MP Board Class 10 Mathematics Basic 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. The sum of a rational and an irrational number is always an _____.

Correct Answer: Irrational number

Solution:

Concept:

- A rational number can be written in the form $\frac{p}{q}$, where p, q are integers and $q \neq 0$.
- An irrational number cannot be written in fractional form (e.g., $\sqrt{2}, \pi$).

Explanation: Let:

$$r = \text{rational number}, \quad x = \text{irrational number}$$

Assume their sum is rational:

$$r + x = y \quad \text{(rational)}$$

Then,

$$x = y - r$$

Since the difference of two rational numbers is rational, this would imply x is rational.

But this contradicts the fact that x is irrational.

Conclusion: Hence, the sum of a rational and an irrational number is always:

$$\boxed{\text{Irrational}}$$

Quick Tip

Key results to remember:

- Rational + Irrational = Irrational
- Rational $\times$ Irrational = Irrational (generally)
- Irrational + Irrational may be rational or irrational

These are common exam fill-in-the-blanks.

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2. The common difference in the AP: $4, 10, 16, 22, \ldots$ **is** _____.

Correct Answer: 6

Solution:

Concept: In an Arithmetic Progression (A.P.), the common difference is the difference between any two consecutive terms:

$$d = a_2 - a_1$$

Step 1: Identify first two terms

$$a_1 = 4, \quad a_2 = 10$$

Step 2: Find the common difference

$$d = 10 - 4 = 6$$

Verification:

$$16 - 10 = 6, \quad 22 - 16 = 6$$

So, the difference is constant.

Conclusion:

$$\boxed{6}$$

Quick Tip

To find common difference quickly:

$$d = \text{second term} - \text{first term}$$

Always check one more pair to confirm it is an A.P.

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3. All equilateral triangles are similar.

Correct Answer: True

Solution:

Concept: Two triangles are similar if:

- Their corresponding angles are equal (AAA similarity), or
- Their corresponding sides are proportional.

Explanation: In an equilateral triangle:

- All three sides are equal.
- All three angles are $60°$.

Consider any two equilateral triangles:

$$\triangle ABC \quad \text{and} \quad \triangle PQR$$

Then,

$$\angle A = \angle B = \angle C = 60^\circ$$

$$\angle P = \angle Q = \angle R = 60^\circ$$

So, corresponding angles are equal.

Using AAA similarity criterion: If all corresponding angles of two triangles are equal, then the triangles are similar.

Hence,

$$\triangle ABC \sim \triangle PQR$$

Conclusion: All equilateral triangles have the same angles, so they are always similar.

All equilateral triangles are similar.

Quick Tip

Remember:

- Equilateral triangle $\rightarrow$ all angles 60°.
- Same angles AAA similarity triangles are similar.

But they may not be congruent (sizes can differ).

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4. Express 140 as a product of its prime factors.

Correct Answer: $140 = 2^2 \times 5 \times 7$

Solution:

Concept: Prime factorization means expressing a number as a product of prime numbers only.

Step 1: Divide by smallest prime number

$$140 \div 2 = 70$$

Step 2: Divide again by 2

$$70 \div 2 = 35$$

Step 3: Divide by next prime

$$35 \div 5 = 7$$

Step 4: Final prime

$$7 \div 7 = 1$$

So, prime factors are:

$$2, 2, 5, 7$$

Step 5: Write in exponential form

$$140 = 2^2 \times 5 \times 7$$

Final Answer:

$$\boxed{2^2 \times 5 \times 7}$$

Quick Tip

For prime factorization:

- Start dividing by 2, then 3, 5, 7, etc.
- Stop when quotient becomes 1.
- Write repeated primes using powers.

This is useful for HCF and LCM problems.

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5. Find the zeroes of the quadratic polynomial $x^2 + 7x + 10$.

Correct Answer: $x = -5$ and $x = -2$

Solution:

Concept: The zeroes of a quadratic polynomial are the values of x that make the polynomial equal to zero. We solve:

$$x^2 + 7x + 10 = 0$$

Step 1: Factorize the quadratic We need two numbers whose:

- Sum = 7
- Product = 10

These numbers are 5 and 2.

Step 2: Split the middle term

$$x^2 + 5x + 2x + 10 = 0$$

Step 3: Factor by grouping

$$x(x + 5) + 2(x + 5) = 0$$

$$(x + 5)(x + 2) = 0$$

Step 4: Find zeroes

$$x + 5 = 0 \Rightarrow x = -5$$

$$x + 2 = 0 \Rightarrow x = -2$$

Final Answer:

$$\boxed{x = -5,\ -2}$$

Quick Tip

For quick factorization:

- Find two numbers whose sum = middle coefficient.
- Product = constant term.

If factorization is difficult, use quadratic formula.

6. Find the 10^{th} term of the A.P.: $2, 7, 12, \ldots$

Correct Answer: 47

Solution:

Concept: The n^{th} term of an Arithmetic Progression (A.P.) is given by:

$$a_n = a + (n-1)d$$

where:

- a = first term
- d = common difference

Step 1: Identify values

$$a = 2, \quad d = 7 - 2 = 5, \quad n = 10$$

Step 2: Apply formula

$$a_{10} = 2 + (10 - 1) \times 5$$

$$= 2 + 9 \times 5$$

$$= 2 + 45 = 47$$

Final Answer:

$$\boxed{47}$$

Quick Tip

To find any term of an A.P.:

$$a_n = a + (n-1)d$$

This is one of the most frequently used formulas in A.P. problems.

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7. Determine the probability of rolling a prime number on a die.

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

Solution:

Concept: Probability is defined as:

$$\text{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

A standard die has 6 faces numbered:

$$1, 2, 3, 4, 5, 6$$

Step 1: Identify prime numbers on a die Prime numbers are numbers greater than 1 that have only two factors (1 and itself).

Prime numbers between 1 and 6:

$$2, 3, 5$$

Step 2: Count favourable outcomes Number of prime numbers = 3

Step 3: Total outcomes Total outcomes when rolling a die = 6

Step 4: Find probability

$$P(\text{prime number}) = \frac{3}{6} = \frac{1}{2}$$

Final Answer:

$$\boxed{\frac{1}{2}}$$

Quick Tip

Steps for probability:

- List all possible outcomes.
- Identify favourable outcomes.
- Use $\frac{\text{favourable}}{\text{total}}$.

Always simplify the fraction to lowest form.

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8. Prove that tangents from an external point to a circle are equal in length.

Correct Answer: Tangents drawn from an external point to a circle are equal in length.

Solution:

Concept: A tangent to a circle is perpendicular to the radius at the point of contact. We prove the result using congruent triangles.

Given: Let P be an external point, and PA and PB be tangents to a circle with center O, touching the circle at A and B respectively.

To Prove:

$$PA = PB$$

Construction: Join OA, OB, and OP.

Proof:

Step 1: Radius is perpendicular to tangent

$$OA \perp PA \quad \text{and} \quad OB \perp PB$$

So,

$$\angle OAP = \angle OBP = 90^\circ$$

Step 2: Consider triangles $\triangle OAP$ and $\triangle OBP$ We have:

- $OA = OB$ (radii of the same circle)
- $OP = OP$ (common side)
- $\angle OAP = \angle OBP = 90^\circ$

Step 3: Apply RHS congruence

$$\triangle OAP \cong \triangle OBP \quad (\text{RHS})$$

Step 4: Corresponding parts are equal

$$PA = PB$$

Conclusion: Hence, tangents drawn from an external point to a circle are equal in length.

Quick Tip

To prove tangent properties:

- Join center to points of contact.
- Use radius tangent property.
- Apply RHS congruence.

This is a standard geometry proof.
