CAT 2010 QA Slot 2 Question Paper with Solutions

Time Allowed :3 Hours	**Maximum Marks :**300	**Total questions :**100

General Instructions

Read the following instructions very carefully and strictly follow them:

1. **Duration of Section:** 40 Minutes

2. **Total Number of Questions:** 22 Questions (as per latest pattern, may vary slightly)

3. **Section Covered:** Quantitative Aptitude (QA)

4. **Type of Questions:**

   • Multiple Choice Questions (MCQs)

   • Type In The Answer (TITA) Questions – No options given, answer to be typed in

5. **Marking Scheme:**

   • +3 marks for each correct answer

   • -1 mark for each incorrect MCQ

   • No negative marking for TITA questions

6. **Syllabus Coverage:** Arithmetic, Algebra, Geometry, Number System, Modern Math, and Mensuration

7. **Skills Tested:** Numerical ability, analytical thinking, and problem-solving

1.

If $x + 2y = 10$ and $3x - y = 5$, what is the value of $x + y$?

(1) $\frac{45}{7}$

(2) 5

(3) 6

(4) 7

Correct Answer: (1) $\frac{45}{7}$

Solution:

Step 1: Understanding the problem

We are given two linear equations in two variables:

(1) $x + 2y = 10$

(2) $3x - y = 5$

We are asked to find $x + y$. The goal is to solve the system and then sum the variables.

Step 2: Choosing a method

We can solve this system using the elimination method, which allows us to remove one variable and find the other.

Step 3: Elimination of y

From equation (2), multiply the whole equation by 2 to match the coefficient of y in equation (1):

$2(3x - y) = 2 \cdot 5$

$\Rightarrow 6x - 2y = 10$ (3)

Step 4: Adding equations to eliminate y

Add equation (1) and equation (3):

$(x + 2y) + (6x - 2y) = 10 + 10$

$7x = 20$

$\Rightarrow x = \frac{20}{7}.$

Step 5: Substituting back to find y

Substitute $x = \frac{20}{7}$ into equation (1):

$\frac{20}{7} + 2y = 10$

$2y = 10 - \frac{20}{7}$

$2y = \frac{70}{7} - \frac{20}{7} = \frac{50}{7}$

$\Rightarrow y = \frac{25}{7}.$

Step 6: Finding $x + y$

$x + y = \frac{20}{7} + \frac{25}{7} = \frac{45}{7}.$

Step 7: Final check

Check in equation (2): $3x - y = 3\left(\frac{20}{7}\right) - \frac{25}{7} = \frac{60}{7} - \frac{25}{7} = \frac{35}{7} = 5$, correct.

Final Answer: $\boxed{\dfrac{45}{7}}$

Quick Tip

In elimination, align coefficients to remove one variable. Always verify your answer by substituting back into both original equations.

2.

A shopkeeper sells an item at a 20% discount on the marked price and still makes a 25% profit on the cost price. If the cost price is Rs. 400, what is the marked price?

(1) Rs. 500

(2) Rs. 600

(3) Rs. 625

(4) Rs. 650

Correct Answer: (3) Rs. 625

Solution:

Step 1: Define variables and known values

Let the marked price be M. Cost price (CP) = Rs. 400. Profit percentage = 25% of CP.

Step 2: Calculate selling price (SP)

Profit = $0.25 \times 400 = Rs.100.$

Selling price = CP + Profit = $400 + 100 = Rs.500.$

Step 3: Relating SP and MP

The shopkeeper gives a discount of 20% on MP:

Discounted price = MP - (20% of MP) = $M - 0.20M = 0.80M.$

We know this discounted price equals the SP: $0.80M = 500$.

Step 4: Solving for M

$M = \frac{500}{0.80} = \frac{500 \times 100}{80} = 625$.

Step 5: Verification

If MP = Rs. 625, discount = $0.20 \times 625 = Rs.125$, so SP = $625 - 125 = Rs.500$. Profit = $500 - 400 = Rs.100$, which is exactly 25% of Rs. 400. Verified.

Final Answer: $\boxed{\text{Rs. 625}}$

Quick Tip

Link MP, SP, and CP carefully in profit-discount problems. Remember: SP = MP × (1 - discount rate).

3.

A train travels 240 km in 4 hours. What is its speed in km/h?

(1) 50

(2) 60

(3) 70

(4) 80

Correct Answer: (2) 60

Solution:

Step 1: Understanding the problem

We are given the total distance covered by the train (240 km) and the total time taken (4 hours). We need to find the average speed in km/h.

Step 2: Formula for speed

The formula for average speed is:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Step 3: Substitution of values

Distance = 240 km, Time = 4 hours:

$$\text{Speed} = \frac{240}{4} = 60 \text{ km/h}$$

Step 4: Verification

If the speed is 60 km/h and the time is 4 hours, then distance covered $= 60 \times 4 = 240$ km, which matches the given data.

Final Answer: $\boxed{60 \text{ km/h}}$

> **Quick Tip**
>
> Always keep distance and time in the same units when calculating speed. If the time is in minutes, convert to hours for km/h calculations.

4.

The ratio of the ages of A and B is 3:4. Five years from now, their ages will be in the ratio 4:5. What is the present age of A?

(1) 12 years

(2) 15 years

(3) 18 years

(4) 21 years

Correct Answer: (2) 15 years

Solution:

Step 1: Represent the present ages

Let A's present age $= 3x$ years, B's present age $= 4x$ years (as per ratio 3:4).

Step 2: Write the condition for future ages

In 5 years: A's age $= 3x + 5$ years, B's age $= 4x + 5$ years. We are told their ages will be in the ratio 4:5:

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

Step 3: Solve for x

Cross-multiply: $5(3x + 5) = 4(4x + 5)$

$15x + 25 = 16x + 20$

$$25 - 20 = 16x - 15x$$

$$5 = x$$

Step 4: Find A's present age

A's age $= 3x = 3 \times 5 = 15$ years.

Step 5: Verification

B's age $= 4 \times 5 = 20$ years. In 5 years: A = 20 years, B = 25 years. Ratio $= 20 : 25 = 4 : 5$, which matches perfectly.

Final Answer: $\boxed{15 \text{ years}}$

> **Quick Tip**
>
> When solving ratio-age problems, always define variables proportionally to the ratio, then apply the future/past condition.

5.

What is the value of $\log_2(32) + \log_3(9)$?

(1) 5

(2) 6

(3) 7

(4) 8

Correct Answer: (3) 7

Solution:

Step 1: Simplify each logarithm

$32 = 2^5 \implies \log_2(32) = \log_2(2^5) = 5.$

$9 = 3^2 \implies \log_3(9) = \log_3(3^2) = 2.$

Step 2: Add the results

$$\log_2(32) + \log_3(9) = 5 + 2 = 7$$

Step 3: Verification

Both logs are exact integers because the numbers are perfect powers of their bases.

Final Answer: $\boxed{7}$

6.

A sum of money doubles in 4 years at compound interest. In how many years will it become 8 times itself?

(1) 12 years

(2) 14 years

(3) 16 years

(4) 18 years

Correct Answer: (1) 12 years

Solution:

Step 1: Understanding the problem

We are told that the money doubles in 4 years under compound interest. We need to find the time to make it 8 times the principal.

Step 2: Finding the growth factor per 4 years

If in 4 years the amount becomes $2P$, then: $(1+R)^4 = 2$. Taking the fourth root: $1 + R = 2^{1/4}$.

Step 3: For 8 times the principal

We want P to become $8P$: $(1+R)^T = 8$. Substitute $1 + R = 2^{1/4}$: $(2^{1/4})^T = 8$.

Step 4: Express in powers of 2

$8 = 2^3$. So: $2^{T/4} = 2^3$. Equating exponents: $\frac{T}{4} = 3 \implies T = 12$.

Final Answer: $\boxed{12 \text{ years}}$

7.

The area of a circle is 154 cm^2. What is its radius? (Use $\pi = \frac{22}{7}$)

(1) 5 cm

(2) 6 cm

(3) 7 cm

(4) 8 cm

Correct Answer: (3) 7 cm

Solution:

Step 1: Recall the area formula

Area of a circle $= \pi r^2$.

Step 2: Substitution

$\frac{22}{7} r^2 = 154$.

Step 3: Solve for r^2

Multiply both sides by $\frac{7}{22}$: $r^2 = 154 \times \frac{7}{22} = 49$.

Step 4: Find r

$r = \sqrt{49} = 7$ cm.

Final Answer: $\boxed{7 \text{ cm}}$

> **Quick Tip**
>
> Always keep π as given in the question—do not replace with 3.14 unless told.

8.

If $a^2 + b^2 = 25$ and $ab = 12$, what is the value of $a + b$?

(1) 5

(2) 7

(3) 9

(4) 11

Correct Answer: (2) 7

Solution:

Step 1: Apply the square identity

$(a + b)^2 = a^2 + b^2 + 2ab.$

Step 2: Substitution

$a^2 + b^2 = 25$, $ab = 12$: $(a + b)^2 = 25 + 2(12) = 25 + 24 = 49.$

Step 3: Solve for $a + b$

$a + b = \sqrt{49} = 7$. Since we generally consider positive sums in such contexts, we take $+7$.

Final Answer: $\boxed{7}$

> **Quick Tip**
>
> When given $a^2 + b^2$ and ab, use $(a + b)^2$ identity to avoid solving individual variables.

9.

A boat travels 60 km downstream in 5 hours and 60 km upstream in 6 hours. What is the speed of the boat in still water?

(1) 10 km/h

(2) 11 km/h

(3) 12 km/h

(4) 13 km/h

Correct Answer: (2) 11 km/h

Solution:

Step 1: Represent the speeds

Let boat speed in still water = B km/h, stream speed = S km/h.

Step 2: Downstream speed

$B + S = \frac{60}{5} = 12$ km/h.

Step 3: Upstream speed

$B - S = \frac{60}{6} = 10$ km/h.

Step 4: Solve for B

Add both: $(B + S) + (B - S) = 12 + 10 \implies 2B = 22 \implies B = 11$ km/h.

Final Answer: $\boxed{11 \text{ km/h}}$

10.

The sum of the first 20 terms of an arithmetic progression is 670, and the first term is 5.

What is the common difference?

(1) 2

(2) 3

(3) 4

(4) 5

Correct Answer: (2) 3

Solution:

Step 1: Recall the AP sum formula

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

Step 2: Substitution

$670 = \frac{20}{2}[2(5) + 19d]$.

$670 = 10[10 + 19d]$.

Step 3: Solve for d

$67 = 10 + 19d$

$19d = 57$

$d = 3$.

Final Answer: $\boxed{3}$

11.

A man invests Rs. 5000 at 10% per annum compound interest. What is the amount after 2 years?

(1) Rs. 6000

(2) Rs. 6050

(3) Rs. 6100

(4) Rs. 6055

Correct Answer: (2) Rs. 6050

Solution:

Step 1: Recall the compound interest formula

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

Where: P = Principal amount, R = Annual rate of interest, n = Number of years, A = Final amount.

Step 2: Substitution of values

Here: $P = 5000$, $R = 10\%$, $n = 2$:

$$A = 5000 \left(1 + \frac{10}{100}\right)^2 = 5000(1.1)^2$$

Step 3: Square the factor

$(1.1)^2 = 1.21$

Step 4: Multiply with principal

$A = 5000 \times 1.21 = 6050$

Step 5: Verification

Year 1: $5000 \times 1.1 = 5500$

Year 2: $5500 \times 1.1 = 6050$

Final Answer: $\boxed{\text{Rs. 6050}}$

Quick Tip

In compound interest, the interest of each year is calculated on the amount from the previous year, not just the original principal.

12.

If $2x + 3y = 12$ and $x - y = 1$, what is the value of x?

(1) 3

(2) 4

(3) 5

(4) 6

Correct Answer: (1) 3

Solution:

Step 1: From the second equation, express y in terms of x

$x - y = 1 \implies y = x - 1$

Step 2: Substitute $y = x - 1$ into the first equation

$2x + 3(x - 1) = 12$

Step 3: Expand and simplify

$2x + 3x - 3 = 12$

$5x - 3 = 12$

Step 4: Solve for x

$5x = 15 \implies x = 3$

Step 5: Verification

If $x = 3$, then $y = 3 - 1 = 2$. Check equation 1: $2(3) + 3(2) = 6 + 6 = 12$

Check equation 2: $3 - 2 = 1$

Final Answer: $\boxed{3}$

Quick Tip

When one equation is easily rearranged, substitution is often the quickest method for solving simultaneous equations.

13.

The perimeter of a rectangle is 50 cm, and its length is 5 cm more than its breadth. What is the area of the rectangle?

(1) 150 cm^2

(2) 156 cm^2

(3) 144 cm^2

(4) 160 cm^2

Correct Answer: (1) 150 cm^2

Solution:

Step 1: Represent dimensions with variables

Let breadth = B cm. Length = $B + 5$ cm (since it is 5 cm more than breadth).

Step 2: Use the perimeter formula

Perimeter $P = 2(L + B) = 50$: $2((B + 5) + B) = 50$

$2(2B + 5) = 50$

Step 3: Solve for B

$2B + 5 = 25$

$2B = 20 \implies B = 10$ cm

Step 4: Find length

$L = B + 5 = 10 + 5 = 15$ cm

Step 5: Calculate area

Area = $L \times B = 15 \times 10 = 150$ cm^2

Step 6: Verification

Perimeter = $2(15 + 10) = 50$

Final Answer: $\boxed{150 \text{ cm}^2}$

Quick Tip

In rectangle problems, first solve for one dimension using the perimeter, then use the area formula.

14.

What is the value of $\sqrt{169} + \sqrt{64}$?

(1) 20

(2) 21

(3) 22

(4) 23

Correct Answer: (2) 21

Solution:

Step 1: Find each square root

$\sqrt{169} = 13$ (since $13^2 = 169$)

$\sqrt{64} = 8$ (since $8^2 = 64$)

Step 2: Add the values

$13 + 8 = 21$

Final Answer: $\boxed{21}$

Quick Tip

Memorizing perfect squares up to 20 helps to solve such problems instantly.

15.

A man can complete a work in 12 days, and a woman can complete it in 18 days. How many days will they take together?

(1) 6 days

(2) 7.2 days

(3) 8 days

(4) 9 days

Correct Answer: (2) 7.2 days

Solution:

Step 1: Find individual work rates

Man's rate $= \frac{1}{12}$ work/day. Woman's rate $= \frac{1}{18}$ work/day.

Step 2: Find combined work rate

$\frac{1}{12} + \frac{1}{18} = \frac{3}{36} + \frac{2}{36} = \frac{5}{36}$ work/day.

Step 3: Time taken together

Time = $\frac{1}{\frac{5}{36}} = \frac{36}{5} = 7.2$ days.

Final Answer: 7.2 days

Quick Tip

When combining work rates, always add them to find the total work per day, then take the reciprocal for total time.

16.

The cost price of an article is Rs. 200, and it is sold at a profit of 25%. What is the selling price?

(1) Rs. 240

(2) Rs. 250

(3) Rs. 260

(4) Rs. 270

Correct Answer: (2) Rs. 250

Solution:

Step 1: Calculate profit

Profit = 25% of 200 = $0.25 \times 200 = 50$

Step 2: Find selling price

SP = CP + Profit = $200 + 50 = 250$

Final Answer: Rs. 250

Quick Tip

SP = CP × (1 + Profit%) is the fastest method for selling price in profit cases.

17.

What is the value of $3^4 \div 3^2$?

(1) 6

(2) 9

(3) 12

(4) 15

Correct Answer: (2) 9

Solution:

Step 1: Apply the laws of exponents

$\frac{a^m}{a^n} = a^{m-n}$

Step 2: Substitution

$3^4 \div 3^2 = 3^{4-2} = 3^2$

Step 3: Evaluate

$3^2 = 9$

Final Answer: $\boxed{9}$

Quick Tip

For same base division, subtract exponents from numerator and denominator.

18.

A car travels at 60 km/h for 3 hours and then at 80 km/h for 2 hours. What is the average speed?

(1) 65 km/h

(2) 68 km/h

(3) 70 km/h

(4) 72 km/h

Correct Answer: (2) 68 km/h

Solution:

Step 1: Find distances

First part: $60 \times 3 = 180$ km. Second part: $80 \times 2 = 160$ km. Total $= 180 + 160 = 340$ km.

Step 2: Find total time

$3 + 2 = 5$ hours.

Step 3: Average speed

$\frac{340}{5} = 68$ km/h.

Final Answer: $\boxed{68 \text{ km/h}}$

> **Quick Tip**
>
> Average speed is total distance divided by total time, not the average of the speeds.

19.

If the selling price of an article is Rs. 240 and the profit is 20%, what is the cost price?

(1) Rs. 180

(2) Rs. 190

(3) Rs. 200

(4) Rs. 210

Correct Answer: (3) Rs. 200

Solution:

Step 1: Use formula

$SP = CP \times (1 + \frac{\text{Profit}\%}{100})$

Step 2: Substitution

$240 = CP \times 1.2$

Step 3: Solve

$CP = \frac{240}{1.2} = 200$

Final Answer: $\boxed{\text{Rs. 200}}$

> **Quick Tip**
>
> To reverse profit, divide selling price by $(1 + \text{Profit}\%)$.

20.

The HCF of 48 and 72 is:

(1) 12

(2) 24

(3) 16

(4) 18

Correct Answer: (2) 24

Solution:

Method 1: Prime factorization

$48 = 2^4 \times 3$

$72 = 2^3 \times 3^2$

Common factors: 2^3 and 3. HCF = $2^3 \times 3 = 8 \times 3 = 24$.

Method 2: Euclidean algorithm

$72 \div 48 = 1$ remainder 24

$48 \div 24 = 2$ remainder 0 HCF = 24.

Final Answer: $\boxed{24}$

Quick Tip

Use Euclidean algorithm for faster HCF, especially with large numbers.

21.

What is the value of $5! + 4!$?

(1) 120

(2) 144

(3) 168

(4) 192

Correct Answer: (2) 144

Solution:

Step 1: Recall the definition of factorial

The factorial of a positive integer n, denoted $n!$, is the product of all positive integers from n down to 1. For example: $5! = 5 \times 4 \times 3 \times 2 \times 1$

$4! = 4 \times 3 \times 2 \times 1$

Step 2: Calculate $5!$

$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

Step 3: Calculate $4!$

$4! = 4 \times 3 \times 2 \times 1 = 24$

Step 4: Add the results

$5! + 4! = 120 + 24 = 144$

Step 5: Verification

We computed each factorial separately and summed them correctly. No simplification possible.

Final Answer: $\boxed{144}$

Quick Tip

When dealing with factorial expressions, always compute each factorial term separately before performing addition or subtraction.

22.

A pipe can fill a tank in 6 hours, and another pipe can empty it in 8 hours. If both are opened together, how long will it take to fill the tank?

(1) 24 hours

(2) 28 hours

(3) 32 hours

(4) 36 hours

Correct Answer: (1) 24 hours

Solution:

Step 1: Understand work rate concept

Filling rate of pipe A = fraction of tank filled per hour = $\frac{1}{6}$. Emptying rate of pipe B = fraction of tank emptied per hour = $\frac{1}{8}$.

Step 2: Determine net rate

Net rate = Filling rate Emptying rate = $\frac{1}{6} - \frac{1}{8}$.

Step 3: Subtract fractions

LCM of 6 and 8 = 24. $\frac{1}{6} = \frac{4}{24}$, $\frac{1}{8} = \frac{3}{24}$. Net rate = $\frac{4}{24} - \frac{3}{24} = \frac{1}{24}$ tank/hour.

Step 4: Find total time

If $\frac{1}{24}$ of the tank is filled per hour, then the whole tank takes 24 hours.

Step 5: Verification

In 24 hours, filling pipe puts in $\frac{24}{6} = 4$ tanks worth, emptying pipe removes $\frac{24}{8} = 3$ tanks worth. Net = 1 tank filled.

Final Answer: 24 hours

> **Quick Tip**
>
> For problems with filling and emptying rates, express each rate as work per hour and subtract appropriately for opposite actions.

23.

The volume of a cube is 343 cm^3. What is its edge length?

(1) 6 cm

(2) 7 cm

(3) 8 cm

(4) 9 cm

Correct Answer: (2) 7 cm

Solution:

Step 1: Recall cube volume formula

Volume of a cube = a^3, where a = edge length.

Step 2: Set equation

$a^3 = 343$

Step 3: Find cube root

$a = \sqrt[3]{343}$

Step 4: Simplify cube root

Since $343 = 7 \times 7 \times 7 = 7^3$, we get $a = 7$.

Step 5: Verification

$7^3 = 343$, matches given volume.

Final Answer: $\boxed{7 \text{ cm}}$

> **Quick Tip**
>
> To find cube roots, factorize the number and group factors in threes.

24.

If $x^2 - 5x + 6 = 0$, what are the roots of the equation?

(1) 2, 3

(2) 1, 4

(3) 1, 5

(4) 2, 4

Correct Answer: (1) 2, 3

Solution:

Step 1: Recognize it's a quadratic

A quadratic equation has the form $ax^2 + bx + c = 0$. Here $a = 1, b = -5, c = 6$.

Step 2: Factorize

Find two numbers whose product = 6 and sum = -5: -2 and -3.

Step 3: Write factors

$(x - 2)(x - 3) = 0$

Step 4: Solve each factor

$x - 2 = 0 \implies x = 2 \quad x - 3 = 0 \implies x = 3$

Step 5: Verification

Substitute $x = 2$: $4 - 10 + 6 = 0$ \quad Substitute $x = 3$: $9 - 15 + 6 = 0$

Final Answer: $\boxed{2, 3}$

> **Quick Tip**
>
> Factoring is faster than the quadratic formula when integer factors exist for c.

25.

A sum of Rs. 1000 is divided among A, B, and C in the ratio 2:3:5. How much does C get?

(1) Rs. 400

(2) Rs. 500

(3) Rs. 600

(4) Rs. 700

Correct Answer: (2) Rs. 500

Solution:

Step 1: Sum the parts in the ratio

$2 + 3 + 5 = 10$ parts total.

Step 2: Determine value per part

Each part $= \frac{1000}{10} = 100$

Step 3: Find C's share

C's share $= 5$ parts $= 5 \times 100 = 500$ Rs.

Step 4: Verification

A $= 200$, B $= 300$, C $= 500$. Sum $= 1000$.

Final Answer: $\boxed{\text{Rs. 500}}$

Quick Tip

Always divide total sum by total parts to find per-part value in ratio problems.

26.

What is the value of $\sin^2 30° + \cos^2 60°$?

(1) $\frac{1}{2}$

(2) $\frac{3}{4}$

(3) 1

(4) $\frac{5}{4}$

Correct Answer: (1) $\frac{1}{2}$

Solution:

Step 1: Recall trigonometric values

$\sin 30° = \frac{1}{2}$, so $\sin^2 30° = \frac{1}{4}$. $\cos 60° = \frac{1}{2}$, so $\cos^2 60° = \frac{1}{4}$.

Step 2: Add the squares

$\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$.

Final Answer: $\boxed{\dfrac{1}{2}}$

> **Quick Tip**
>
> Memorize standard angles' sine and cosine values for quick trigonometric calculations.

27.

A number when divided by 7 leaves a remainder of 4. What is the remainder when the square of the number is divided by 7?

(1) 1

(2) 2

(3) 3

(4) 4

Correct Answer: (2) 2

Solution:

Step 1: Express the number in modular form

If a number leaves remainder 4 when divided by 7, it can be written as:

$$N = 7k + 4$$

where k is any integer.

Step 2: Square the number

$$N^2 = (7k + 4)^2 = 49k^2 + 56k + 16$$

Step 3: Divide each term by 7 and check remainders

- $49k^2$ is divisible by 7 (remainder 0). - $56k$ is divisible by 7 (remainder 0). - $16 \div 7 = 2$ remainder 2.

Thus, the remainder when N^2 is divided by 7 is 2.

Step 4: Shorter modular arithmetic method

We know:

$$N \equiv 4 \pmod 7$$

Squaring both sides:

$$N^2 \equiv 4^2 \pmod 7 \implies N^2 \equiv 16 \pmod 7$$

Since $16 \div 7 = 2$ remainder 2,

$$N^2 \equiv 2 \pmod 7$$

Step 5: Verification example

Let $N = 11$ (since $11 \div 7$ leaves remainder 4). $N^2 = 121$. $121 \div 7 = 17$ remainder 2, confirming our result.

Final Answer: $\boxed{2}$

> **Quick Tip**
>
> Use modular arithmetic for remainder problems — it simplifies calculations without expanding large numbers.

28.

The sum of two numbers is 15, and their product is 56. What is the larger number?

(1) 7

(2) 8

(3) 9

(4) 10

Correct Answer: (2) 8

Solution:

Step 1: Define the two numbers

Let the numbers be x and y. We are told:

$$x + y = 15 \quad \text{(Sum)}$$

$$xy = 56 \quad \text{(Product)}$$

Step 2: Form a quadratic equation

If x and y are roots of a quadratic equation, it can be written as:

$$t^2 - (x + y)t + xy = 0$$

Substitute the given values:

$$t^2 - 15t + 56 = 0$$

Step 3: Solve the quadratic by factorization

Find two numbers whose sum is -15 (coefficient of t) and whose product is 56: These are -7 and -8.

Factorize:

$$t^2 - 15t + 56 = (t - 7)(t - 8) = 0$$

Step 4: Find the two numbers

$t = 7$ or $t = 8$. Thus, the two numbers are 7 and 8.

Step 5: Identify the larger number

Larger = 8.

Step 6: Verification

Sum: $7 + 8 = 15$ Product: $7 \times 8 = 56$

Final Answer: $\boxed{8}$

Quick Tip

For sum and product problems, convert them into a quadratic equation and solve to get both numbers easily.

29.

A train covers a distance of 300 km in 5 hours. What is the time taken to cover 180 km at the same speed?

(1) 2 hours

(2) 2.5 hours

(3) 3 hours

(4) 3.5 hours

Correct Answer: (3) 3 hours

Solution:

Step 1: Calculate the speed of the train

Speed $= \frac{\text{Distance}}{\text{Time}} = \frac{300}{5} = 60$ km/h.

Step 2: Use the speed to find the required time

Time $= \frac{\text{Distance}}{\text{Speed}}$

$$\text{Time} = \frac{180}{60} = 3 \text{ hours}$$

Step 3: Verification

If the speed is 60 km/h, then in 3 hours: Distance $= 60 \times 3 = 180$ km, matches the given distance.

Step 4: Relation between distance and time at constant speed

Since speed is constant, time is directly proportional to distance. Here: $\frac{180}{300} = 0.6$, and 0.6×5 hours = 3 hours.

Final Answer: $\boxed{3 \text{ hours}}$

Quick Tip

At constant speed, $\frac{\text{Distance}_1}{\text{Time}_1} = \frac{\text{Distance}_2}{\text{Time}_2}$. Use this proportion to solve quickly.

30.

What is the value of $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5}$?

(1) $\frac{2}{5}$

(2) $\frac{3}{5}$

(3) $\frac{4}{5}$

(4) $\frac{1}{2}$

Correct Answer: (1) $\frac{2}{5}$

Solution:

Step 1: Multiply the numerators together

Numerator = $2 \times 3 \times 4 = 24$.

Step 2: Multiply the denominators together

Denominator = $3 \times 4 \times 5 = 60$.

Step 3: Form the fraction

$$\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{24}{60}$$

Step 4: Simplify the fraction

Divide numerator and denominator by their GCD (12):

$$\frac{24}{60} = \frac{2}{5}$$

Step 5: Verification by cancellation before multiplication

Cancel common terms early: $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5}$ Cancel 4 with denominator 4: $= \frac{2}{1} \times \frac{1}{1} \times \frac{1}{5} = \frac{2}{5}$

Final Answer: $\boxed{\dfrac{2}{5}}$

> Quick Tip
>
> In fraction multiplication, always simplify by cancelling common factors before multiplying to reduce calculations.

31.

The average of 5 numbers is 20. If one number is removed, the average becomes 18. What is the removed number?

(1) 22

(2) 24

(3) 26

(4) 28

Correct Answer: (4) 28

Solution:

Step 1: Use the formula for sum from average

We know:

$$\text{Sum of terms} = \text{Average} \times \text{Number of terms}$$

For 5 numbers:

$$\text{Original sum} = 20 \times 5 = 100$$

Step 2: Find the new sum after removal

After removing one number, there are 4 numbers with an average of 18:

$$\text{New sum} = 18 \times 4 = 72$$

Step 3: Find the removed number

Removed number = Original sum New sum:

$$\text{Removed number} = 100 - 72 = 28$$

Step 4: Verification

If removed number is 28, then remaining sum $= 100 - 28 = 72$ Average $= 72 \div 4 = 18$, matches perfectly.

Final Answer: $\boxed{28}$

Quick Tip

When an element is removed from an average problem, compute the total sums before and after removal to find the missing number.

32.

A shopkeeper marks an item at Rs. 500 and offers a 10% discount. What is the selling price?

(1) Rs. 440

(2) Rs. 450

(3) Rs. 460

(4) Rs. 470

Correct Answer: (2) Rs. 450

Solution:

Step 1: Calculate the discount amount

$$\text{Discount} = \frac{\text{Discount \%}}{100} \times \text{Marked Price}$$

$$\text{Discount} = \frac{10}{100} \times 500 = 50$$

Step 2: Find the selling price

Selling Price (SP) = Marked Price Discount:

$$SP = 500 - 50 = 450$$

Step 3: Alternative percentage method

$$SP = MP \times \left(1 - \frac{\text{Discount \%}}{100}\right)$$

$$SP = 500 \times 0.9 = 450$$

Step 4: Verification

Discount given = Rs. 50, selling price = Rs. 450, matches both methods.

Final Answer: Rs. 450

Quick Tip

For discount problems, remember $SP = MP \times (1 - \frac{\text{Discount\%}}{100})$ for quick calculations.

33.

If $3x = 4y$ and $y = 2z$, what is the ratio $x : y : z$?

(1) 6:4:3

(2) 8:6:3

(3) 8:6:2

(4) 4:3:2

Correct Answer: (2) 8:6:3

Solution:

Step 1: Express x in terms of y

From $3x = 4y$:

$$x = \frac{4y}{3}$$

Step 2: Express y in terms of z

From $y = 2z$, substitute into x:

$$x = \frac{4(2z)}{3} = \frac{8z}{3}$$

Thus:

$$x : y : z = \frac{8z}{3} : 2z : z$$

Step 3: Remove the fraction

Multiply each term by 3:

$$8z : 6z : 3z$$

Step 4: Simplify the ratio

Cancel z from each term:

$$8 : 6 : 3$$

Step 5: Verification

Check with actual values: Let $z = 3$, then $y = 6$, $x = \frac{8(3)}{3} = 8$. Ratio $= 8 : 6 : 3$, correct.

Final Answer: $\boxed{8 : 6 : 3}$

> **Quick Tip**
>
> When given equations relating variables, express all in terms of one variable to easily find ratios.

34.

What is the value of 2^{10}?

(1) 512

(2) 1024

(3) 2048

(4) 4096

Correct Answer: (2) 1024

Solution:

Step 1: Recall the meaning of exponent

2^{10} means multiplying 2 by itself 10 times:

$$2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

Step 2: Break down into smaller powers

We know: $2^5 = 32$. Thus:

$$2^{10} = (2^5)^2 = 32^2$$

Step 3: Square 32

$$32^2 = 1024$$

Step 4: Verification

Multiply step-by-step: $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^{10} = 32 \times 32 = 1024$.

Final Answer: $\boxed{1024}$

Quick Tip

When calculating high powers, break them into known powers for easier multiplication.