

## CBSE Class 10 Mathematics — Real Numbers PYQs

*Bifurcated by Standard (041) & Basic (241) Curriculums (2021-2025)*

### Part A: Standard Mathematics (041) Question Bank

#### Question 1 [2025 Exam] (1 Mark - MCQ)

If two positive integers  $p$  and  $q$  can be expressed as  $p = a^2 \times b^3$  and  $q = a^4 \times b$ , where  $a$  and  $b$  are prime numbers, then LCM ( $p, q$ ) is:

(A)  $a^2 \times b$    (B)  $a^4 \times b^3$    (C)  $a^4 \times b$    (D)  $a^2 \times b^3$

[Marking Scheme] Correct Option identification: 0.5 Mark | Correct final expression: 0.5 Mark.

**Answer:** To find the Least Common Multiple (LCM), we take the highest power of each prime factor involved.

- Highest power of  $a$  in  $p$  and  $q$  is  $a^4$ .
- Highest power of  $b$  in  $p$  and  $q$  is  $b^3$ .

Therefore,  $\text{LCM}(p, q) = a^4 \times b^3$ .

Hence, Correct Option is **(B)**

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#### Question 2 [2024 Exam] (3 Marks - Short Answer)

Prove that  $5 + 2\sqrt{3}$  is an irrational number, given that  $\sqrt{3}$  is an irrational number.

[Marking Scheme] Assumption of contradiction: 0.5 Mark | Rearranging and isolating  $\sqrt{3}$ : 1.5 Marks | Logical reasoning and contradiction conclusion: 1 Mark.

**Answer:** Let us assume to the contrary that  $5 + 2\sqrt{3}$  is a rational number. Therefore, it can be expressed in the form  $a/b$ , where  $a$  and  $b$  are co-prime integers and  $b \neq 0$ .

Here,

$$5 + 2\sqrt{3} = \frac{a}{b}$$

$$2\sqrt{3} = \frac{a}{b} - 5$$

$$2\sqrt{3} = \frac{(a-5b)}{b} \text{ (making denominators the same)}$$

$$\sqrt{3} = \frac{(a-5b)}{2b}$$

Since  $a, b, 5,$  and  $2$  are integers, the right-hand side  $\frac{(a-5b)}{2b}$  must be a rational number.

This implies that  $\sqrt{3}$  is also a rational number. But this contradicts the given fact that  $\sqrt{3}$  is irrational.

Hence, our assumption was incorrect, and  $5 + 2\sqrt{3}$  is an irrational number.

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**Question 3 [2023 Exam] (3 Marks - Standard Proof)**

Prove that  $\sqrt{5}$  is an irrational number.

[Marking Scheme] Contradiction setup: 0.5 Mark | Proving 5 divides  $a^2$  and  $a$ : 1 Mark | Proving 5 divides  $b^2$  and  $b$ : 1 Mark | Concluding contradiction: 0.5 Mark.

**Answer:** Let us assume to the contrary that  $\sqrt{5}$  is a rational number.

Then,  $\sqrt{5} = \frac{a}{b}$ , where  $a$  and  $b$  are co-prime integers and  $b \neq 0$ .

$$5 = \frac{a^2}{b^2} \text{--- (Equation 1) (Squaring on both sides)}$$

$$\Rightarrow 5 \times b^2 = a^2$$

Since 5 divides  $5b^2$ , it must divide  $a^2$ . Thus, 5 also divides  $a$ .

So, let  $a = 5c$  for some integer  $c$ . Substitute  $a = 5c$  into Equation 1,

$$(5c)^2 = 5b^2 \Rightarrow 25c^2 = 5b^2 \Rightarrow b^2 = 5c^2$$

Since 5 divides  $5c^2$ , it must divide  $b^2$ . This means 5 also divides  $b$ .

Therefore,  $a$  and  $b$  have a common factor of 5, which contradicts our assumption that  $a$  and  $b$  are co-prime. Hence,  $\sqrt{5}$  is an irrational number.

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**Question 4 [2021 Exam] (3 Marks - Long Word Problem)**

A merchant has 120 litres of oil of one kind, 180 litres of another kind and 240 litres of a third kind. He wants to sell the oil by filling the three kinds of oil in tins of equal capacity. What should be the greatest capacity of such a tin?

[Marking Scheme] Identifying the need to find HCF: 1 Mark | Finding prime factors: 1 Mark | Calculating the final HCF: 1 Mark.

**Answer:** To find the greatest capacity of the tin that can measure all three quantities exactly, we need to calculate the HCF of 120, 180, and 240.

- $120 = 2^3 \times 3^1 \times 5^1$

- $180 = 2^2 \times 3^2 \times 5^1$

- $240 = 2^4 \times 3^1 \times 5^1$

To find HCF, take the lowest power of the common prime factors:

$$\text{HCF} = 2^2 \times 3^1 \times 5^1 = 4 \times 3 \times 5 = 60.$$

Therefore, the greatest capacity of such a tin should be 60 litres.

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## Part B: Basic Mathematics (241) Question Bank

### Question 5 [2025 Exam] (2 Marks - Short Answer)

Given that  $\text{HCF}(70, 630) = 10$ , find the  $\text{LCM}(70, 630)$ .

[Marking Scheme] Stating the formula  $\text{HCF} \times \text{LCM} = a \times b$ , 1 Mark | Correct calculation and substitution: 1 Mark.

**Answer:** We use the property:

$$\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$$

$$10 \times \text{LCM} = 70 \times 630$$

$$\Rightarrow \text{LCM} = \frac{70 \times 630}{10} = 7 \times 630 = 4410.$$

Final Answer: 4410

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### Question 6 [2024 Exam] (1 Mark - MCQ)

The exponent of 5 in the prime factorization of 3750 is:

(A) 3 (B) 4 (C) 5 (D) 6

[Marking Scheme] Finding prime factors: 0.5 Mark | Stating the correct exponent: 0.5 Mark.

**Answer:** Prime factorization of 3750:

$$3750 = 2 \times 3 \times 625 = 2^1 \times 3^1 \times 5^4.$$

The exponent of 5 is 4. Hence,

Correct Option is **(B)**

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### Question 7 [2023 Exam] (2 Marks - Application Variation)

Two bells toll together at intervals of 9 and 12 minutes respectively. If they toll together at 10:00 AM, at what time will they toll together next?

[Marking Scheme] Identifying the need to find LCM: 0.5 Mark | Finding LCM: 1 Mark | Final answer conversion: 0.5 Mark.

**Answer:** LCM of 9 and 12:

- $9 = 3^2$

- $12 = 2^2 \times 3$

$$\text{LCM}(9, 12) = 2^2 \times 3^2 = 36 \text{ minutes.}$$

Next tolling time = 10:00 AM + 36 minutes = 10:36 AM. At 10:36 AM the bell toll together next.

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**Question 8 [2022 Exam] (3 Marks - Short Answer)**

Prove that  $3 - \sqrt{2}$  is an irrational number, given that  $\sqrt{2}$  is irrational.

[Marking Scheme] Assumption and equation setup: 1 Mark | Transposition and isolating radical: 1 Mark | Final contradiction rationale: 1 Mark.

**Answer:** Let  $3 - \sqrt{2} = x$ , where  $x$  is rational.

$$3 - x = \sqrt{2}$$

Since 3 and  $x$  are rational,  $(3 - x)$  must be rational.

However,  $\sqrt{2}$  is irrational. A rational cannot equal an irrational, which is a contradiction. Hence,  $3 - \sqrt{2}$  is irrational.

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**Question 9 [2022 Exam] (1 Mark - Objective)**

If  $\text{HCF}(x, 8) = 4$  and  $\text{LCM}(x, 8) = 24$ , find the value of  $x$ .

[Marking Scheme] Correct usage of formula: 0.5 Mark | Correct final value: 0.5 Mark.

**Answer:**  $\text{HCF} \times \text{LCM} = \text{Product of numbers}$

$$\Rightarrow 4 \times 24 = x \times 8$$

$$\Rightarrow 96 = 8x$$

$$\Rightarrow x = 12.$$

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**Question 10 [2021 Exam] (2 Marks - Factoring Theory)**

Explain why  $7 \times 11 \times 13 + 13$  and  $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$  are composite numbers.

[Marking Scheme] Simplifying first expression: 1 Mark | Simplifying second expression: 1 Mark.

**Answer:**

Case 1:  $13 \times (7 \times 11 + 1) = 13 \times 78$ . It has factors other than 1 and itself, so it is composite.

Case 2:  $5 \times (7 \times 6 \times 4 \times 3 \times 2 \times 1 + 1) = 5 \times 1009$ . It has factors other than 1 and itself, so it is composite.

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