of factors $= 2 \times 2 \times 2 = 8$.

> Quick Tip
>
> When minimizing a number based on digit properties, always fill the most significant places (leftmost) with the smallest valid digits first. Don't forget that 1 is a perfect square!

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3. If the quadratic equation $ax^2+bx+c = 0$ has roots that differ by 4, and $a+b+c = 12$, what is the value of $b^2 - 4ac$?

(A) 12

(B) 16

(C) 20

(D) 24

Correct Answer: (B) 16

Solution:
Step 1: Relate the difference of roots to the discriminant.

Let the roots of the quadratic equation be α and β.

The difference of the roots is given by the formula $|\alpha - \beta| = \frac{\sqrt{D}}{|a|}$, where $D = b^2 - 4ac$ is the discriminant.

Given that the difference is 4, we have:

$\frac{\sqrt{b^2-4ac}}{a} = 4$.

Step 2: Express the discriminant in terms of a.

Squaring both sides of the equation:

$\frac{b^2-4ac}{a^2} = 16$

$b^2 - 4ac = 16a^2$.

Step 3: Determine the value of a.

This problem implies integer coefficients (a standard constraint in such number theory/algebra problems to obtain a unique solution).

Substitute $c = 12 - a - b$ into the discriminant equation:

$b^2 - 4a(12 - a - b) = 16a^2$

$b^2 - 48a + 4a^2 + 4ab - 16a^2 = 0$

$b^2 + 4ab - 12a^2 - 48a = 0$.

Solving for b to be an integer requires the discriminant of this new quadratic (in terms of b) to be a perfect square.

$\Delta_b = (4a)^2 - 4(1)(-12a^2 - 48a) = 16a^2 + 48a^2 + 192a = 64a^2 + 192a$.

For $a = 1$, $\Delta_b = 64 + 192 = 256 = 16^2$, which is a perfect square. This yields integer values for b and c. (e.g., if $a = 1$, $b = 6, c = 5$ or $b = -10, c = 21$).

For other small integers (like $a = 2, 3$), we do not get integer solutions.

Thus, taking $a = 1$:

$b^2 - 4ac = 16(1)^2 = 16$.

Conclusion:

The value of the discriminant $b^2 - 4ac$ is 16.

Quick Tip

The difference of roots formula $|\alpha - \beta| = \frac{\sqrt{D}}{a}$ is a powerful tool. In problems asking for a specific numerical value with variable coefficients, checking the simplest integer case (usually $a = 1$) often leads directly to the answer.

4. A number when divided by 7 leaves a remainder 4 and when divided by 9 leaves a remainder 5. What is the smallest such number greater than 100?
(A) 148
(B) 158
(C) 163
(D) 191
Correct Answer: (B) 158

Solution:
Step 1: Set up the modular arithmetic equations.

Let the number be N.

Condition 1: $N \equiv 4 \pmod 7 \implies N = 7a + 4$ for some integer a.

Condition 2: $N \equiv 5 \pmod 9 \implies N = 9b + 5$ for some integer b.

Step 2: Equate the expressions and solve for the smallest positive N.

$7a + 4 = 9b + 5$

$7a = 9b + 1.$

We look for the smallest integer $b \geq 0$ such that $9b + 1$ is divisible by 7.

Test values for b:
If $b = 1, 9(1) + 1 = 10$ (Not divisible by 7).
If $b = 2, 9(2) + 1 = 19$ (Not divisible by 7).
If $b = 3, 9(3) + 1 = 28$. Since $28 \div 7 = 4$, this works.

Substitute $b = 3$ back into the equation for N:

$N = 9(3) + 5 = 27 + 5 = 32.$

So, 32 is the smallest number satisfying both conditions.

Step 3: Find the general form of the number.

Since 7 and 9 are coprime, the solutions repeat every $\text{LCM}(7, 9) = 63$.

General Form: $N_k = 32 + 63k$, where k is a non-negative integer.

Step 4: Find the smallest value greater than 100.

For $k = 0, N = 32$.

For $k = 1, N = 32 + 63 = 95$.

For $k = 2, N = 32 + 126 = 158$.

Since $158 > 100$, this is the required number.

Quick Tip

When solving remainder problems with two divisors d_1 and d_2, find the first number that satisfies both conditions by trial and error. The general solution is simply "First Number + $k \times \text{LCM}(d_1, d_2)$".

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5. In a triangle ABC, the sides are in the ratio 3 : 4 : 5. If the area of the triangle is 96 sq units, what is its perimeter?
(A) 40
(B) 48
(C) 50
(D) 60
Correct Answer: (B) 48

Solution:
Step 1: Identify the type of triangle.

The ratio of the sides is 3 : 4 : 5.

Since $3^2 + 4^2 = 9 + 16 = 25 = 5^2$, this satisfies the Pythagorean theorem.

Therefore, the triangle is a right-angled triangle.

Step 2: Define the sides in terms of a variable x.

Let the legs of the right-angled triangle be $3x$ and $4x$.

Let the hypotenuse be $5x$.

Step 3: Use the area formula to solve for x.

Area of a right-angled triangle $= \frac{1}{2} \times \text{base} \times \text{height}$.

$96 = \frac{1}{2} \times (3x) \times (4x)$.

$96 = 6x^2$.

$x^2 = \frac{96}{6} = 16.$

$x = 4.$

Step 4: Calculate the perimeter.

Perimeter = Sum of the three sides.

Perimeter $= 3x + 4x + 5x = 12x$.

Substitute $x = 4$:

Perimeter $= 12 \times 4 = 48$ units.

> Quick Tip
>
> Recognizing Pythagorean triples (like 3-4-5, 5-12-13, 8-15-17) instantly tells you the triangle is right-angled, allowing you to use the simple area formula Area $= \frac{1}{2} \times \text{leg}_1 \times \text{leg}_2$.

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6. Using digits 1 to 6 (each at most once), how many 4-digit numbers can be formed that are divisible by 4?

(A) 72

(B) 84

(C) 96

(D) 108

Correct Answer: (C) 96

Solution:
Step 1: Identify the condition for divisibility by 4.

A number is divisible by 4 if the number formed by its last two digits is divisible by 4.

The available digits are $\{1, 2, 3, 4, 5, 6\}$, and repetition is not allowed.

Step 2: List all valid pairs for the last two digits.

We need to find pairs (d_3, d_4) such that the number d_3d_4 is a multiple of 4, using distinct digits from the set.

- Starting with 1: 12, 16.
- Starting with 2: 24 (28 is not possible).
- Starting with 3: 32, 36.
- Starting with 4: (44 is not allowed due to no repetition, 48 not possible).
- Starting with 5: 52, 56.
- Starting with 6: 64.

The valid pairs are: $\{12, 16, 24, 32, 36, 52, 56, 64\}$.

There are exactly 8 such pairs.

Step 3: Calculate the number of ways to fill the first two digits.

For each valid pair used in the last two positions, we have used 2 digits.

Total digits available = 6.

Remaining digits for the first two positions $(d_1, d_2) = 6 - 2 = 4$.

We need to arrange 2 digits out of these 4 remaining digits.

Number of ways = ${}^4P_2 = 4 \times 3 = 12$.

Step 4: Calculate the total count.

Total numbers = (Number of valid last-two-digit pairs) $\times$ (Ways to arrange remaining digits).

Total numbers = $8 \times 12 = 96$.

Quick Tip

For divisibility problems involving permutations, always fix the constrained positions (like the last digits for divisibility by 4, 5, or 2) first, count the possibilities, and then fill the remaining spots.

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7. N is a 3-digit number with non-zero digits. No digit is a perfect square and only 1 of the digits is a prime number. What is the number of factors of the smallest such number possible?

(A) 6

(B) 8

(C) 9

(D) 12

Correct Answer: (B) 8

Solution:
Step 1: Filter the allowed digits.

The digits must be non-zero: $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$.

Eliminate perfect squares $(1, 4, 9)$.

Allowed digits set $S = \{2, 3, 5, 6, 7, 8\}$.

Step 2: Classify allowed digits as Prime or Non-Prime.

Primes in S: $\{2, 3, 5, 7\}$.

Non-Primes (Composites) in S: $\{6, 8\}$.

Step 3: Construct the smallest 3-digit number N.

To minimize the number, we must select the smallest possible digit for the hundreds place (d_1).

The smallest available digit is 2.

If we set $d_1 = 2$:

- 2 is a Prime number.
- The problem states exactly one digit is prime. Since we used the prime here, the remaining two digits (d_2, d_3) must be non-primes.

To minimize N, we choose the smallest available non-prime digits for d_2 and d_3.

Smallest non-prime is 6.

So, set $d_2 = 6$ and $d_3 = 6$.

The number is $N = 266$.

(Note: If we started with a non-prime like 6, the number would be at least 600, which is larger than 266).

Step 4: Find the number of factors of 266.

Perform prime factorization of 266:

$266 = 2 \times 133.$

$133 = 7 \times 19.$

$266 = 2^1 \times 7^1 \times 19^1.$

The number of factors is calculated by multiplying the successors of the exponents:

Total Factors $= (1 + 1) \times (1 + 1) \times (1 + 1).$

Total Factors $= 2 \times 2 \times 2 = 8.$

Quick Tip

When minimizing a number under digit constraints, prioritize the leftmost digit (Highest Place Value). Also, remember that 1 is a perfect square ($1^2 = 1$) and must be excluded if the condition forbids squares.
