Bihar Board Class 10 Higher Mathematics(Elective) Question Paper with Solutions(Memory Based)

Time Allowed :3 Hours	Maximum Marks :70	Total questions :37

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Answers to this Paper must be written on the paper provided separately.
2. You will not be allowed to write during the first 15 minutes
3. This time is to be spent in reading the question paper.
4. The time given at the head of this Paper is the time allowed for writing the answers,
5. The paper has four Sections.
6. Section A is compulsory - All questions in Section A must be answered.
7. You must attempt one question from each of the Sections B, C and D and one other question from any Section of your choice.
8. The intended marks for questions or parts of questions are given in brackets [ ].

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1. If $540 = 2^x \times 3^y \times 5^z$, find the value of $x + y - z$.

Correct Answer: 3

Solution:

Concept: To compare exponents, express the number as a product of its prime factors.

Step 1: Prime factorization of 540

$$540 = 54 \times 10$$

$$54 = 2 \times 27 = 2 \times 3^3$$

$$10 = 2 \times 5$$

So,

$$540 = (2 \times 3^3)(2 \times 5) = 2^2 \times 3^3 \times 5^1$$

Step 2: Compare with given form

$$540 = 2^x \times 3^y \times 5^z$$

Thus,

$$x = 2, \quad y = 3, \quad z = 1$$

Step 3: Find required value

$$x + y - z = 2 + 3 - 1 = 4$$

Final Answer:

$$\boxed{4}$$

Quick Tip

To compare exponents:

- Always do prime factorization first.
- Match bases and compare powers.

This method is common in factorization problems.

2. Which of the following is an irrational number? (A) 2.3**, (B)** $\sqrt{13} \times \sqrt{13}$**, (C)** $\sqrt{441}$

Correct Answer: None of these (All are rational)

Solution:

Concept:

- Rational numbers can be written in the form $\frac{p}{q}$.
- Irrational numbers cannot be written as fractions.

- Square root of a perfect square is rational.

Option (A): 2.3

$$2.3 = \frac{23}{10}$$

This is a fraction, so it is rational.

Option (B): $\sqrt{13} \times \sqrt{13}$

$$\sqrt{13} \times \sqrt{13} = 13$$

Since 13 is an integer, it is rational.

Option (C): $\sqrt{441}$

$$441 = 21^2$$

$$\sqrt{441} = 21$$

This is also rational.

Conclusion: All given options are rational numbers. Hence, none of them is irrational.

$$\boxed{\text{None of these}}$$

Quick Tip

Quick checks:

- Terminating decimals $\rightarrow$ rational
- $\sqrt{a} \times \sqrt{a} = a$
- Square root of perfect square $\rightarrow$ rational

Only roots of non-perfect squares are irrational.

3. Find the HCF of m and n if both are prime numbers.

Correct Answer: 1 (if $m \neq n$)

Solution:

Concept:

- A prime number has only two factors: 1 and itself.

- HCF (Highest Common Factor) is the greatest common factor of two numbers.

Case 1: m and n are different prime numbers Factors of m: $1, m$ Factors of n: $1, n$

Common factor = 1

So,

$$\text{HCF}(m, n) = 1$$

Case 2: If $m = n$ (same prime) Then,

$$\text{HCF}(m, n) = m$$

Conclusion: Generally, for two distinct prime numbers:

$$\boxed{1}$$

Quick Tip

Remember:

- HCF of two different primes = 1
- Same primes $\rightarrow$ HCF is the number itself

This is a common objective question.

4. What is the value of $\sin 90° + \cos 0°$?

Correct Answer: 2

Solution:

Concept: Standard trigonometric values:

$$\sin 90° = 1, \quad \cos 0° = 1$$

Step 1: Substitute known values

$$\sin 90° + \cos 0° = 1 + 1$$

Step 2: Simplify

$$= 2$$

Final Answer:

$$\boxed{2}$$

Quick Tip

Important values to memorize:

$$\sin 0^\circ = 0, \quad \sin 90^\circ = 1$$

$$\cos 0^\circ = 1, \quad \cos 90^\circ = 0$$

These are frequently used in basic trigonometry.

5. Find the distance of point $P(3, 4)$ from the origin.

Correct Answer: 5

Solution:

Concept: Distance of a point (x, y) from the origin $(0, 0)$ is given by:

$$\text{Distance} = \sqrt{x^2 + y^2}$$

Step 1: Substitute coordinates

$$x = 3, \quad y = 4$$

$$\text{Distance} = \sqrt{3^2 + 4^2}$$

Step 2: Simplify

$$= \sqrt{9 + 16} = \sqrt{25}$$

$$= 5$$

Final Answer:

$$\boxed{5}$$

Quick Tip

Distance from origin formula:

$$\sqrt{x^2 + y^2}$$

Recognize Pythagorean triples like $(3, 4, 5)$ to solve quickly.

6. What is the degree of the polynomial $(x + 3)(x - 8)$?

Correct Answer: 2

Solution:

Concept: The degree of a polynomial is the highest power of the variable in its expanded form.

Step 1: Expand the polynomial

$$(x + 3)(x - 8)$$

Using distributive property:

$$x(x - 8) + 3(x - 8)$$

$$= x^2 - 8x + 3x - 24$$

$$= x^2 - 5x - 24$$

Step 2: Identify highest power The highest power of x is 2.

Final Answer:

$$\boxed{2}$$

Quick Tip

Degree rules:

- Product of two linear polynomials $\rightarrow$ degree 2
- Add degrees when multiplying polynomials

Example: $(x)(x)$ gives degree 2.

7. Find the HCF of 36, 54, and 90 using the prime factorization method.

Correct Answer: 18

Solution:

Concept: To find the HCF using prime factorization:

- Express each number as a product of prime factors.
- Take only the common prime factors with the smallest powers.

Step 1: Prime factorization

36:

$$36 = 2^2 \times 3^2$$

54:

$$54 = 2 \times 27 = 2 \times 3^3$$

90:

$$90 = 9 \times 10 = 3^2 \times 2 \times 5 = 2 \times 3^2 \times 5$$

Step 2: Identify common prime factors Common primes in all three:

$$2 \quad \text{and} \quad 3$$

Smallest powers:

$$2^1, \quad 3^2$$

Step 3: Find HCF

$$\text{HCF} = 2 \times 3^2 = 2 \times 9 = 18$$

Final Answer:

$$\boxed{18}$$

Quick Tip

Steps for HCF using prime factors:

- Write prime factorization of all numbers.
- Pick common primes only.
- Take smallest powers.

This method works for any number of values.

8. Find the zeroes of the polynomial $2x^2 - 6$.

Correct Answer: $x = \pm\sqrt{3}$

Solution:

Concept: Zeroes of a polynomial are values of x that make it equal to zero.

Step 1: Set the polynomial equal to zero

$$2x^2 - 6 = 0$$

Step 2: Solve for x

$$2x^2 = 6$$

$$x^2 = 3$$

Step 3: Take square root

$$x = \pm\sqrt{3}$$

Final Answer:

$$\boxed{x = \pm\sqrt{3}}$$

Quick Tip

For equations of type $ax^2 - b = 0$:

- Move constant term to RHS.
- Divide by coefficient of x^2.
- Take square root.

Always include both $+$ and $-$ roots.

9. Solve the pair of linear equations $4x - 5y = 20$ and $3x + 5y = 15$ using the graphical method.

Correct Answer: $(5, 0)$

Solution:

Concept: In the graphical method:

- Each linear equation represents a straight line.
- The solution is the point of intersection of the two lines.

Step 1: Convert equations into convenient form

Equation (1):

$$4x - 5y = 20$$

Find intercepts:

- If $x = 0$, then $-5y = 20 \Rightarrow y = -4$
- If $y = 0$, then $4x = 20 \Rightarrow x = 5$

So points: $(0, -4)$ and $(5, 0)$

Equation (2):

$$3x + 5y = 15$$

Find intercepts:

- If $x = 0$, then $5y = 15 \Rightarrow y = 3$

- If $y = 0$, then $3x = 15 \Rightarrow x = 5$

So points: $(0, 3)$ and $(5, 0)$

Step 2: Graph the lines Plot both pairs of points and draw the lines.

Step 3: Identify intersection point Both lines intersect at:

$$(5, 0)$$

Conclusion: The graphical solution of the equations is:

$$\boxed{(5, 0)}$$

Quick Tip

For graphical method:

- Find two points for each line.
- Plot and draw lines.
- Intersection point = solution.

If lines intersect at one point $\rightarrow$ unique solution.

10. State and prove the Pythagoras Theorem.

Correct Answer: In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

Solution:

Statement (Pythagoras Theorem): In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

Given: In $\triangle ABC$, $\angle B = 90°$. So, AC is the hypotenuse.

To Prove:

$$AC^2 = AB^2 + BC^2$$

Proof (Using similarity):

Step 1: Draw altitude Draw $BD \perp AC$ from the right angle B to the hypotenuse AC.

Step 2: Consider similar triangles Triangles $\triangle ABC$, $\triangle ADB$, and $\triangle BDC$ are similar because they share common angles.

From similarity of $\triangle ABC \sim \triangle ADB$:

$$\frac{AB}{AC} = \frac{AD}{AB}$$

$$AB^2 = AC \cdot AD \quad \cdots (1)$$

From similarity of $\triangle ABC \sim \triangle BDC$:

$$\frac{BC}{AC} = \frac{DC}{BC}$$

$$BC^2 = AC \cdot DC \quad \cdots (2)$$

Step 3: Add equations (1) and (2)

$$AB^2 + BC^2 = AC \cdot AD + AC \cdot DC$$

$$AB^2 + BC^2 = AC(AD + DC)$$

But,

$$AD + DC = AC$$

So,

$$AB^2 + BC^2 = AC^2$$

Conclusion: Hence proved,

$$\boxed{AC^2 = AB^2 + BC^2}$$

Quick Tip

Pythagoras Theorem applies only to right-angled triangles. Remember the formula:

$$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$$

Useful in distance formula and coordinate geometry.

11. The difference of squares of two numbers is 180. If the square of the smaller number is 8 times the larger number, find both numbers.

Correct Answer: Smaller number = 12, Larger number = 18

Solution:

Concept: Translate the given statements into equations and solve simultaneously.

Let:

$$\text{Smaller number} = x, \quad \text{Larger number} = y$$

Step 1: Form equations

Difference of squares:

$$y^2 - x^2 = 180 \quad \cdots (1)$$

Square of smaller number is 8 times the larger:

$$x^2 = 8y \quad \cdots (2)$$

Step 2: Substitute equation (2) into (1)

$$y^2 - 8y = 180$$

$$y^2 - 8y - 180 = 0$$

Step 3: Solve quadratic

$$y^2 - 8y - 180 = 0$$

Factorization:

$$(y - 18)(y + 10) = 0$$

$$y = 18 \quad \text{or} \quad y = -10$$

Since larger number must be positive:

$$y = 18$$

Step 4: Find x Using $x^2 = 8y$:

$$x^2 = 8 \times 18 = 144$$

$$x = 12 \quad \text{(taking positive value)}$$

Final Answer:

$$\boxed{\text{Smaller number } = 12, \quad \text{Larger number } = 18}$$

Quick Tip

Word problems $\rightarrow$ form equations first. Steps:

- Assign variables clearly.
- Convert statements into equations.
- Substitute to reduce variables.

Always check which root is valid.