CLASS 10 · CBSE MATHEMATICS STANDARD (041)

Maths Solved Board Papers

Chapter-wise and year-wise CBSE board questions with complete step-by-step solutions

10 years · 2016–2026

- ✓ Part A: every question sorted chapter-wise, grouped by marks, with full solutions
- ✓ Part B: 17 complete board papers, each followed by its solutions
- ✓ Board weightage table and most-asked topics for every chapter
- ✓ Every step shown, written the way the board awards marks
- ✓ Questions on topics out of the board syllabus are flagged

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WHAT YOU GET

10 years of CBSE Maths papers. Every question solved. Sorted chapter-wise.

124	2219	10	14	208
board papers	solved questions	years · 2016–26	chapters	diagrams

✗ Questions scattered across years	→ ✓ All in one place, chapter-wise
✗ Don't know what to study first	→ ✓ Weightage + most-asked topics
✗ One-line answers online	→ ✓ Full solutions, board-style
✗ Old books carry deleted topics	→ ✓ Topics out of the syllabus clearly marked

A PART A
Chapter-wise
- ✓ Weightage table
- ✓ Most-asked topics
- ✓ Every question + solution

B PART B
Full papers
- ✓ Exactly as set by CBSE
- ✓ Solutions after each paper
- ✓ Timed 3-hour practice

2026 · 30/4/1	**2026** · 30/5/1	**2025** · 30/1/1	**2025** · 30/2/1	**2024** · 30/2/1
2024 · 30/4/1	**2023** · 30/2/1	**2023** · 30/4/1	**2022** · 30/1/1 · T2	**2022** · 30/3/1 · T2
2020 · 30/1/1	**2020** · 30/3/1	**2019** · 30/2/1	**2019** · 30/5/1	**2018** · 30/1
2017 · 30/1	**2016** · 30/1			

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How to use this book

Part A puts every board question of a chapter together, from 1-mark MCQs to 5-mark long answers. Finish a chapter in your notes, then solve its Part A questions without looking at the solutions. Check your answer, mark the ones you got wrong, and repeat them a week later.

Each question shows where it was asked, for example **CBSE 2026 · 30/4/1 · Q13**. Use the weightage table and the most-asked topics chart at the start of each chapter to decide what to revise first.

Part B gives full papers. In the last month before the exam, sit with a clock and write one paper in 3 hours, then check it with the solutions that follow the paper.

Solutions are written the way the board awards marks: every step shown, formulas stated, units and a neat figure where needed. Write your answers the same way.

Contents

Part A · Chapter-wise questions with solutions

1. Real Numbers 136 Qs
2. Polynomials 107 Qs
3. Pair of Linear Equations in Two Variables 134 Qs
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Part B · Full board papers, each followed by its solutions

1. CBSE 2026 · 30/4/1 solutions
2. CBSE 2026 · 30/5/1 solutions
3. CBSE 2025 · 30/1/1 solutions
4. CBSE 2025 · 30/2/1 solutions
5. CBSE 2024 · 30/2/1 solutions
6. CBSE 2024 · 30/4/1 solutions
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10. CBSE 2022 · 30/3/1 · Term 2 solutions
11. CBSE 2020 · 30/1/1 solutions
12. CBSE 2020 · 30/3/1 solutions
13. CBSE 2019 · 30/2/1 solutions
14. CBSE 2019 · 30/5/1 solutions
15. CBSE 2018 · 30/1 solutions
16. CBSE 2017 · 30/1 solutions
17. CBSE 2016 · 30/1 solutions

2219 questions in all. Questions are taken from the CBSE Class 10 Mathematics board papers and the solutions are our own, checked against the official marking schemes where they are available. Questions from papers before 2022 on topics not in the 2026-27 syllabus, and construction questions from any year, are left out of Part A and marked in Part B. Where a topic is named only in CBSE's practicals or objectives, or was asked in a recent paper, its questions stay in Part A so that nothing you may need is missing.

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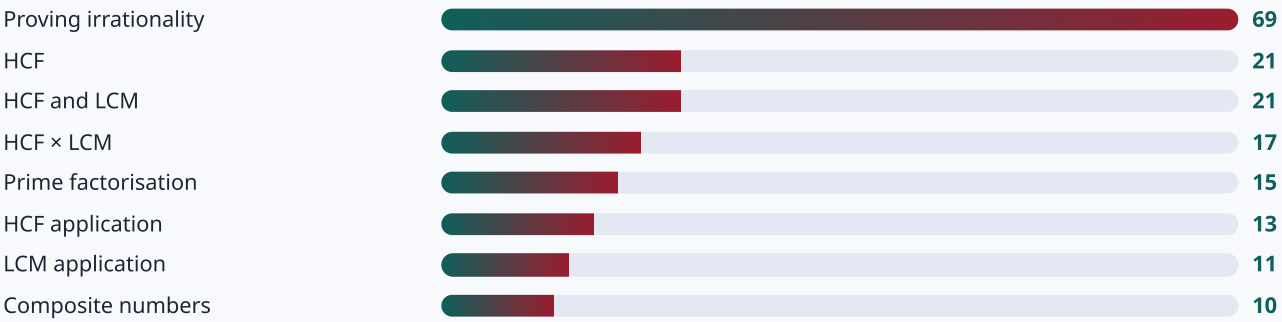
CHAPTER 1

Real Numbers

Board weightage 2016–2026

Year	2016	2017	2018	2019	2020	2022	2023	2024	2025	2026
Questions per paper	–	–	3	3.1	2.8	–	3.8	3.7	4.5	3.6
Marks per paper	–	–	6	6	5	–	8	7	8	6

Most asked topics



136 different questions from 94 papers. Repeated questions are shown once with every year they were asked.

1 mark: MCQ and Assertion–Reason

CBSE 2026 · 30/1/1 · Q1 | CBSE 2026 · 30/1/2 · Q3 | CBSE 2026 · 30/1/3 · Q17 **asked 3 times** — **1 mark**

The HCF of 960 and 432 is :

(a) 48 (b) 54
(c) 72 (d) 36

Solution

Answer: (a) 48

$960 = 2^6 \times 3 \times 5$ and $432 = 2^4 \times 3^3$, so HCF $= 2^4 \times 3 = 48$.

CBSE 2026 · 30/1/1 · Q2 | CBSE 2026 · 30/1/2 · Q1 | CBSE 2026 · 30/1/3 · Q18 **asked 3 times** — **1 mark**

The natural number 2 is :

(a) a prime number (b) a composite number
(c) prime as well as composite (d) neither prime nor composite

Solution

Answer: (a) a prime number

2 has exactly two factors, 1 and 2. It is the smallest prime and the only even prime.

CBSE 2026 · 30/1/1 · Q3 | CBSE 2026 · 30/1/2 · Q2 | CBSE 2026 · 30/1/3 · Q1 **asked 3 times** — **1 mark**

For any natural number n, 6^n ends with the digit :

(a) 0 (b) 6
(c) 3 (d) 2

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Solution

Answer: (b) 6

$6^1 = 6, 6^2 = 36, 6^3 = 216, \ldots$ Since 6×6 ends in 6, every power of 6 ends in 6.

CBSE 2026 · 30/2/1 · Q1 | CBSE 2026 · 30/2/3 · Q6 **asked 2 times** — 1 mark

The LCM of 960 and 240 is :

(A) 960 (B) 240
(C) 60 (D) 15

Solution

Answer: (A) 960

$960 = 240 \times 4$, so 240 is a factor of 960. The LCM of a number and its factor is the number itself: LCM $= 960$.

CBSE 2026 · 30/2/1 · Q2 | CBSE 2026 · 30/2/2 · Q4 | CBSE 2026 · 30/2/3 · Q2 **asked 3 times** — 1 mark

The natural number 1 is :

(A) a prime number. (B) a composite number.
(C) prime as well as composite. (D) neither prime nor composite.

Solution

Answer: (D) neither prime nor composite.

A prime has exactly two factors and a composite number has more than two. The number 1 has only one factor.

CBSE 2026 · 30/2/1 · Q3 | CBSE 2026 · 30/2/2 · Q6 | CBSE 2026 · 30/2/3 · Q4 **asked 3 times** — 1 mark

For any natural number n, 5^n ends with the digit :

(A) 0 (B) 5
(C) 3 (D) 2

Solution

Answer: (B) 5

$5^1 = 5, 5^2 = 25, 5^3 = 125, \ldots$ An odd number times 5 always ends in 5, so every power of 5 ends in 5.

CBSE 2026 · 30/2/2 · Q2 — 1 mark

There are two sections A and B of Grade X. There are 28 students in Section A and 30 students in Section B. What is the minimum number of books you will acquire for the class library so that they can be distributed equally among students of Section A or Section B ?

(A) 144 (B) 2
(C) 420 (D) 272

Solution

Answer: (C) 420

The number must be a multiple of both 28 and 30. $28 = 2^2 \times 7$ and $30 = 2 \times 3 \times 5$, so LCM $= 2^2 \times 3 \times 5 \times 7 = 420$.

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CBSE 2026 · 30/3/1 · Q4 | CBSE 2026 · 30/3/2 · Q18 | CBSE 2026 · 30/3/3 · Q11 asked 3 times 1 mark

$(3 \times 11 \times 13 + 3)$ is :

(A) a prime number
(B) divisible by 13
(C) a composite number
(D) an odd number

Solution

Answer: (C) a composite number

$3 \times 11 \times 13 + 3 = 3(143 + 1) = 3 \times 144 = 432$, which has factors other than 1 and itself.

CBSE 2026 · 30/4/1 · Q20 | CBSE 2026 · 30/4/2 · Q19 | CBSE 2026 · 30/4/3 · Q20 asked 3 times 1 mark

Assertion (A): $(\sqrt{3} + \sqrt{5})$ is an irrational number.
Reason (R): Sum of the any two irrational numbers is always irrational.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution

Answer: (C)

A is true ($\sqrt{3} + \sqrt{5}$ is irrational). R is false: $\sqrt{2}$ and $-\sqrt{2}$ are irrational but their sum is 0, which is rational.

CBSE 2026 · 30/5/1 · Q20 | CBSE 2026 · 30/5/2 · Q20 | CBSE 2026 · 30/5/3 · Q19 asked 3 times 1 mark

Assertion (A): H.C.F. $(36m^2, 18m) = 18m$, where m is a prime number.
Reason (R): H.C.F. of two numbers is always less than or equal to the smaller number.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution

Answer: (B)

$36m^2 = 18m \times 2m$, so $18m$ divides $36m^2$, and HCF $= 18m$: A is true. R is a true general fact, but it does not explain why the HCF here equals $18m$.

CBSE 2025 · 30/1/1 · Q6 | CBSE 2025 · 30/1/2 · Q12 | CBSE 2025 · 30/1/3 · Q9 asked 3 times 1 mark

If HCF$(98, 28) = m$ and LCM$(98, 28) = n$, then the value of $n - 7m$ is:

(A) 0
(B) 28
(C) 98
(D) 198

Solution

Answer: (C) 98

$98 = 2 \times 7^2$, $28 = 2^2 \times 7$. HCF $m = 2 \times 7 = 14$, LCM $n = 2^2 \times 7^2 = 196$.

$n - 7m = 196 - 98 = 98$.

CBSE 2025 · 30/1/1 · Q9 | CBSE 2025 · 30/1/3 · Q15 asked 2 times 1 mark

If $(-1)^n + (-1)^8 = 0$, then n is:

(A) any positive integer
(B) any negative integer
(C) any odd number
(D) any even number

Solution

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Answer: (C) any odd number

$(-1)^8 = 1$, so $(-1)^n = -1$, which happens exactly when n is odd.

CBSE 2025 · 30/1/1 · Q14 | CBSE 2025 · 30/1/2 · Q11 | CBSE 2025 · 30/1/3 · Q10 **asked 3 times** — 1 mark

Which of the following is a rational number between $\sqrt{3}$ and $\sqrt{5}$?

(A) $1.4142387954012\ldots$ (B) $2.32\overline{6}$

(C) π (D) 1.857142

Solution

Answer: (D) 1.857142

$\sqrt{3} \approx 1.732$ and $\sqrt{5} \approx 2.236$. 1.857142 is a terminating decimal (rational) and lies between them. (A) is below $\sqrt{3}$ and non-repeating, (B) is above $\sqrt{5}$, and π is irrational and too large.

CBSE 2025 · 30/1/2 · Q14 — 1 mark

The greatest number which divides 70 and 125, leaving remainders 5 and 8 respectively, is :

(A) 13 (B) 65

(C) 875 (D) 1750

Solution

Answer: (A) 13

The number must divide $70 - 5 = 65$ and $125 - 8 = 117$. $65 = 5 \times 13$, $117 = 3^2 \times 13$, so HCF $= 13$.

CBSE 2025 · 30/2/1 · Q4 | CBSE 2025 · 30/2/2 · Q8 | CBSE 2025 · 30/2/3 · Q16 **asked 3 times** — 1 mark

The least number which is a perfect square and is divisible by each of 16, 20 and 50, is:

(A) 1200 (B) 100

(C) 3600 (D) 2400

Solution

Answer: 400 (none of the options). The board gave full marks to every candidate for this question.

LCM$(16, 20, 50) = 2^4 \times 5^2 = 400 = 20^2$, which is already a perfect square, so the least such number is 400.

(Among the options, only $3600 = 60^2$ is a perfect square divisible by all three, but it is not the least.)

CBSE 2025 · 30/2/1 · Q10 | CBSE 2025 · 30/2/3 · Q7 **asked 2 times** — 1 mark

The sum of the exponents of prime factors in the prime factorisation of 4004 is:

(A) 5 (B) 4

(C) 3 (D) 2

Solution

Answer: (A) 5

$4004 = 2^2 \times 7 \times 11 \times 13$. Sum of exponents $= 2 + 1 + 1 + 1 = 5$.

CBSE 2025 · 30/2/1 · Q18 | CBSE 2025 · 30/2/2 · Q6 **asked 2 times** — 1 mark

The HCF of 40, 110 and 360 is:

(A) 40 (B) 110

(C) 360 (D) 10

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Solution

Answer: (D) 10

$40 = 2^3 \times 5, 110 = 2 \times 5 \times 11, 360 = 2^3 \times 3^2 \times 5$. HCF $= 2 \times 5 = 10$.

CBSE 2025 · 30/2/2 · Q12 — 1 mark

If $1080 = 2^p \times 3^q \times 5$, then $(p - q)$ is equal to :

(A) 6 (B) -1

(C) 1 (D) 0

Solution

Answer: (D) 0

$1080 = 8 \times 27 \times 5 = 2^3 \times 3^3 \times 5$. So $p = 3$, $q = 3$ and $p - q = 0$.

CBSE 2025 · 30/2/3 · Q4 — 1 mark

If $a^b = 32$, where 'a' and 'b' are positive integers, then the value of b^{ab} is :

(A) 72 (B) 5^{10}

(C) 2^{10} (D) 5^{12}

Solution

Answer: (B) 5^{10}

$32 = 2^5$, so $a = 2$, $b = 5$ and $ab = 10$. Hence $b^{ab} = 5^{10}$.

CBSE 2025 · 30/3/1 · Q2 | CBSE 2025 · 30/3/2 · Q9 | CBSE 2025 · 30/3/3 · Q16 — asked 3 times — 1 mark

If x is the LCM of 4, 6, 8 and y is the LCM of 3, 5, 7 and p is the LCM of x and y, then which of the following is true ?

(A) $p = 35x$ (B) $p = 4y$

(C) $p = 8x$ (D) $p = 16y$

Solution

Answer: (A) $p = 35x$

$x = 24$, $y = 105$. LCM$(24, 105) = 840 = 35 \times 24$, so $p = 35x$.

CBSE 2025 · 30/4/1 · Q1 | CBSE 2025 · 30/4/2 · Q3 | CBSE 2025 · 30/4/3 · Q10 — asked 3 times — 1 mark

If $x = ab^3$ and $y = a^3b$, where a and b are prime numbers, then $[\text{HCF}(x, y) - \text{LCM}(x, y)]$ is equal to :

(a) $1 - a^3b^3$ (b) $ab(1 - ab)$

(c) $ab - a^4b^4$ (d) $ab(1 - ab)(1 + ab)$

Solution

Answer: (d) $ab(1 - ab)(1 + ab)$

HCF $= ab$ and LCM $= a^3b^3$. So HCF − LCM $= ab - a^3b^3 = ab(1 - a^2b^2) = ab(1 - ab)(1 + ab)$.

CBSE 2025 · 30/4/1 · Q2 | CBSE 2025 · 30/4/2 · Q4 | CBSE 2025 · 30/4/3 · Q11 — asked 3 times — 1 mark

$(1 + \sqrt{3})^2 - (1 - \sqrt{3})^2$ is :

(a) a positive rational number. (b) a negative integer.

(c) a positive irrational number. (d) a negative irrational number.

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Solution

Answer: (c) a positive irrational number.

$(1+3+2\sqrt{3})-(1+3-2\sqrt{3})=4\sqrt{3}$, which is positive and irrational.

CBSE 2025 · 30/4/1 · Q19 | CBSE 2025 · 30/4/2 · Q20 **asked 2 times** **1 mark**

Directions : In question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

Assertion (A): 4^n ends with digit 0 for some natural number n.

Reason (R): For a number 'x' having 2 and 5 as its prime factors, x^n always ends with digit 0 for every natural number n.

(a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

(b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

Solution

Answer: (d) Assertion (A) is false but Reason (R) is true

$4^n=2^{2n}$ has no prime factor 5, so it never ends with 0. A is false. R is true: 2 and 5 as prime factors make x^n a multiple of 10.

CBSE 2025 · 30/4/3 · Q20 **1 mark**

Directions : In question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

Assertion (A): Unit digit of 3^n cannot be an even number for any natural number n.

Reason (R): 2 is not a prime factor of 3^n for any natural number n.

(a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

(b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

Solution

Answer: (a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

A number ending in an even digit is divisible by 2. 3^n has only the prime factor 3, so it is not divisible by 2. That is exactly why its unit digit cannot be even.

CBSE 2025 · 30/5/1 · Q1 | CBSE 2025 · 30/5/2 · Q3 | CBSE 2025 · 30/5/3 · Q10 **asked 3 times** **1 mark**

$(\sqrt{3}+2)^2+(\sqrt{3}-2)^2$ is a/an

(A) positive rational number

(B) negative rational number

(C) positive irrational number

(D) negative irrational number

Solution

Answer: (A) positive rational number

$(3+4+4\sqrt{3})+(3+4-4\sqrt{3})=14$, which is a positive rational number.

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CBSE 2025 · 30/5/1 · Q2 — 1 mark

Let $x = a^2b^3c^n$ and $y = a^3b^mc^2$, where a, b, c are prime numbers. If LCM of x and y is $a^3b^4c^3$, then the value of $m + n$ is

(A) 10 (B) 7
(C) 6 (D) 5

Solution

Answer: (B) 7

LCM takes the highest power of each prime: b^4 gives $m = 4$ and c^3 gives $n = 3$. So $m + n = 7$.

CBSE 2025 · 30/5/1 · Q3 | CBSE 2025 · 30/5/2 · Q5 | CBSE 2025 · 30/5/3 · Q12 — asked 3 times — 1 mark

For any prime number p, if p divides a^2, where a is any real number then p also divides

(A) a (B) $a^{\frac{1}{2}}$
(C) $a^{\frac{3}{2}}$ (D) $a^{\frac{1}{8}}$

Solution

Answer: (A) a

By the standard result, if a prime p divides a^2, then p divides a.

CBSE 2025 · 30/5/2 · Q4 — 1 mark

Let $a = p^2q^3r^n$ and $b = p^3q^mr^2$, where p, q, r are prime numbers. If LCM of a and b is $p^3q^4r^3$, then the value of $3n - 2m$ is

(A) -1 (B) 1
(C) 3 (D) -3

Solution

Answer: (B) 1

LCM takes the highest power of each prime: q^4 gives $m = 4$ and r^3 gives $n = 3$. So $3n - 2m = 9 - 8 = 1$.

CBSE 2025 · 30/5/3 · Q11 — 1 mark

Let $p = x^2y^3z^n$ and $q = x^3y^mz^2$, where x, y, z are prime numbers. If LCM $(p, q) = x^3y^4z^3$, then the value of $(2m + 3n)$ is

(A) 18 (B) 17
(C) 15 (D) 14

Solution

Answer: (B) 17

LCM takes the highest power of each prime: y^4 gives $m = 4$ and z^3 gives $n = 3$. So $2m + 3n = 8 + 9 = 17$

.

CBSE 2025 · 30/6/1 · Q1 | CBSE 2025 · 30/6/2 · Q3 | CBSE 2025 · 30/6/3 · Q10 — asked 3 times — 1 mark

$\sqrt{0.4}$ is a/an

(A) natural number (B) integer
(C) rational number (D) irrational number

Solution

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Answer: (D) irrational number

$\sqrt{0.4} = \sqrt{\frac{2}{5}} = \frac{\sqrt{10}}{5}$. Since $\sqrt{10}$ is irrational, this is irrational.

CBSE 2025 · 30/6/1 · Q2 | CBSE 2025 · 30/6/2 · Q4 | CBSE 2025 · 30/6/3 · Q11 **asked 3 times** — 1 mark

Which of the following cannot be the unit digit of 8^n, where n is a natural number ?

(A) 4 (B) 2

(C) 0 (D) 6

Solution

Answer: (C) 0

$8^n = 2^{3n}$ has no prime factor 5, so it cannot end with 0.

CBSE 2025 · 30/6/1 · Q19 — 1 mark

Assertion (A): For any two prime numbers p and q, their HCF is 1 and LCM is $p + q$.

Reason (R): For any two natural numbers, HCF × LCM = product of numbers.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution

Answer: (D)

LCM of two primes is pq, not $p + q$, so A is false. R is the standard result, so it is true.

CBSE 2025 · 30/6/2 · Q19 — 1 mark

Assertion (A): For two prime numbers x and y $(x < y)$, HCF$(x, y) = x$ and LCM$(x, y) = y$.

Reason (R): HCF$(x, y) \leq$ LCM(x, y), where x, y are any two natural numbers.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution

Answer: (D)

For two primes, HCF $= 1$ and LCM $= xy$, so A is false. The HCF divides the LCM, so HCF ≤ LCM and R is true.

CBSE 2025 · 30/6/3 · Q20 — 1 mark

Assertion (A): For two odd prime numbers x and y, $(x \neq y)$, LCM$(2x, 4y) = 4xy$

Reason (R): LCM(x, y) is a multiple of HCF(x, y).

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution

Answer: (B)

$2x = 2 \times x$ and $4y = 2^2 \times y$, so LCM $= 2^2 \times x \times y = 4xy$. A is true. R is also true (HCF divides LCM), but it does not explain A.

CBSE 2024 · 30/1/1 · Q5 | CBSE 2024 · 30/1/2 · Q16 | CBSE 2024 · 30/1/3 · Q1 **asked 3 times** **1 mark**

If two positive integers p and q can be expressed as $p = 18\,a^2b^4$ and $q = 20\,a^3b^2$, where a and b are prime numbers, then LCM (p, q) is :

(a) $2\,a^2b^2$ (b) $180\,a^2b^2$

(c) $12\,a^2b^2$ (d) $180\,a^3b^4$

Solution

Answer: (d) $180\,a^3b^4$

LCM takes the highest power of each factor: LCM $(18, 20) = 180$, then a^3 and b^4. So LCM $= 180\,a^3b^4$.

CBSE 2024 · 30/2/1 · Q5 | CBSE 2024 · 30/2/2 · Q16 | CBSE 2024 · 30/2/3 · Q17 **asked 3 times** **1 mark**

If the HCF $(2520, 6600) = 40$ and LCM $(2520, 6600) = 252 \times k$, then the value of k is

(A) 1650 (B) 1600

(C) 165 (D) 1625

Solution

Answer: (A) 1650

HCF × LCM = product of the numbers: $40 \times 252k = 2520 \times 6600$

$$k = \frac{2520 \times 6600}{40 \times 252} = 10 \times 165 = 1650$$

CBSE 2024 · 30/3/1 · Q5 | CBSE 2024 · 30/3/2 · Q9 **asked 2 times** **1 mark**

If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM $(a, b, c) = 3780$, then x is equal to

(A) 1 (B) 2

(C) 3 (D) 0

Solution

Answer: (C) 3

$3780 = 2^2 \times 3^3 \times 5 \times 7$. LCM $= 2^2 \times 3^x \times 5 \times 7$ (for $x \geq 1$), so $x = 3$.

CBSE 2024 · 30/3/1 · Q13 | CBSE 2024 · 30/3/2 · Q16 | CBSE 2024 · 30/3/3 · Q7 **asked 3 times** **1 mark**

Given HCF $(2520, 6600) = 40$, LCM $(2520, 6600) = 252 \times k$, then the value of k is :

(A) 1650 (B) 1600

(C) 165 (D) 1625

Solution

Answer: (A) 1650

HCF × LCM = product of the numbers: $40 \times 252k = 2520 \times 6600$

$$k = \frac{2520 \times 6600}{40 \times 252} = 10 \times 165 = 1650$$

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CBSE 2024 · 30/3/1 · Q14 | CBSE 2024 · 30/3/3 · Q4 **asked 2 times** **1 mark**

A pair of irrational numbers whose product is a rational number is :

(A) $(\sqrt{16}, \sqrt{4})$ (B) $(\sqrt{5}, \sqrt{2})$

(C) $(\sqrt{3}, \sqrt{27})$ (D) $(\sqrt{36}, \sqrt{2})$

Solution

Answer: (C) $(\sqrt{3}, \sqrt{27})$

$\sqrt{3}$ and $\sqrt{27}$ are irrational, and $\sqrt{3} \times \sqrt{27} = \sqrt{81} = 9$ is rational.

CBSE 2024 · 30/3/3 · Q15 **1 mark**

The smallest irrational number by which $\sqrt{20}$ should be multiplied so as to get a rational number, is :

(A) $\sqrt{20}$ (B) $\sqrt{2}$

(C) 5 (D) $\sqrt{5}$

Solution

Answer: (D) $\sqrt{5}$

$\sqrt{20} = 2\sqrt{5}$, so $\sqrt{20} \times \sqrt{5} = 2 \times 5 = 10$, which is rational.

CBSE 2024 · 30/4/1 · Q2 | CBSE 2024 · 30/4/3 · Q9 **asked 2 times** **1 mark**

The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is $40x$, then the value of x is:

(A) 5 (B) 13

(C) 40 (D) 8

Solution

Answer: (B) 13

LCM $= \frac{65 \times 104}{13} = 520 = 40x \Rightarrow x = 13.$

CBSE 2024 · 30/4/2 · Q16 **1 mark**

If $3825 = 3^x \times 5^y \times 17^z$, then the value of $x + y - 2z$ is :

(A) 0 (B) 1

(C) 2 (D) 3

Solution

Answer: (C) 2

$3825 = 3^2 \times 5^2 \times 17^1$, so $x = 2$, $y = 2$, $z = 1$. $x + y - 2z = 2 + 2 - 2 = 2.$

CBSE 2024 · 30/5/1 · Q10 | CBSE 2024 · 30/5/3 · Q18 **asked 2 times** **1 mark**

The greatest number which divides 281 and 1249, leaving remainder 5 and 7 respectively, is :

(A) 23 (B) 276

(C) 138 (D) 69

Solution

Answer: (C) 138

The number divides $281 - 5 = 276$ and $1249 - 7 = 1242$. $276 = 2^2 \times 3 \times 23$ and $1242 = 2 \times 3^3 \times 23$.

HCF $= 2 \times 3 \times 23 = 138.$

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CBSE 2024 · 30/5/1 · Q13 | CBSE 2024 · 30/5/2 · Q15 | CBSE 2024 · 30/5/3 · Q15 **asked 3 times** **1 mark**

The LCM of three numbers 28, 44, 132 is :

(A) 258 (B) 231
(C) 462 (D) 924

Solution

Answer: (D) 924

$28 = 2^2 \times 7$, $44 = 2^2 \times 11$, $132 = 2^2 \times 3 \times 11$. LCM $= 2^2 \times 3 \times 7 \times 11 = 924$.

CBSE 2024 · 30/5/1 · Q14 | CBSE 2024 · 30/5/2 · Q4 **asked 2 times** **1 mark**

If the product of two co-prime numbers is 553, then their HCF is :

(A) 1 (B) 553
(C) 7 (D) 79

Solution

Answer: (A) 1

Co-prime numbers have no common factor other than 1, so their HCF is 1.

CBSE 2024 · 30/5/2 · Q12 **1 mark**

If the prime factorisation of 2520 is $2^3 \times 3^a \times b \times 7$, then the value of $a + 2b$ is :

(A) 12 (B) 10
(C) 9 (D) 7

Solution

Answer: (A) 12

$2520 = 2^3 \times 3^2 \times 5 \times 7$, so $a = 2$, $b = 5$. $a + 2b = 2 + 10 = 12$.

CBSE 2024 · 30/5/3 · Q1 **1 mark**

The LCM of the smallest prime number and the smallest odd composite number is :

(A) 10 (B) 6
(C) 9 (D) 18

Solution

Answer: (D) 18

The smallest prime is 2 and the smallest odd composite number is 9. LCM $(2, 9) = 18$.

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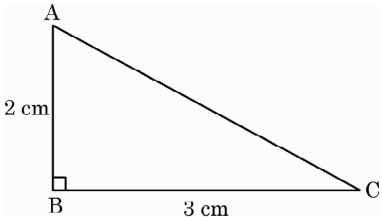
CBSE 2023 · 30/1/1 · Q20 | CBSE 2023 · 30/1/2 · Q19 | CBSE 2023 · 30/1/3 · Q19 **asked 3 times** **1 mark**

In Question 19 and 20, an **Assertion (A)** statement is followed by a statement of **Reason (R)**. Select the correct option out of the following :
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.
Assertion (A) : The perimeter of $\triangle ABC$ is a rational number.
Reason (R) : The sum of the squares of two rational numbers is always rational.



Solution

Answer: (D)
$AC = \sqrt{2^2 + 3^2} = \sqrt{13}$, so the perimeter $= 5 + \sqrt{13}$ cm is irrational: A is false. R is true, since squares and sums of rationals are rational.

CBSE 2023 · 30/2/1 · Q4 | CBSE 2023 · 30/2/2 · Q7 **asked 2 times** **1 mark**

If 'p' and 'q' are natural numbers and 'p' is the multiple of 'q', then what is the HCF of 'p' and 'q'?

(a) pq (b) p
(c) q (d) $p + q$

Solution

Answer: (c) q
q divides itself and divides p, and no larger number divides q. So HCF $= q$.

CBSE 2023 · 30/2/3 · Q1 **1 mark**

If 'n' is a natural number, then which of the following numbers end with zero ?

(a) $(3 \times 2)^n$ (b) $(2 \times 5)^n$
(c) $(6 \times 2)^n$ (d) $(5 \times 3)^n$

Solution

Answer: (b) $(2 \times 5)^n$
A number ends with zero only if it has both 2 and 5 as prime factors. Only $(2 \times 5)^n = 10^n$ has both.

CBSE 2023 · 30/4/1 · Q1 | CBSE 2023 · 30/4/2 · Q4 | CBSE 2023 · 30/4/3 · Q3 **asked 3 times** **1 mark**

The ratio of HCF to LCM of the least composite number and the least prime number is:

(a) 1 : 2 (b) 2 : 1
(c) 1 : 1 (d) 1 : 3

Solution

Answer: (a) 1 : 2
Least composite number = 4, least prime = 2. HCF$(4, 2) = 2$, LCM$(4, 2) = 4$. Ratio $= 2 : 4 = 1 : 2$.

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CBSE 2023 · 30/5/1 · Q20 | CBSE 2023 · 30/5/2 · Q19 | CBSE 2023 · 30/5/3 · Q19 **asked 3 times** **1 mark**

*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.*

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Assertion (A) : The number 5^n cannot end with the digit 0, where n is a natural number.

Reason (R): Prime factorisation of 5 has only two factors, 1 and 5.

Solution

Answer: (c)

5^n has no prime factor 2, so it cannot end with 0: A is true. R is false: 1 is not a prime, so "prime factorisation of 5" has only the factor 5 (the marking scheme's answer is (c)).

CBSE 2023 · 30/6/1 · Q1 | CBSE 2023 · 30/6/3 · Q7 **asked 2 times** **1 mark**

If $p^2 = \frac{32}{50}$, then p is a/an

(A) whole number (B) integer

(C) rational number (D) irrational number

Solution

Answer: (C) rational number

$p^2 = \frac{32}{50} = \frac{16}{25} \Rightarrow p = \pm\frac{4}{5}$, which is rational and not an integer.

CBSE 2023 · 30/6/2 · Q6 **1 mark**

The LCM of smallest 2-digit number and smallest composite number is

(A) 12 (B) 4

(C) 20 (D) 40

Solution

Answer: (C) 20

Smallest 2-digit number is 10 and smallest composite number is 4. LCM(10, 4) = 20.

CBSE 2020 · 30/1/1 · Q2 | CBSE 2020 · 30/1/2 · Q7 | CBSE 2020 · 30/1/3 · Q6 **asked 3 times** **1 mark**

The total number of factors of a prime number is

(a) 1 (b) 0

(c) 2 (d) 3

Solution

Answer: (c) 2

A prime has exactly two factors: 1 and itself.

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CBSE 2020 · 30/1/1 · Q5 | CBSE 2020 · 30/1/2 · Q1 | CBSE 2020 · 30/1/3 · Q2 asked 3 times — 1 mark

The HCF and the LCM of 12, 21, 15 respectively are

(a) 3, 140 (b) 12, 420
(c) 3, 420 (d) 420, 3

Solution

Answer: (c) 3, 420

$12 = 2^2 \times 3, 21 = 3 \times 7, 15 = 3 \times 5$. HCF $= 3$, LCM $= 2^2 \times 3 \times 5 \times 7 = 420$.

CBSE 2020 · 30/2/1 · Q1 | CBSE 2020 · 30/2/2 · Q4 | CBSE 2020 · 30/2/3 · Q4 asked 3 times — 1 mark

The sum of exponents of prime factors in the prime-factorisation of 196 is

(a) 3 (b) 4
(c) 5 (d) 2

Solution

Answer: (b) 4

$196 = 2^2 \times 7^2$. Sum of exponents $= 2 + 2 = 4$.

CBSE 2020 · 30/3/1 · Q1 | CBSE 2020 · 30/3/2 · Q5 | CBSE 2020 · 30/3/3 · Q3 asked 3 times — 1 mark

The HCF of 135 and 225 is

(a) 15 (b) 75
(c) 45 (d) 5

Solution

Answer: (c) 45

$135 = 3^3 \times 5, 225 = 3^2 \times 5^2$. HCF $= 3^2 \times 5 = 45$.

CBSE 2020 · 30/3/1 · Q2 | CBSE 2020 · 30/3/2 · Q6 | CBSE 2020 · 30/3/3 · Q1 asked 3 times — 1 mark

The exponent of 2 in the prime factorization of 144, is

(a) 2 (b) 4
(c) 1 (d) 6

Solution

Answer: (b) 4

$144 = 2^4 \times 3^2$.

CBSE 2020 · 30/4/1 · Q11 | CBSE 2020 · 30/4/2 · Q13 | CBSE 2020 · 30/4/3 · Q13 asked 3 times — 1 mark

$\left(\frac{2+\sqrt{5}}{3}\right)$ is _____ number.

Solution

Answer: irrational

$\sqrt{5}$ is irrational, so $2 + \sqrt{5}$ and its quotient by 3 are irrational too.

CBSE 2020 · 30/4/1 · Q16 | CBSE 2020 · 30/4/3 · Q18 asked 2 times — 1 mark

Given that HCF (135, 225) = 45, find the LCM (135, 225).

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Solution

LCM $= \frac{135 \times 225}{45} = 675.$

CBSE 2020 · 30/4/2 · Q17 — 1 mark

Given that HCF (120, 160) = 40, find LCM (120, 160).

Solution

LCM $= \frac{120 \times 160}{40} = 480.$

CBSE 2020 · 30/5/1 · Q18 | CBSE 2020 · 30/5/2 · Q16 | CBSE 2020 · 30/5/3 · Q19 — asked 3 times — 1 mark

The LCM of two numbers is 182 and their HCF is 13. If one of the numbers is 26, find the other.

Solution

Other number $= \frac{\text{LCM} \times \text{HCF}}{26} = \frac{182 \times 13}{26} = 91.$

CBSE 2019 · 30/1/1 · Q6 | CBSE 2019 · 30/1/2 · Q2 — asked 2 times — 1 mark

Find a rational number between $\sqrt{2}$ and $\sqrt{3}$.

Solution

$\sqrt{2} \approx 1.41$ and $\sqrt{3} \approx 1.73$. A rational number between them is **1.5** (any such number is correct, for example 1.6).

CBSE 2019 · 30/1/3 · Q1 — 1 mark

Two positive integers a and b can be written as $a = x^3y^2$ and $b = xy^3$. x, y are prime numbers. Find LCM (a, b).

Solution

LCM is the product of the greatest powers of the primes: LCM $= x^3y^3$.

CBSE 2019 · 30/2/1 · Q1 | CBSE 2019 · 30/2/2 · Q5 | CBSE 2019 · 30/2/3 · Q6 — asked 3 times — 1 mark

If HCF $(336, 54) = 6$, find LCM $(336, 54)$.

Solution

LCM $= \frac{336 \times 54}{6} = 336 \times 9 = 3024.$

CBSE 2019 · 30/3/1 · Q2(b) | CBSE 2019 · 30/3/3 · Q4(b) — asked 2 times — 1 mark

Express 429 as a product of its prime factors.

Solution

$429 = 3 \times 11 \times 13.$

CBSE 2019 · 30/4/2 · Q3(a) | CBSE 2019 · 30/4/3 · Q4(a) — asked 2 times — 1 mark

Find a rational number between $\sqrt{2}$ and $\sqrt{7}$.

Solution

$\sqrt{2} \approx 1.41$ and $\sqrt{7} \approx 2.65$. A rational number between them is **2** (any such number is correct).

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CBSE 2019 · 30/4/2 · Q3(b) | CBSE 2019 · 30/4/3 · Q4(b) asked 2 times — 1 mark

Write the number of zeroes in the end of a number whose prime factorization is $2^2 \times 5^3 \times 3^2 \times 17$.

Solution

Each end zero needs one factor 2×5. The least power is of 2, namely 2. So the number ends with **2 zeroes**.

CBSE 2019 · 30/5/1 · Q1 | CBSE 2019 · 30/5/2 · Q3 | CBSE 2019 · 30/5/3 · Q4 asked 3 times — 1 mark

The HCF of two numbers a and b is 5 and their LCM is 200. Find the product ab.

Solution

$ab = \text{HCF} \times \text{LCM} = 5 \times 200 = 1000.$

CBSE 2018 · 30/1 · Q2 | CBSE 2018 · 30/2 · Q5 | CBSE 2018 · 30/3 · Q4 asked 3 times — 1 mark

What is the HCF of smallest prime number and the smallest composite number?

Solution

Smallest prime = 2, smallest composite = 4. HCF$(2, 4) = 2$.

2 marks: very short answer

CBSE 2026 · 30/3/1 · Q21 | CBSE 2026 · 30/3/2 · Q23 | CBSE 2026 · 30/3/3 · Q24 asked 3 times — 2 marks

Find the length of the plank that can be used to measure the lengths 4 m 20 cm and 5 m 4 cm exactly, in the least time.

Solution

4 m 20 cm = 420 cm and 5 m 4 cm = 504 cm. The plank must be as long as possible, so we find HCF(420, 504).

$420 = 2^2 \times 3 \times 5 \times 7$ and $504 = 2^3 \times 3^2 \times 7$, so HCF $= 2^2 \times 3 \times 7 = 84$.

The required length of the plank is **84 cm**.

CBSE 2026 · 30/4/1 · Q24(a) | CBSE 2026 · 30/4/2 · Q21(a) | CBSE 2026 · 30/4/3 · Q25(a) asked 3 times — 2 marks

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

Solution

Suppose $2 + 3\sqrt{5}$ is rational. Then $2 + 3\sqrt{5} = \frac{a}{b}$, where a, b are integers and $b \neq 0$.

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

Since a, b are integers, $\frac{a-2b}{3b}$ is rational, so $\sqrt{5}$ would be rational.

This contradicts the fact that $\sqrt{5}$ is irrational. Hence $2 + 3\sqrt{5}$ is irrational.

CBSE 2026 · 30/4/1 · Q24(b) | CBSE 2026 · 30/4/2 · Q21(b) | CBSE 2026 · 30/4/3 · Q25(b) asked 3 times — 2 marks

If the HCF of 210 and 55 is expressed as $210 \times 5 + 55m$, then find the value of m.

Solution

$210 = 2 \times 3 \times 5 \times 7$ and $55 = 5 \times 11$, so HCF $= 5$.

$$5 = 210 \times 5 + 55m \Rightarrow 55m = 5 - 1050 = -1045 \Rightarrow m = -19$$

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CBSE 2026 · 30/5/1 · Q21 — 2 marks

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

Solution

Suppose $2 - 5\sqrt{3}$ is rational, say $2 - 5\sqrt{3} = \frac{a}{b}$, where a, b are integers, $b \neq 0$.

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

The right side is rational (a ratio of integers), so $\sqrt{3}$ would be rational, which contradicts the given fact.
Hence $2 - 5\sqrt{3}$ is irrational.

CBSE 2026 · 30/5/2 · Q23 — 2 marks

Prove that $4 - 2\sqrt{5}$ is an irrational number given that $\sqrt{5}$ is irrational.

Solution

Suppose $4 - 2\sqrt{5}$ is rational, say $4 - 2\sqrt{5} = \frac{a}{b}$, where a, b are integers, $b \neq 0$.

$$2\sqrt{5} = 4 - \frac{a}{b} = \frac{4b - a}{b} \Rightarrow \sqrt{5} = \frac{4b - a}{2b}$$

The right side is rational, but $\sqrt{5}$ is irrational. This is a contradiction.
Hence $4 - 2\sqrt{5}$ is irrational.

CBSE 2026 · 30/5/3 · Q25 — 2 marks

Prove that $14 - 2\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is irrational.

Solution

Suppose $14 - 2\sqrt{3}$ is rational, say $14 - 2\sqrt{3} = \frac{a}{b}$, where a, b are integers, $b \neq 0$.

$$2\sqrt{3} = 14 - \frac{a}{b} = \frac{14b - a}{b} \Rightarrow \sqrt{3} = \frac{14b - a}{2b}$$

The right side is rational, but $\sqrt{3}$ is irrational. This is a contradiction.
Hence $14 - 2\sqrt{3}$ is irrational.

CBSE 2025 · 30/3/1 · Q23(a) | CBSE 2025 · 30/3/2 · Q23(a) | CBSE 2025 · 30/3/3 · Q25(a) **asked 3 times** — 2 marks

Find the smallest number which is divisible by both 644 and 462.

Solution

$462 = 2 \times 3 \times 7 \times 11$ and $644 = 2^2 \times 7 \times 23$.
$\text{LCM}(462, 644) = 2^2 \times 3 \times 7 \times 11 \times 23 = 21252$.
The smallest number divisible by both is **21252**.

CBSE 2025 · 30/3/1 · Q23(b) | CBSE 2025 · 30/3/2 · Q23(b) | CBSE 2025 · 30/3/3 · Q25(b) **asked 3 times** — 2 marks

Two numbers are in the ratio 4 : 5 and their HCF is 11. Find the LCM of these numbers.

Solution

Let the numbers be $4x$ and $5x$. Since 4 and 5 are coprime, HCF $= x = 11$.
The numbers are 44 and 55.

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LCM$(44, 55) = \frac{44 \times 55}{11} = 220$.

CBSE 2024 · 30/1/1 · Q25(a) | CBSE 2024 · 30/1/2 · Q22(a) | CBSE 2024 · 30/1/3 · Q23(a) **asked 3 times** — 2 marks

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

Solution

Assume $5 - 2\sqrt{3}$ is rational: $5 - 2\sqrt{3} = \frac{a}{b}$, where a, b are integers and $b \neq 0$.

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

The right side is rational, but $\sqrt{3}$ is irrational. This is a contradiction, so our assumption is wrong.

Hence $5 - 2\sqrt{3}$ is an irrational number.

CBSE 2024 · 30/1/1 · Q25(b) | CBSE 2024 · 30/1/2 · Q22(b) | CBSE 2024 · 30/1/3 · Q23(b) **asked 3 times** — 2 marks

Show that the number $5 \times 11 \times 17 + 3 \times 11$ is a composite number.

Solution

$5 \times 11 \times 17 + 3 \times 11 = 11 \times (5 \times 17 + 3) = 11 \times 88 = 11 \times 11 \times 2^3$.

The number can be written as a product of factors other than 1 and itself, so it is a composite number.

CBSE 2024 · 30/2/1 · Q21 — 2 marks

Can the number $(15)^n$, n being a natural number, end with the digit 0? Give reasons.

Solution

A number ends with 0 only if it is divisible by 10, i.e. its prime factorisation contains both 2 and 5.

$(15)^n = (3 \times 5)^n = 3^n \times 5^n$. It has no factor 2.

By the uniqueness of prime factorisation (Fundamental Theorem of Arithmetic), 15^n can never have 2 as a factor. So 15^n **cannot end with the digit 0**.

CBSE 2024 · 30/2/2 · Q23 — 2 marks

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.

Solution

$7 \times 11 \times 13 + 13 = 13 \times (7 \times 11 + 1) = 13 \times 78$.

$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5 = 5 \times (7 \times 6 \times 4 \times 3 \times 2 \times 1 + 1) = 5 \times 1009$.

Each number has factors other than 1 and itself, so both are composite numbers.

CBSE 2024 · 30/2/3 · Q25 — 2 marks

Can the number 8^n, n being a natural number, end with the digit 0 ? Give reasons.

Solution

A number ends with the digit 0 only if it has both 2 and 5 as prime factors.

$8^n = (2 \times 2 \times 2)^n = 2^{3n}$. It has no prime factor 5.

So, by the uniqueness of prime factorisation, 8^n **cannot end with the digit 0**.

CBSE 2024 · 30/4/1 · Q21 | CBSE 2024 · 30/4/3 · Q25 **asked 2 times** — 2 marks

Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together?

Solution

They toll together again after LCM(9, 12, 15) minutes.

$9 = 3^2, 12 = 2^2 \times 3, 15 = 3 \times 5$. LCM $= 2^2 \times 3^2 \times 5 = 180$ minutes.

They will toll together after **180 minutes = 3 hours**.

CBSE 2024 · 30/4/2 · Q23 — 2 marks

In a school, there are two sections of class X. There are 40 students in the first section and 48 students in the second section. Determine the minimum number of books required for their class library so that they can be distributed equally among students of both sections.

Solution

The number of books must be exactly divisible by both 40 and 48, so we need their LCM.

$40 = 2^3 \times 5$

$48 = 2^4 \times 3$

LCM $(40, 48) = 2^4 \times 3 \times 5 = 240$.

Minimum number of books required is **240**.

CBSE 2023 · 30/1/1 · Q24 | CBSE 2023 · 30/1/3 · Q22 — asked 2 times — 2 marks

Find the greatest number which divides 85 and 72 leaving remainders 1 and 2 respectively.

Solution

The number must divide exactly $85 - 1 = 84$ and $72 - 2 = 70$, so we need HCF(84, 70).

$84 = 2^2 \times 3 \times 7, 70 = 2 \times 5 \times 7$. HCF $= 2 \times 7 = 14$.

The required number is **14**.

CBSE 2023 · 30/1/2 · Q21 — 2 marks

Find the least number which when divided by 12, 16 and 24 leaves remainder 7 in each case.

Solution

$12 = 2^2 \times 3, 16 = 2^4, 24 = 2^3 \times 3$. LCM $= 2^4 \times 3 = 48$.

Required number $= 48 + 7 =$ **55**.

CBSE 2023 · 30/2/1 · Q21 — 2 marks

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

Solution

Suppose $2 + \sqrt{3}$ is rational: $2 + \sqrt{3} = \frac{a}{b}$, with integers $a, b, b \neq 0$.

Then $\sqrt{3} = \frac{a}{b} - 2 = \frac{a-2b}{b}$, which is rational. This contradicts that $\sqrt{3}$ is irrational.

Hence $2 + \sqrt{3}$ is irrational.

CBSE 2023 · 30/2/2 · Q25 — 2 marks

Prove that 4^n can never end with digit 0, where n is a natural number.

Solution

If 4^n ended with digit 0, it would be divisible by 5, so its prime factorisation would contain the prime 5.

But $4^n = (2 \times 2)^n = 2^{2n}$, whose only prime factor is 2.

By the Fundamental Theorem of Arithmetic this factorisation is unique, so 5 is not a factor of 4^n.

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Hence 4^n can never end with digit 0.

CBSE 2023 · 30/2/3 · Q25 — 2 marks

Prove that $6 - \sqrt{7}$ is irrational number, given that $\sqrt{7}$ is an irrational number.

Solution

Suppose $6 - \sqrt{7}$ is rational: $6 - \sqrt{7} = \frac{a}{b}$, with integers $a, b, b \neq 0$.
Then $\sqrt{7} = 6 - \frac{a}{b} = \frac{6b-a}{b}$, which is rational. This contradicts that $\sqrt{7}$ is irrational.
Hence $6 - \sqrt{7}$ is irrational.

CBSE 2023 · 30/4/1 · Q21 | CBSE 2023 · 30/4/2 · Q23 | CBSE 2023 · 30/4/3 · Q24 — asked 3 times — 2 marks

Two numbers are in the ratio 2 : 3 and their LCM is 180. What is the HCF of these numbers?

Solution

Let the numbers be $2x$ and $3x$, where x is their HCF (2 and 3 are coprime). Their LCM is $2 \times 3 \times x = 6x$.
$6x = 180 \Rightarrow x = 30$. HCF $= 30$ (the numbers are 60 and 90).

CBSE 2023 · 30/5/1 · Q23 | CBSE 2023 · 30/5/2 · Q21 — asked 2 times — 2 marks

Using prime factorisation, find HCF and LCM of 96 and 120.

Solution

$96 = 2^5 \times 3, 120 = 2^3 \times 3 \times 5$.
HCF $= 2^3 \times 3 = 24$.
LCM $= 2^5 \times 3 \times 5 = 480$.

CBSE 2023 · 30/5/3 · Q21 — 2 marks

Find the greatest 3-digit number which is divisible by 18, 24 and 36.

Solution

$18 = 2 \times 3^2, 24 = 2^3 \times 3, 36 = 2^2 \times 3^2$. LCM $= 2^3 \times 3^2 = 72$.
The number must be a multiple of 72. $999 \div 72$ gives quotient 13, remainder 63.
Greatest 3-digit number $= 72 \times 13 =$ **936**.

CBSE 2023 · 30/6/1 · Q21(a) | CBSE 2023 · 30/6/2 · Q23(a) | CBSE 2023 · 30/6/3 · Q23(a) — asked 3 times — 2 marks

Show that 6^n can not end with digit 0 for any natural number 'n'.

Solution

If 6^n ended with digit 0, it would be divisible by 5, so its prime factorisation would contain the prime 5.
But $6^n = (2 \times 3)^n = 2^n \times 3^n$, whose only prime factors are 2 and 3.
By the Fundamental Theorem of Arithmetic this factorisation is unique, so 5 is not a factor of 6^n. Hence 6^n can not end with digit 0.

CBSE 2023 · 30/6/1 · Q21(b) — 2 marks

Find the HCF and LCM of 72 and 120.

Solution

$72 = 2^3 \times 3^2, 120 = 2^3 \times 3 \times 5$.

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HCF $= 2^3 \times 3 = 24$.
LCM $= 2^3 \times 3^2 \times 5 = 360$.

CBSE 2023 · 30/6/2 · Q23(b) | CBSE 2023 · 30/6/3 · Q23(b) **asked 2 times** **2 marks**

Find the LCM and HCF of 72 and 120.

Solution

$72 = 2^3 \times 3^2, 120 = 2^3 \times 3 \times 5$.
LCM $= 2^3 \times 3^2 \times 5 = 360$.
HCF $= 2^3 \times 3 = 24$.

CBSE 2020 · 30/5/1 · Q22(a) | CBSE 2020 · 30/5/2 · Q25(a) | CBSE 2020 · 30/5/3 · Q25(a) **asked 3 times** **2 marks**

Show that $5 + 2\sqrt{7}$ is an irrational number, where $\sqrt{7}$ is given to be an irrational number.

Solution

Suppose $5 + 2\sqrt{7}$ is rational, say $= \frac{p}{q}$ with p, q integers, $q \neq 0$.
Then $\sqrt{7} = \frac{p-5q}{2q}$, which is rational.
This contradicts that $\sqrt{7}$ is irrational. Hence $5 + 2\sqrt{7}$ is irrational.

CBSE 2020 · 30/5/1 · Q22(b) | CBSE 2020 · 30/5/2 · Q25(b) | CBSE 2020 · 30/5/3 · Q25(b) **asked 3 times** **2 marks**

Check whether 12^n can end with the digit 0 for any natural number n.

Solution

$12 = 2 \times 2 \times 3$, so $12^n = 2^{2n} \times 3^n$.
A number ending in 0 must have 5 as a prime factor. 12^n has only 2 and 3 as prime factors, and the factorisation is unique.
So 12^n cannot end with 0 for any natural number n.

CBSE 2019 · 30/2/1 · Q7 | CBSE 2019 · 30/2/2 · Q12 | CBSE 2019 · 30/2/3 · Q12 **asked 3 times** **2 marks**

Write the smallest number which is divisible by both 306 and 657.

Solution

The smallest such number is the LCM.
$306 = 2 \times 3^2 \times 17, 657 = 3^2 \times 73$.
LCM $= 2 \times 3^2 \times 17 \times 73 = 22338$.

CBSE 2019 · 30/3/1 · Q9(a) | CBSE 2019 · 30/3/3 · Q7(a) **asked 2 times** **2 marks**

If HCF of 65 and 117 is expressible in the form $65n - 117$, then find the value of n.

Solution

$65 = 5 \times 13, 117 = 9 \times 13$, so HCF $= 13$.
$65n - 117 = 13 \Rightarrow 65n = 130 \Rightarrow n = 2$.

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CBSE 2019 · 30/3/1 · Q9(b) | CBSE 2019 · 30/3/3 · Q7(b) **asked 2 times** — **2 marks**

On a morning walk, three persons step out together and their steps measure 30 cm, 36 cm and 40 cm respectively. What is the minimum distance each should walk so that each can cover the same distance in complete steps ?

Solution

Required distance is the LCM of 30, 36, 40.

$30 = 2 \times 3 \times 5$, $36 = 2^2 \times 3^2$, $40 = 2^3 \times 5$. LCM $= 2^3 \times 3^2 \times 5 = 360$.

Minimum distance $=$ **360 cm**.

CBSE 2019 · 30/5/1 · Q10(a) | CBSE 2019 · 30/5/2 · Q11(a) | CBSE 2019 · 30/5/3 · Q8(a) **asked 3 times** — **2 marks**

Find the HCF of 612 and 1314 using prime factorisation.

Solution

$612 = 2^2 \times 3^2 \times 17$, $1314 = 2 \times 3^2 \times 73$. HCF $= 2 \times 3^2 = 18$.

CBSE 2018 · 30/1 · Q7 | CBSE 2018 · 30/2 · Q10 | CBSE 2018 · 30/3 · Q12 **asked 3 times** — **2 marks**

Given that $\sqrt{2}$ is irrational, prove that $(5 + 3\sqrt{2})$ is an irrational number.

Solution

Suppose $5 + 3\sqrt{2} = \frac{a}{b}$ with integers a, b, $b \neq 0$. Then $\sqrt{2} = \frac{a-5b}{3b}$, which is rational, contradicting that $\sqrt{2}$ is irrational.

Hence $5 + 3\sqrt{2}$ is irrational.

3 marks: short answer

CBSE 2026 · 30/1/1 · Q26 | CBSE 2026 · 30/1/3 · Q30 | CBSE 2026 · 30/3/2 · Q31 | CBSE 2025 · 30/2/1 · Q30 | CBSE 2025 · 30/2/2 · Q29 | CBSE 2025 · 30/2/3 · Q31 | CBSE 2025 · 30/5/1 · Q26(a) | CBSE 2025 · 30/5/2 · Q28(a) | CBSE 2025 · 30/5/3 · Q30(a) | CBSE 2024 · 30/5/1 · Q26(a) | CBSE 2024 · 30/5/2 · Q28(a) | CBSE 2024 · 30/5/3 · Q28(a) | CBSE 2023 · 30/4/2 · Q30 | CBSE 2023 · 30/5/1 · Q26(a) | CBSE 2023 · 30/5/2 · Q29(a) | CBSE 2023 · 30/5/3 · Q30(a) | CBSE 2019 · 30/3/1 · Q17(a) | CBSE 2019 · 30/3/3 · Q16(a)
asked 18 times — **3 marks**

Prove that $\sqrt{3}$ is an irrational number.

Solution

Suppose $\sqrt{3}$ is rational. Then $\sqrt{3} = \frac{a}{b}$, where a, b are integers, $b \neq 0$, and a, b are coprime.

Squaring: $3b^2 = a^2$. So 3 divides a^2, and hence 3 divides a ...(i)

Let $a = 3c$, where c is an integer. Then $3b^2 = 9c^2 \Rightarrow b^2 = 3c^2$. So 3 divides b^2, and hence 3 divides b ...(ii)

From (i) and (ii), 3 is a common factor of a and b. This contradicts that a and b are coprime.

Hence $\sqrt{3}$ is an irrational number.

CBSE 2026 · 30/1/2 · Q26 | CBSE 2026 · 30/3/3 · Q26 | CBSE 2025 · 30/4/1 · Q26(a) | CBSE 2025 · 30/4/2 · Q28(a) | CBSE 2025 · 30/4/3 · Q30(a) | CBSE 2023 · 30/6/1 · Q27(b) | CBSE 2023 · 30/6/2 · Q31(b) | CBSE 2023 · 30/6/3 · Q31(b) | CBSE 2019 · 30/1/1 · Q13 | CBSE 2019 · 30/1/2 · Q18
asked 10 times — **3 marks**

Prove that $\sqrt{2}$ is an irrational number.

Solution

Suppose $\sqrt{2}$ is rational. Then $\sqrt{2} = \frac{a}{b}$, where a, b are integers, $b \neq 0$, and a, b are coprime.

Squaring: $2b^2 = a^2$. So 2 divides a^2, and hence 2 divides a ...(i)

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Let $a = 2c$, where c is an integer. Then $2b^2 = 4c^2 \Rightarrow b^2 = 2c^2$. So 2 divides b^2, and hence 2 divides b ...(ii)

From (i) and (ii), 2 is a common factor of a and b. This contradicts that a and b are coprime.

Hence $\sqrt{2}$ is an irrational number.

CBSE 2026 · 30/2/1 · Q26 | CBSE 2026 · 30/2/2 · Q29 | CBSE 2026 · 30/2/3 · Q27 | CBSE 2026 · 30/3/1 · Q28 | CBSE 2025 · 30/1/3 · Q26 | CBSE 2025 · 30/6/1 · Q26(a) | CBSE 2025 · 30/6/2 · Q28(a) | CBSE 2025 · 30/6/3 · Q30(a) | CBSE 2024 · 30/2/1 · Q27 | CBSE 2024 · 30/2/2 · Q30 | CBSE 2024 · 30/2/3 · Q28 | CBSE 2023 · 30/1/1 · Q27 | CBSE 2023 · 30/1/2 · Q30 | CBSE 2023 · 30/1/3 · Q30 | CBSE 2023 · 30/4/1 · Q27 | CBSE 2023 · 30/4/3 · Q31 | CBSE 2020 · 30/4/1 · Q27 | CBSE 2020 · 30/4/2 · Q30 | CBSE 2020 · 30/4/3 · Q32 | CBSE 2019 · 30/5/1 · Q13 | CBSE 2019 · 30/5/2 · Q18

asked 21 times

3 marks

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

Solution

Suppose $\sqrt{5}$ is rational. Then $\sqrt{5} = \frac{p}{q}$, where p, q are integers, $q \neq 0$, and p, q are coprime.

Squaring: $5q^2 = p^2$. So 5 divides p^2, and hence 5 divides p ...(i)

Let $p = 5a$, where a is an integer. Then $5q^2 = 25a^2 \Rightarrow q^2 = 5a^2$. So 5 divides q^2, and hence 5 divides q ...(ii)

From (i) and (ii), 5 is a common factor of p and q. This contradicts that p and q are coprime.

Hence $\sqrt{5}$ is an irrational number.

CBSE 2026 · 30/4/1 · Q31

3 marks

Find the greatest number less than 10,000 which is exactly divisible by 48, 60 and 65.

Solution

$48 = 2^4 \times 3, 60 = 2^2 \times 3 \times 5, 65 = 5 \times 13.$

LCM $= 2^4 \times 3 \times 5 \times 13 = 3120.$

The number must be a multiple of 3120: $3120 \times 3 = 9360$ and $3120 \times 4 = 12480 > 10000.$

Greatest such number $= 9360.$

CBSE 2026 · 30/4/2 · Q26

3 marks

A trader has three different types of oils of volume 870 l, 812 l and 638 l. Find the least number of containers of equal size required to store all the oil without getting mixed.

Solution

For the least number of containers, the size of each container must be the HCF of the three volumes.

$870 = 2 \times 3 \times 5 \times 29, 812 = 2^2 \times 7 \times 29, 638 = 2 \times 11 \times 29.$

HCF$(870, 812, 638) = 2 \times 29 = 58.$

Number of containers $= \frac{870}{58} + \frac{812}{58} + \frac{638}{58} = 15 + 14 + 11 =$ **40**.

CBSE 2026 · 30/4/3 · Q28

3 marks

Find the greatest number which divides 764 and 1198, leaving remainders 8 and 10 respectively.

Solution

The required number divides $764 - 8 = 756$ and $1198 - 10 = 1188$ exactly.

$756 = 2^2 \times 3^3 \times 7$ and $1188 = 2^2 \times 3^3 \times 11.$

HCF$(756, 1188) = 2^2 \times 3^3 = 108.$

The required greatest number is **108**.

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CBSE 2026 · 30/5/1 · Q31 | CBSE 2026 · 30/5/2 · Q27 | CBSE 2026 · 30/5/3 · Q29 asked 3 times 3 marks

The dimensions of a window are 156 cm × 216 cm. Arjun wants to put grill on the window creating complete squares of maximum size. Determine the side length of the square and hence find the number of squares formed.

Solution

The side of the largest square is HCF(156, 216).

$156 = 2^2 \times 3 \times 13, 216 = 2^3 \times 3^3$. HCF $= 2^2 \times 3 = 12$.

Side of each square = **12 cm**.

Number of squares $= \frac{156}{12} \times \frac{216}{12} = 13 \times 18 =$ **234**.

CBSE 2025 · 30/1/1 · Q29 3 marks

Prove that $\frac{1}{\sqrt{5}}$ is an irrational number.

Solution

First, $\sqrt{5}$ is irrational. Suppose $\sqrt{5} = \frac{a}{b}$ with a, b coprime integers, $b \neq 0$. Then $a^2 = 5b^2$, so 5 divides a^2 and hence a. Write $a = 5c$: $25c^2 = 5b^2 \Rightarrow b^2 = 5c^2$, so 5 divides b too. This contradicts a, b being coprime, so $\sqrt{5}$ is irrational.

Now suppose $\frac{1}{\sqrt{5}}$ is rational, $\frac{1}{\sqrt{5}} = \frac{p}{q}$ with integers $p, q, p \neq 0, q \neq 0$. Then $\sqrt{5} = \frac{q}{p}$, which is rational. This contradicts the irrationality of $\sqrt{5}$.

Hence $\frac{1}{\sqrt{5}}$ is irrational.

CBSE 2025 · 30/1/2 · Q27 3 marks

Three sets of Physics, Chemistry and Mathematics books have to be stacked in such a way that all the books are stored subject-wise and the height of each stack is the same. The number of Physics books is 144, the number of Chemistry books is 180 and the number of Mathematics books is 192. Assuming that the books are of same thickness, determine the number of stacks of Physics, Chemistry and Mathematics books.

Solution

Each stack must hold the same number of books, and that number must divide all three totals, so take the HCF.

$144 = 2^4 \times 3^2, 180 = 2^2 \times 3^2 \times 5, 192 = 2^6 \times 3$.

HCF $= 2^2 \times 3 = 12$, so each stack has 12 books.

Stacks of Physics books $= \frac{144}{12} = 12$.

Stacks of Chemistry books $= \frac{180}{12} = 15$.

Stacks of Mathematics books $= \frac{192}{12} = 16$.

CBSE 2025 · 30/3/1 · Q27 | CBSE 2025 · 30/3/3 · Q29 asked 2 times 3 marks

Prove that $\left(5\sqrt{3} + \frac{2}{3}\right)$ is an irrational number given that $\sqrt{3}$ is an irrational number.

Solution

Suppose $5\sqrt{3} + \frac{2}{3}$ is rational. Then $5\sqrt{3} + \frac{2}{3} = \frac{a}{b}$, where a, b are integers and $b \neq 0$.

$$5\sqrt{3} = \frac{a}{b} - \frac{2}{3} \Rightarrow \sqrt{3} = \frac{3a - 2b}{15b}$$

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$3a - 2b$ and $15b$ are integers and $15b \neq 0$, so the right side is rational. But $\sqrt{3}$ is irrational, which is a contradiction.
Hence $5\sqrt{3} + \frac{2}{3}$ is an irrational number.

CBSE 2025 · 30/3/2 · Q26 — 3 marks

Prove that $\left(4\sqrt{2} + \frac{5}{3}\right)$ is an irrational number given that $\sqrt{2}$ is an irrational number.

Solution

Suppose $4\sqrt{2} + \frac{5}{3}$ is rational. Then $4\sqrt{2} + \frac{5}{3} = \frac{a}{b}$, where a, b are integers and $b \neq 0$.

$$4\sqrt{2} = \frac{a}{b} - \frac{5}{3} \Rightarrow \sqrt{2} = \frac{3a - 5b}{12b}$$

$3a - 5b$ and $12b$ are integers and $12b \neq 0$, so the right side is rational. But $\sqrt{2}$ is irrational, which is a contradiction.
Hence $4\sqrt{2} + \frac{5}{3}$ is an irrational number.

CBSE 2025 · 30/4/1 · Q26(b) | CBSE 2025 · 30/4/2 · Q28(b) | CBSE 2025 · 30/4/3 · Q30(b) asked 3 times — 3 marks

Let x and y be two distinct prime numbers and $p = x^2y^3$, $q = xy^4$, $r = x^5y^2$. Find the HCF and LCM of p, q and r. Further check if HCF $(p, q, r) \times$ LCM $(p, q, r) = p \times q \times r$ or not.

Solution

HCF$(p, q, r) = xy^2$ (lowest powers).
LCM$(p, q, r) = x^5y^4$ (highest powers).
HCF × LCM $= xy^2 \times x^5y^4 = x^6y^6$.
$p \times q \times r = x^2y^3 \times xy^4 \times x^5y^2 = x^8y^9$.
Since $x^6y^6 \neq x^8y^9$, HCF$(p, q, r) \times$ LCM$(p, q, r) \neq p \times q \times r$.

CBSE 2025 · 30/5/1 · Q26(b) | CBSE 2025 · 30/5/2 · Q28(b) | CBSE 2025 · 30/5/3 · Q30(b) asked 3 times — 3 marks

State true or false for each of the following statements and justify in each case :
(i) $2 \times 3 \times 5 \times 7 + 7$ is a composite number.
(ii) $2 \times 3 \times 5 \times 7 + 1$ is a composite number.

Solution

(i) **True.** $2 \times 3 \times 5 \times 7 + 7 = 7(2 \times 3 \times 5 + 1) = 7 \times 31 = 217$, which has more than two factors.
(ii) **False.** $2 \times 3 \times 5 \times 7 + 1 = 211$, which has only two factors (1 and 211), so it is prime.

CBSE 2025 · 30/6/1 · Q26(b) | CBSE 2025 · 30/6/2 · Q28(b) | CBSE 2025 · 30/6/3 · Q30(b) asked 3 times — 3 marks

Let p, q and r be three distinct prime numbers.
Check whether $p \cdot q \cdot r + q$ is a composite number or not.
Further, give an example for 3 distinct primes p, q, r such that
(i) $p \cdot q \cdot r + 1$ is a composite number.
(ii) $p \cdot q \cdot r + 1$ is a prime number.

Solution

$p \cdot q \cdot r + q = q(pr + 1)$. It has more than 2 factors, so it is composite.
(i) Taking $p = 3$, $q = 5$, $r = 7$: $3 \cdot 5 \cdot 7 + 1 = 106$, a composite number.

(ii) Taking $p = 2, q = 3, r = 5$: $2 \cdot 3 \cdot 5 + 1 = 31$, a prime number.

(Any other correct examples are also acceptable.)

CBSE 2024 · 30/1/1 · Q27 | CBSE 2024 · 30/1/2 · Q30 | CBSE 2024 · 30/1/3 · Q28 **asked 3 times** **3 marks**

In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject.

Solution

Minimum rooms means the maximum number of teachers in each room, so we need the HCF of 48, 80 and 144.

$48 = 2^4 \times 3$

$80 = 2^4 \times 5$

$144 = 2^4 \times 3^2$

HCF $(48, 80, 144) = 2^4 = 16$.

$$\text{Number of rooms} = \frac{48}{16} + \frac{80}{16} + \frac{144}{16} = 3 + 5 + 9 = 17$$

CBSE 2024 · 30/4/1 · Q30 | CBSE 2024 · 30/4/2 · Q28 | CBSE 2024 · 30/4/3 · Q29 **asked 3 times** **3 marks**

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

Solution

Suppose $\frac{2-\sqrt{3}}{5}$ is rational, say $\frac{2-\sqrt{3}}{5} = \frac{a}{b}$ with integers a, b, $b \neq 0$.

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

The right side is rational, so $\sqrt{3}$ would be rational, a contradiction.

Hence $\frac{2-\sqrt{3}}{5}$ is irrational.

CBSE 2024 · 30/5/1 · Q26(b) | CBSE 2024 · 30/5/2 · Q28(b) | CBSE 2024 · 30/5/3 · Q28(b) **asked 3 times** **3 marks**

Prove that $\left(\sqrt{2} + \sqrt{3}\right)^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.

Solution

$\left(\sqrt{2} + \sqrt{3}\right)^2 = 2 + 3 + 2\sqrt{6} = 5 + 2\sqrt{6}$.

Assume $5 + 2\sqrt{6}$ is rational: $5 + 2\sqrt{6} = \frac{a}{b}$, where a, b are integers and $b \neq 0$.

$$\sqrt{6} = \frac{a - 5b}{2b}$$

The right side is rational but $\sqrt{6}$ is irrational. This is a contradiction, so our assumption is wrong.

Hence $\left(\sqrt{2} + \sqrt{3}\right)^2$ is an irrational number.

CBSE 2023 · 30/2/1 · Q26(a) | CBSE 2023 · 30/2/2 · Q28(a) | CBSE 2023 · 30/2/3 · Q28(a) **asked 3 times** **3 marks**

Find by prime factorisation the LCM of the numbers 18180 and 7575. Also, find the HCF of the two numbers.

Solution

$18180 = 2^2 \times 3^2 \times 5 \times 101$

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$7575 = 3 \times 5^2 \times 101$

LCM $= 2^2 \times 3^2 \times 5^2 \times 101 = 90900$.

HCF $= 3 \times 5 \times 101 = 1515$.

(Check: $1515 \times 90900 = 137713500 = 18180 \times 7575$ ✓)

CBSE 2023 · 30/2/1 · Q26(b) | CBSE 2023 · 30/2/2 · Q28(b) | CBSE 2023 · 30/2/3 · Q28(b) asked 3 times — 3 marks

Three bells ring at intervals of 6, 12 and 18 minutes. If all the three bells rang at 6 a.m., when will they ring together again?

Solution

$6 = 2 \times 3$, $12 = 2^2 \times 3$, $18 = 2 \times 3^2$. LCM $= 2^2 \times 3^2 = 36$ minutes.

They will ring together again 36 minutes after 6 a.m., at **6:36 a.m.**

CBSE 2023 · 30/5/1 · Q26(b) | CBSE 2023 · 30/5/2 · Q29(b) | CBSE 2023 · 30/5/3 · Q30(b) asked 3 times — 3 marks

The traffic lights at three different road crossings change after every 48 seconds, 72 seconds and 108 seconds respectively. If they change simultaneously at 7 a.m., at what time will they change together next ?

Solution

$48 = 2^4 \times 3$, $72 = 2^3 \times 3^2$, $108 = 2^2 \times 3^3$.

LCM $= 2^4 \times 3^3 = 432$ seconds $= 7$ minutes 12 seconds.

They will change together next at **7 : 07 : 12 a.m.**

CBSE 2023 · 30/6/1 · Q27(a) | CBSE 2023 · 30/6/2 · Q31(a) | CBSE 2023 · 30/6/3 · Q31(a) asked 3 times — 3 marks

Find the HCF and LCM of 26, 65 and 117, using prime factorisation.

Solution

$26 = 2 \times 13$, $65 = 5 \times 13$, $117 = 3^2 \times 13$.

HCF $= 13$.

LCM $= 2 \times 3^2 \times 5 \times 13 = 1170$.

CBSE 2019 · 30/1/3 · Q15 — 3 marks

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

Solution

Suppose $\frac{2+\sqrt{3}}{5}$ is rational, say $= \frac{p}{q}$ with p, q integers, $q \neq 0$.

Then $\sqrt{3} = \frac{5p}{q} - 2 = \frac{5p-2q}{q}$, which is rational.

This contradicts that $\sqrt{3}$ is irrational. Hence $\frac{2+\sqrt{3}}{5}$ is irrational.

CBSE 2019 · 30/2/1 · Q13(a) | CBSE 2019 · 30/2/2 · Q16(a) | CBSE 2019 · 30/2/3 · Q16(a) asked 3 times — 3 marks

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

Solution

Suppose $2 + 5\sqrt{3} = \frac{a}{b}$, with integers a, b, $b \neq 0$.

Then $\sqrt{3} = \frac{a-2b}{5b}$, which is rational. This contradicts that $\sqrt{3}$ is irrational.

Hence $2 + 5\sqrt{3}$ is irrational.

CBSE 2019 · 30/3/1 · Q17(b) | CBSE 2019 · 30/3/3 · Q16(b) **asked 2 times** — 3 marks

Find the largest number which on dividing 1251, 9377 and 15628 leaves remainders 1, 2 and 3 respectively.

Solution

The number is the HCF of $1251 - 1 = 1250$, $9377 - 2 = 9375$ and $15628 - 3 = 15625$.

$1250 = 2 \times 5^4$, $9375 = 3 \times 5^5$, $15625 = 5^6$.

HCF $= 5^4 =$ **625**.

CBSE 2019 · 30/4/2 · Q20 — 3 marks

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

Solution

Suppose $2 + 3\sqrt{3} = \frac{a}{b}$, with integers a, b, $b \neq 0$.

Then $\sqrt{3} = \frac{a-2b}{3b}$, which is rational. This contradicts that $\sqrt{3}$ is irrational.

Hence $2 + 3\sqrt{3}$ is irrational.

CBSE 2019 · 30/4/3 · Q17 — 3 marks

Show that $\dfrac{2 + 3\sqrt{2}}{7}$ is not a rational number, given that $\sqrt{2}$ is an irrational number.

Solution

Suppose $\frac{2+3\sqrt{2}}{7}$ is rational, say $= \frac{p}{q}$ with p, q integers, $q \neq 0$.

Then $\sqrt{2} = \frac{7p-2q}{3q}$, which is rational. This contradicts that $\sqrt{2}$ is irrational.

Hence the number is not rational.

CBSE 2019 · 30/5/3 · Q22 — 3 marks

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

Solution

Suppose $5 - 3\sqrt{2} = \frac{a}{b}$, with integers a, b, $b \neq 0$.

Then $\sqrt{2} = \frac{5b-a}{3b}$, which is rational. This contradicts that $\sqrt{2}$ is irrational.

Hence $(5 - 3\sqrt{2})$ is irrational.

CBSE 2018 · 30/1 · Q13 | CBSE 2018 · 30/2 · Q21 | CBSE 2018 · 30/3 · Q15 **asked 3 times** — 3 marks

Find HCF and LCM of 404 and 96 and verify that HCF × LCM = Product of the two given numbers.

Solution

$404 = 2^2 \times 101$, $96 = 2^5 \times 3$.

HCF $= 2^2 = 4$; LCM $= 2^5 \times 3 \times 101 = 9696$.

HCF × LCM $= 4 \times 9696 = 38784$ and $404 \times 96 = 38784$ ✓

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4 marks: case-based / source-based

CBSE 2024 · 30/3/1 · Q38 | CBSE 2024 · 30/3/2 · Q36 | CBSE 2024 · 30/3/3 · Q37 **asked 3 times** **4 marks**

Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250.
Now, Mukta asked some questions as given below to the students :
(i) What is the least prime number used by students ? (1)
(ii) (a) How many students are in the class ? (2)
OR
(b) What is the highest prime number used by students ? (2)
(iii) Which prime number has been used maximum times ? (1)

Solution

$173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$. The 2 is the number announced by the teacher, and the students used the other prime factors.

(i) The least prime number used by the students is **3**.

(ii)(a) Prime factors used: $5, 5, 5, 3, 3, 7, 11$, one by each student. Number of students $= 3 + 2 + 1 + 1 =$ **7**.

(ii)(b) The highest prime number used is **11**.

(iii) **5** has been used the maximum number of times (three times).

CBSE 2020 · 30/2/1 · Q35 | CBSE 2020 · 30/2/2 · Q37 | CBSE 2020 · 30/2/3 · Q38 **asked 3 times** **4 marks**

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

Solution

Suppose $\sqrt{5}$ is rational: $\sqrt{5} = \frac{p}{q}$, where p, q are co-primes and $q \neq 0$.

Squaring: $5q^2 = p^2$, so 5 divides p^2 and therefore 5 divides p. Let $p = 5a$ for some integer a.

Then $5q^2 = 25a^2 \Rightarrow q^2 = 5a^2$, so 5 divides q^2 and therefore 5 divides q.

Thus 5 is a common factor of p and q, which contradicts that they are co-prime.

Hence the assumption is wrong and $\sqrt{5}$ is irrational.

CBSE 2020 · 30/3/1 · Q35(a) | CBSE 2020 · 30/3/2 · Q37(a) | CBSE 2020 · 30/3/3 · Q37(a) **asked 3 times** **4 marks**

Show that $(12)^n$ cannot end with digit 0 or 5 for any natural number n.

Solution

$12^n = (2^2 \times 3)^n = 2^{2n} \times 3^n$.

A number ending in 0 or 5 is divisible by 5, so its prime factorisation must contain 5.

By the Fundamental Theorem of Arithmetic the factorisation of 12^n is unique and contains only 2 and 3. So 12^n cannot end with 0 or 5.

CBSE 2020 · 30/3/1 · Q35(b) | CBSE 2020 · 30/3/2 · Q37(b) | CBSE 2020 · 30/3/3 · Q37(b) **asked 3 times** **4 marks**

Prove that $(\sqrt{2} + \sqrt{5})$ is irrational.

Solution

Suppose $\sqrt{2} + \sqrt{5} = m$, where m is rational. Squaring: $7 + 2\sqrt{10} = m^2 \Rightarrow \sqrt{10} = \frac{m^2 - 7}{2}$.

The right side is rational, so $\sqrt{10}$ would be rational.

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But $\sqrt{10}$ is irrational: if $\sqrt{10} = \frac{a}{b}$ in lowest terms, $a^2 = 10b^2$, so 2 and 5 divide a; writing $a = 10c$ gives $b^2 = 10c^2$, so 2 and 5 divide b too, a contradiction.

Hence $\sqrt{2} + \sqrt{5}$ is irrational.

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CBSE BOARD PAPER

2026 · Q.P. Code 30/4/1

Time: 3 hours
Maximum marks: 80

Section A · Multiple choice and Assertion–Reason (1 mark each)

1. If the quadratic equation $9x^2 + 8kx + 16 = 0$ has real and equal roots, then the value of k is 1

(A) 3
(B) -3
(C) -4
(D) $\frac{3}{2}$

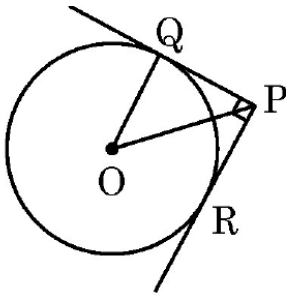
2. It is given that $\triangle ABC \sim \triangle EDF$. Which of the following is **not** true? 1

(A) $\dfrac{\text{Perimeter of } \triangle ABC}{\text{Perimeter of } \triangle EDF} = \dfrac{AB}{ED}$
(B) $\dfrac{AB}{ED} = \dfrac{AC}{EF}$
(C) $\angle A = \angle D,\ \angle C = \angle F$
(D) $\dfrac{AB + BC}{AC} = \dfrac{DE + DF}{EF}$

3. The nth term of an A.P. is $\sqrt{2}\,n + 1$. Its common difference is 1

(A) $\sqrt{2}$
(B) $\sqrt{2}\,n$
(C) 1
(D) $\sqrt{2} + 1$

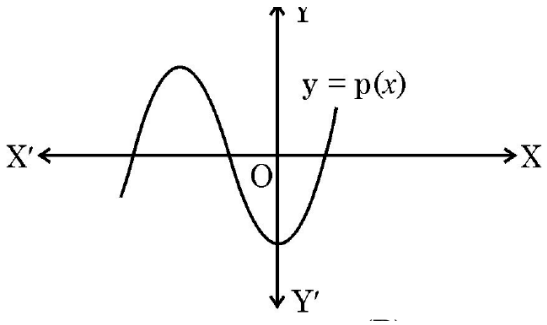
4. 1



If PQ and PR are tangents to the circle with centre O and radius 4 cm such that $\angle QPR = 90^\circ$, then the length OP is

(A) 4 cm
(B) $4\sqrt{2}$ cm
(C) 8 cm
(D) $2\sqrt{2}$ cm

5. Observe the graph of polynomial $p(x)$. Number of zeroes of $p(x)$ is 1



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

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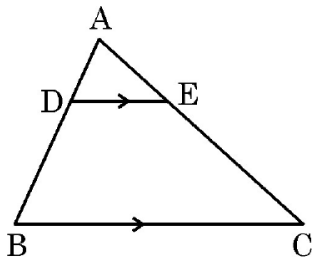
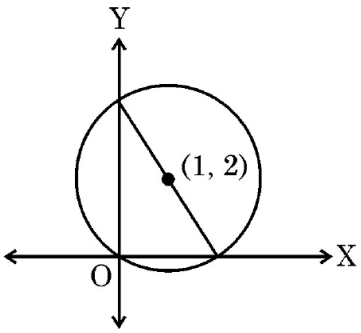
6. In the given figure, $DE \parallel BC$. If $\frac{AD}{DB} = \frac{1}{3}$ and $AC = 6$ cm, then length AE is 1



(A) 1.5 cm
(B) 1 cm
(C) 2 cm
(D) 3 cm

7. In the given figure, a circle is centred at $(1, 2)$. The diameter of the circle is 1



(A) 4
(B) $2\sqrt{2}$
(C) $\sqrt{5}$
(D) $2\sqrt{5}$

8. The value of k for which the system of linear equations $\frac{x}{2} + \frac{y}{3} = 5$ and $2x + ky = 7$ is inconsistent, is 1

(A) $\frac{3}{4}$
(B) $\frac{4}{3}$
(C) $\frac{1}{3}$
(D) 3

9. A circle is divided into 16 identical sectors. If radius of the circle is 7 cm, area of each sector is 1

(A) $\frac{77}{4}$ cm²
(B) 77 cm²
(C) 154 cm²
(D) $\frac{77}{8}$ cm²

10. Two different dice are rolled together. The probability that both the obtained numbers are less than 4, is 1

(A) $\frac{2}{9}$
(B) $\frac{7}{36}$
(C) $\frac{1}{4}$
(D) $\frac{2}{3}$

11. When $\sin A = \frac{1}{3}$, the value of $\cot A$ is 1

(A) $\frac{2\sqrt{2}}{3}$
(B) $2\sqrt{2}$
(C) $\frac{1}{2\sqrt{2}}$
(D) 3

12. $\dfrac{1 + \tan^2 A}{1 + \cot^2 A}$ equals to: 1

(A) $\tan^2 A$
(B) -1
(C) $-\tan^2 A$
(D) $\cot^2 A$

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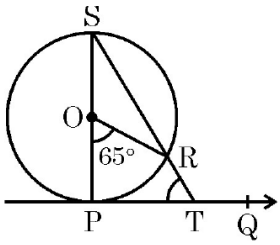
13. Three tennis balls are just packed in a cylindrical jar. If radius of each ball is r, volume of air inside the jar is 1



(A) $2\pi r^3$
(B) $3\pi r^3$
(C) $5\pi r^3$
(D) $4\pi r^3$

14. PQ is tangent to a circle with centre O. If $\angle POR = 65°$, then $m\angle PTR$ is 1



(A) $65°$
(B) $58.5°$
(C) $57.5°$
(D) $45°$

15. The distance between the points $(a\cos\theta + b\sin\theta,\ 0)$ and $(0,\ a\sin\theta - b\cos\theta)$ is 1

(A) $\sqrt{a^2+b^2}$
(B) $a^2 - b^2$
(C) $\sqrt{a^2-b^2}$
(D) $a^2 + b^2$

16. An ice-cream cone of radius r and height h is completely filled by two spherical scoops of ice-cream. If radius of each spherical scoop is $\frac{r}{2}$, then $h : 2r$ equals 1

(A) 1 : 8
(B) 1 : 2
(C) 1 : 1
(D) 2 : 1

17. Arc PQ subtends an angle θ at the centre of the circle with radius 6.3 cm. If $\overset{\frown}{PQ} = 11$ cm, then the value of θ is 1

(A) $10°$
(B) $60°$
(C) $45°$
(D) $100°$

18. Mean and Median of a frequency distribution are 43 and 40 respectively. The value of mode is 1

(A) 34
(B) 43
(C) 38.5
(D) 41.5

19. Assertion (A): If probability of happening of an event is $0.2p$, $p > 0$, then p can't be more than 5. 1
Reason (R): $P(\overline{E}) = 1 - P(E)$ for an event E.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

20. Assertion (A): $(\sqrt{3} + \sqrt{5})$ is an irrational number. 1
Reason (R): Sum of the any two irrational numbers is always irrational.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

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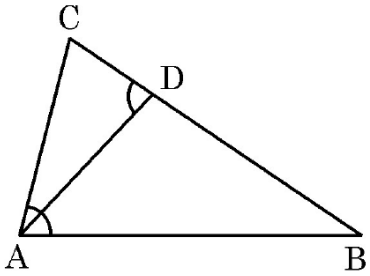
Section B · Very short answer (2 marks each)

21. Verify that roots of the quadratic equation $(p-q)x^2+(q-r)x+(r-p)=0$ are equal when $q+r=2p$. 2

22. D is a point on the side BC of $\triangle ABC$ such that $\angle CAB=\angle CDA$. Show that $CA^2=CB\times CD$. 2



23. **(a)** Prove that: $\sqrt{\dfrac{1+\sin A}{1-\sin A}}=\sec A+\tan A$ 2

OR

(b) Evaluate: $\dfrac{3\cos^2 30^\circ-6\text{cosec}^2 30^\circ}{\tan^2 60^\circ}$ 2

24. **(a)** Prove that $2+3\sqrt{5}$ is an irrational number given that $\sqrt{5}$ is irrational number. 2

OR

(b) If the HCF of 210 and 55 is expressed as $210\times 5+55m$, then find the value of m. 2

25. α and β are the zeroes of the polynomial $5x^2-16x-10$. Find the value of $\dfrac{\alpha}{\beta}+\dfrac{\beta}{\alpha}$. 2

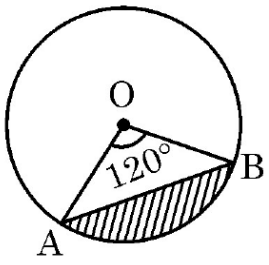
Section C · Short answer (3 marks each)

26. **(a)** In a class test, Veer scored 6 more than twice as many marks as Kevin scored. If one of them had scored 4 more marks, their total score would have been 40. Find the marks obtained by Veer and Kevin. 3

OR

(b) Solve the linear equations $3x+y=14$ and $y=2$ graphically. 3

27. Chord AB of a circle with centre O and radius 21 mm subtends an angle of 120° at the centre. Find the perimeters of the shaded region. (Use $\sqrt{3}=1.73$) 3



28. Prove that: $\dfrac{\sin\theta-\cos\theta+1}{\sin\theta+\cos\theta-1}=\dfrac{1}{\sec\theta-\tan\theta}$ 3

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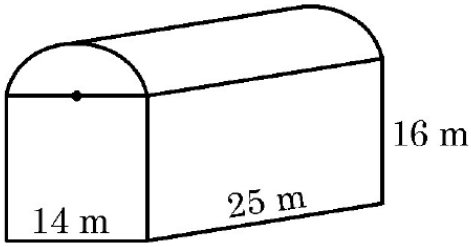
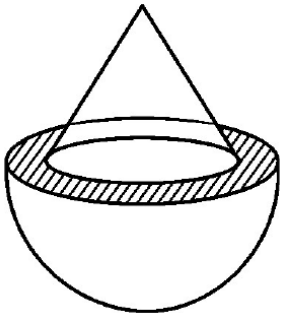
29. **(a)** To protect plants from heat, a shed of iron rods covered with green cloth is made. The lower part of the shed is a cuboid mounted by semi-cylinder as shown in the figure. Find the area of the cloth required to make this shed, if dimensions of the cuboid are 14 m × 25 m × 16 m. 3



OR

(b) The internal and external radii of a hollow hemisphere are $5\sqrt{2}$ cm and 10 cm respectively. A cone of height $5\sqrt{7}$ cm and radius $5\sqrt{2}$ cm is surmounted on the hemisphere as shown in the figure. Find the total surface area of the object in terms of π. (Use $\sqrt{2} = 1.4$) 3



30. A bag contains 30 balls out of which 'm' number of balls are blue in colour. 3

(i) Find the probability that a ball drawn at random from the bag is not blue.
(ii) If 6 more blue balls are added in the bag, then the probability of drawing a blue ball will be $\frac{5}{4}$ times the probability of drawing a blue ball in the first case. Find the value of m.

31. Find the greatest number less than 10,000 which is exactly divisible by 48, 60 and 65. 3

Section D · Long answer (5 marks each)

32. **(a)** A person on tour has ₹ 5,400 for his expenses. If he extends his tour by 5 days, he has to cut down his daily expenses by ₹ 180. Find the original duration of the tour and daily expense. 5

OR

(b) The total cost of certain piece of cloth was ₹ 2,100. During special sale time, the shopkeeper offered 2 m extra cloth for free thus reducing the price of cloth per metre by ₹ 120. What was the original per metre price of cloth and its length? 5

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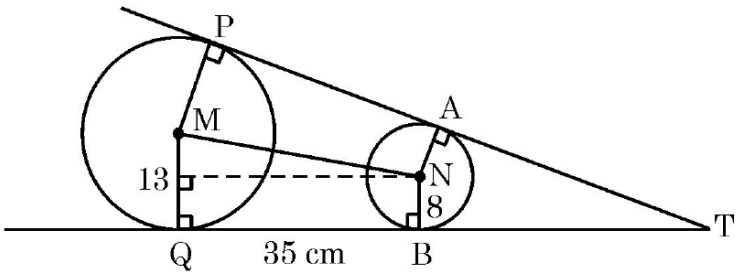
33. 5



In the given figure, TP and TQ are tangents to a circle with centre M, touching another circle with centre N at A and B respectively. It is given that MQ = 13 cm, NB = 8 cm, BQ = 35 cm and TP = 80 cm.

(i) Name the quadrilateral MQBN. (1)

(ii) Is MN parallel to PA? Justify your answer. (1)

(iii) Find length TB. (1)

(iv) Find length MN. (2)

34. A kite is flying at a height of 60 m above the ground level. Ravi, standing at the roof of the house is holding the string straight and observes the angle of elevation of kite as 30°. From the bottom of the same building, the angle of elevation of kite is 45°. Find the length of the string and height of roof from the ground. (Use $\sqrt{3} = 1.73$) 5

35. **(a)** The median of the following data is 50 and sum of all frequencies is 90: 5

Class	20–30	30–40	40–50	50–60	60–70	70–80	80–90
Frequency	p	15	25	20	q	8	10

Find the values of p and q.

OR

(b) Find mean and mode of the following distribution: 5

Class	0–15	15–30	30–45	45–60	60–75	75–90	90–105
Frequency	4	8	11	14	10	7	6

Section E · Case-study based (4 marks each)

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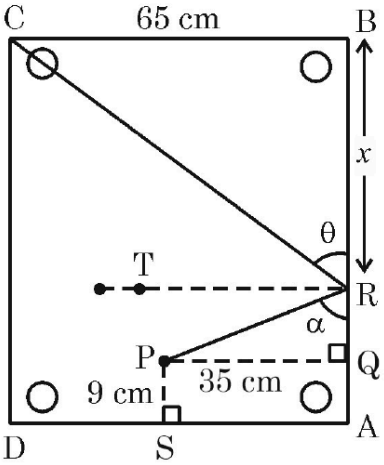
36. 4





Carom board is a very popular game. The board is a square of side length 65 cm. It has circular pockets in each corner. Ansh strikes a disc, kept at position P with a striker. The disc, hits the boundary of the board at R and goes straight to pocket at corner C. It is given that PS = 9 cm, PQ = 35 cm, BR = x, $\angle PRQ = \alpha$ and $\angle CRB = \theta$.

Based on the above information, answer the following questions :

(i) Using law of reflection i.e. $\angle PRT = \angle CRT$, prove that $\theta = \alpha$. (1)

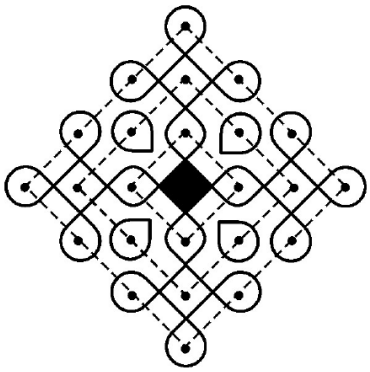
(ii) Prove that $\triangle PQR \sim \triangle CBR$ given that PQ is perpendicular to AB. (1)

(iii) (a) Find the value of x using similarity of triangles. (2)

OR

(iii) (b) If $\frac{\text{Area } \triangle PQR}{\text{Area } \triangle CBR} = \frac{PQ^2}{CB^2}$, then find the value of x. (2)

37. 'Kolam' is a decorative art which is made with rice flour in South Indian States. It is drawn on grid pattern of dots. One such art work is shown below. 4



Observe the given figure carefully. There are 4 dots in first square, 8 dots in second square, 12 dots in third square and so on.

Based on the above, answer the following questions :

(i) Show that number of dots given above form an A.P. Write the first term and common difference. (1)

(ii) Write n^{th} term of the A.P. formed. (1)

(iii) (a) The pattern is expanded on a large ground. If total 220 dots are used, then find the number of squares formed. (2)

OR

(iii) (b) Is it possible to complete n number of squares using 100 dots? If yes, then find the value of n. (2)

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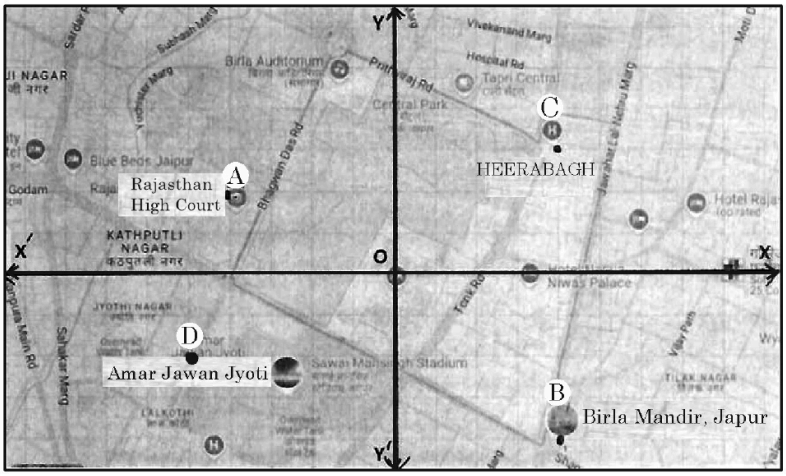
38. 4



Observe the map of Jaipur city placed on a Cartesian plane. Taking Rambagh Palace as origin, the location of some places are given below:

Point A : $(-4, 2)$ Rajasthan High Court

Point B : $(4, -4)$ Birla Mandir

Point C : $(4, 3)$ Heera Bagh

Point D : $(-5, -2)$ Amar Jawan Jyoti

Based on the above, answer the following questions :

(i) Advocate Rehana stays at Heera Bagh. How much distance she has to cover daily to go to the court and coming back home? (1)

(ii) There is a crossing on X-axis which divides AD in a certain ratio. Find the ratio. (1)

(iii) (a) Is Birla Mandir equidistant from Heera Bagh and Amar Jawan Jyoti? Justify your answer. (2)

OR

(iii) (b) Using section formula, show that points A, O and B are not collinear. (2)

Solutions · CBSE 2026 · 30/4/1

Q1 **Answer: (A) 3 or (B) −3** (the board accepted either)

For equal roots, $D = b^2 - 4ac = 0$:

$$(8k)^2 - 4(9)(16) = 0 \Rightarrow 64k^2 = 576 \Rightarrow k^2 = 9 \Rightarrow k = \pm 3$$

Q2 **Answer: (C)**

The order of letters gives the correspondence $A \leftrightarrow E, B \leftrightarrow D, C \leftrightarrow F$. So $\angle A = \angle E$ (not $\angle D$), which makes (C) false.

(A) is true (perimeters are in the ratio of corresponding sides), (B) is true ($\frac{AB}{ED} = \frac{BC}{DF} = \frac{AC}{EF}$), and (D) is true because every side of $\triangle ABC$ is the same multiple of the matching side of $\triangle EDF$.

Q3 **Answer: (A) $\sqrt{2}$**

$d = a_{n+1} - a_n = [\sqrt{2}(n+1) + 1] - [\sqrt{2}n + 1] = \sqrt{2}$. (When a_n is linear in n, the coefficient of n is d.)

Q4 **Answer: (B) $4\sqrt{2}$ cm**

$\angle OQP = \angle ORP = 90^\circ$ (radius ⊥ tangent) and $\angle QPR = 90^\circ$, so $\angle QOR = 90^\circ$. With $OQ = OR = 4$ cm and $PQ = PR$, OQPR is a square of side 4 cm. OP is its diagonal: $OP = 4\sqrt{2}$ cm.

Q5 **Answer: (D) 3**

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The number of zeroes equals the number of points where the graph meets the x-axis. The curve cuts the x-axis at three points, so $p(x)$ has 3 zeroes.

Q6 **Answer: (A) 1.5 cm**

By BPT, $\frac{AE}{EC} = \frac{AD}{DB} = \frac{1}{3}$. So AE is $\frac{1}{1+3} = \frac{1}{4}$ of AC: $AE = \frac{6}{4} = 1.5$ cm.

Q7 **Answer: (D) $2\sqrt{5}$**

The circle passes through the origin O, so radius $= \sqrt{(1-0)^2 + (2-0)^2} = \sqrt{5}$ and diameter $= 2\sqrt{5}$. (Check: the diameter shown joins $(0, 4)$ and $(2, 0)$, whose midpoint is $(1, 2)$; its length is $\sqrt{4+16} = 2\sqrt{5}$.)

Q8 **Answer: (B) $\frac{4}{3}$**

The first equation is $3x + 2y = 30$. For no solution, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$:

$$\frac{3}{2} = \frac{2}{k} \Rightarrow k = \frac{4}{3}, \qquad \text{and } \frac{3}{2} \neq \frac{30}{7} \checkmark$$

Q9 **Answer: (D) $\frac{77}{8}$ cm²**

Area of circle $= \frac{22}{7} \times 7 \times 7 = 154$ cm². Each sector $= \frac{154}{16} = \frac{77}{8}$ cm².

Q10 **Answer: (C) $\frac{1}{4}$**

Total outcomes = 36. Each die must show 1, 2 or 3: $3 \times 3 = 9$ outcomes. $P = \frac{9}{36} = \frac{1}{4}$.

Q11 **Answer: (B) $2\sqrt{2}$**

Take perpendicular = 1, hypotenuse = 3; base $= \sqrt{9-1} = 2\sqrt{2}$. $\cot A = \frac{\text{base}}{\text{perpendicular}} = 2\sqrt{2}$.

Q12 **Answer: (A) $\tan^2 A$**

$$\frac{1 + \tan^2 A}{1 + \cot^2 A} = \frac{\sec^2 A}{\operatorname{cosec}^2 A} = \frac{1/\cos^2 A}{1/\sin^2 A} = \frac{\sin^2 A}{\cos^2 A} = \tan^2 A$$

Q13 **Answer: (A) $2\pi r^3$**

The jar has radius r and height $3 \times 2r = 6r$, so its volume is $\pi r^2(6r) = 6\pi r^3$. The three balls take $3 \times \frac{4}{3}\pi r^3 = 4\pi r^3$. Air $= 6\pi r^3 - 4\pi r^3 = 2\pi r^3$.

Q14 **Answer: (C) 57.5°**

SP is a diameter. Arc PR subtends 65° at the centre, so it subtends half of it at S: $\angle PSR = 32.5^\circ$.

In $\triangle SPT$, $\angle SPT = 90^\circ$ (radius ⊥ tangent), so $\angle PTR = 180^\circ - 90^\circ - 32.5^\circ = 57.5^\circ$.

Q15 **Answer: (A) $\sqrt{a^2 + b^2}$**

$$d^2 = (a\cos\theta + b\sin\theta)^2 + (a\sin\theta - b\cos\theta)^2 = a^2(\cos^2\theta + \sin^2\theta) + b^2(\sin^2\theta + \cos^2\theta) = a^2 + b^2$$

The $2ab\sin\theta\cos\theta$ terms cancel. So $d = \sqrt{a^2 + b^2}$.

Q16 **Answer: (B) 1 : 2**

$$\frac{1}{3}\pi r^2 h = 2 \times \frac{4}{3}\pi\left(\frac{r}{2}\right)^3 = \frac{1}{3}\pi r^3 \Rightarrow h = r$$

So $h : 2r = r : 2r = 1 : 2$.

Q17 **Answer: (D) 100°**

$$\frac{\theta}{360^\circ} \times 2 \times \frac{22}{7} \times 6.3 = 11 \Rightarrow \frac{\theta}{360^\circ} \times 39.6 = 11 \Rightarrow \theta = \frac{11 \times 360^\circ}{39.6} = 100^\circ$$

Q18 **Answer: (A) 34**

Mode = 3 Median − 2 Mean $= 3(40) - 2(43) = 120 - 86 = 34$.

Q19 **Answer: (B)**

A is true: $0 \le 0.2p \le 1 \Rightarrow p \le 5$. R is also true, but A follows from the fact that a probability cannot exceed 1, not from the complement rule. So R does not explain A.

Q20 **Answer: (C)**

A is true ($\sqrt{3} + \sqrt{5}$ is irrational). R is false: $\sqrt{2}$ and $-\sqrt{2}$ are irrational but their sum is 0, which is rational.

Q21 Here $a = p - q, b = q - r, c = r - p$.

$$D = (q - r)^2 - 4(p - q)(r - p)$$

Expand: $(p - q)(r - p) = pr - p^2 - qr + pq$. So

$$D = q^2 - 2qr + r^2 - 4pr + 4p^2 + 4qr - 4pq = q^2 + 2qr + r^2 - 4p(q + r) + 4p^2$$

$$= (q + r)^2 - 4p(q + r) + (2p)^2 = (q + r - 2p)^2$$

When $q + r = 2p$, $D = 0^2 = 0$, so the roots are equal. Verified.

Q22 In $\triangle CAB$ and $\triangle CDA$:

$\angle CAB = \angle CDA$ (given)

$\angle ACB = \angle DCA$ (common angle C)

So $\triangle CAB \sim \triangle CDA$ (AA similarity).

Corresponding sides are proportional:

$$\frac{CA}{CD} = \frac{CB}{CA} \Rightarrow CA^2 = CB \times CD$$

Q23(a) Multiply numerator and denominator inside the root by $(1 + \sin A)$:

$$\text{LHS} = \sqrt{\frac{(1 + \sin A)^2}{1 - \sin^2 A}} = \sqrt{\frac{(1 + \sin A)^2}{\cos^2 A}} = \frac{1 + \sin A}{\cos A}$$

$$= \frac{1}{\cos A} + \frac{\sin A}{\cos A} = \sec A + \tan A = \text{RHS}$$

Q23(b) $\cos 30^\circ = \frac{\sqrt{3}}{2}$, $\operatorname{cosec} 30^\circ = 2$, $\tan 60^\circ = \sqrt{3}$.

$$\frac{3 \times \frac{3}{4} - 6 \times 4}{3} = \frac{\frac{9}{4} - 24}{3} = \frac{-\frac{87}{4}}{3} = -\frac{29}{4}$$

Q24(a) Suppose $2 + 3\sqrt{5}$ is rational. Then $2 + 3\sqrt{5} = \frac{a}{b}$, where a, b are integers and $b \neq 0$.

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

Since a, b are integers, $\frac{a-2b}{3b}$ is rational, so $\sqrt{5}$ would be rational.

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This contradicts the fact that $\sqrt{5}$ is irrational. Hence $2 + 3\sqrt{5}$ is irrational.

Q24(b) $210 = 2 \times 3 \times 5 \times 7$ and $55 = 5 \times 11$, so HCF $= 5$.

$$5 = 210 \times 5 + 55m \Rightarrow 55m = 5 - 1050 = -1045 \Rightarrow m = -19$$

Q25 $\alpha + \beta = -\frac{b}{a} = \frac{16}{5}$, $\alpha\beta = \frac{c}{a} = \frac{-10}{5} = -2$.

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta} = \frac{\frac{256}{25} + 4}{-2} = \frac{\frac{356}{25}}{-2} = -\frac{178}{25}$$

Q26(a) Let Kevin's marks be x and Veer's marks be y.

Given: $y = 2x + 6$ ...(1)

With 4 more marks, the total would be 40: $x + y + 4 = 40 \Rightarrow x + y = 36$ ...(2)

Put (1) in (2): $x + 2x + 6 = 36 \Rightarrow 3x = 30 \Rightarrow x = 10$.

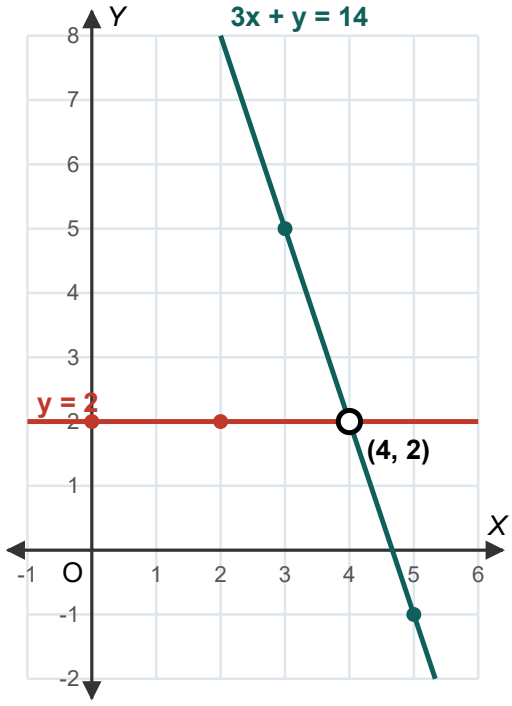
Then $y = 2(10) + 6 = 26$.

Veer scored **26** marks and Kevin scored **10** marks.

Q26(b) Tables of values:

$3x + y = 14$, **i.e.** $y = 14 - 3x$				$y = 2$		
x	3	4	5	0	2	4
y	5	2	−1	2	2	2

Plot the points and draw the two lines. They intersect at $(4, 2)$.



Solution: $x = 4, y = 2$.

Q27 The shaded region is the minor segment, bounded by arc AB and chord AB.

Arc AB $= \frac{120^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 21 = \frac{1}{3} \times 132 = 44$ mm.

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Chord AB: draw OM ⊥ AB. Then $\angle AOM = 60°$ and $AM = 21\sin 60° = \frac{21\sqrt{3}}{2}$, so $AB = 21\sqrt{3} = 21 \times 1.73 = 36.33$ mm.

Perimeter of shaded region $= 44 + 36.33 = 80.33$ mm.

Q28 Divide numerator and denominator by $\cos\theta$:

$$\text{LHS} = \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$$

Write the 1 in the numerator as $\sec^2\theta - \tan^2\theta$:

$$= \frac{(\sec\theta + \tan\theta) - (\sec^2\theta - \tan^2\theta)}{\tan\theta - \sec\theta + 1} = \frac{(\sec\theta + \tan\theta)(1 - \sec\theta + \tan\theta)}{\tan\theta - \sec\theta + 1} = \sec\theta + \tan\theta$$

Since $(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = \sec^2\theta - \tan^2\theta = 1$,

$$\sec\theta + \tan\theta = \frac{1}{\sec\theta - \tan\theta} = \text{RHS}$$

Q29(a) Cloth covers the four walls of the cuboid, the curved top of the semi-cylinder and its two semicircular ends (no cloth on the floor).

Four walls $= 2(14 \times 16 + 25 \times 16) = 2(224 + 400) = 1248$ m².

Semi-cylinder: radius $r = \frac{14}{2} = 7$ m, length 25 m.

Curved surface $= \pi r l = \frac{22}{7} \times 7 \times 25 = 550$ m².

Two semicircular ends $= 2 \times \frac{1}{2}\pi r^2 = \frac{22}{7} \times 49 = 154$ m².

Total cloth $= 1248 + 550 + 154 = 1952$ m².

Q29(b) Let $r_1 = 5\sqrt{2}$ cm (internal), $r_2 = 10$ cm (external).

Slant height of cone $l = \sqrt{(5\sqrt{2})^2 + (5\sqrt{7})^2} = \sqrt{50 + 175} = \sqrt{225} = 15$ cm.

Visible surfaces: outer hemisphere, cone's curved surface and the ring at the rim (the inner surface is covered by the cone).

$$\text{TSA} = 2\pi r_2^2 + \pi r_1 l + \pi(r_2^2 - r_1^2)$$

$$= \pi\left[2(100) + 5\sqrt{2}(15) + (100 - 50)\right] = \pi(250 + 75\sqrt{2})$$

$$= \pi(250 + 75 \times 1.4) = \pi(250 + 105) = 355\pi \text{ cm}^2$$

Q30 (i) $P(\text{not blue}) = \dfrac{30 - m}{30}$

(ii) Now there are 36 balls of which $m + 6$ are blue.

$$\frac{m+6}{36} = \frac{5}{4} \times \frac{m}{30} = \frac{m}{24}$$

$$24(m + 6) = 36m \Rightarrow 24m + 144 = 36m \Rightarrow 12m = 144 \Rightarrow m = 12$$

Q31 $48 = 2^4 \times 3$, $60 = 2^2 \times 3 \times 5$, $65 = 5 \times 13$.

LCM $= 2^4 \times 3 \times 5 \times 13 = 3120$.

The number must be a multiple of 3120: $3120 \times 3 = 9360$ and $3120 \times 4 = 12480 > 10000$.

Greatest such number $= 9360$.

Q32(a) Let the original duration be x days. Daily expense $=$ ₹ $\frac{5400}{x}$.

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With $x+5$ days, daily expense $= ₹\ \frac{5400}{x+5}$.

$$\frac{5400}{x} - \frac{5400}{x+5} = 180$$

$$5400 \cdot \frac{(x+5)-x}{x(x+5)} = 180 \Rightarrow 27000 = 180x(x+5) \Rightarrow x^2 + 5x - 150 = 0$$

$$(x+15)(x-10) = 0 \Rightarrow x = 10 \quad (x = -15 \text{ rejected, days cannot be negative})$$

Original duration = **10 days**; daily expense $= \frac{5400}{10} =$ **₹ 540**.

Q32(b) Let the original length be x m. Original price per metre $= ₹\ \frac{2100}{x}$; in the sale it becomes ₹ $\frac{2100}{x+2}$.

$$\frac{2100}{x} - \frac{2100}{x+2} = 120 \Rightarrow 2100 \cdot \frac{2}{x(x+2)} = 120 \Rightarrow x(x+2) = 35$$

$$x^2 + 2x - 35 = 0 \Rightarrow (x+7)(x-5) = 0 \Rightarrow x = 5 \quad (x = -7 \text{ rejected})$$

Original length = **5 m**; original price $= \frac{2100}{5} =$ **₹ 420 per metre**.

Q33 (i) $MQ \perp QT$ and $NB \perp QT$ (radius ⊥ tangent), so $MQ \parallel NB$, while MN and QB are not parallel. MQBN is a **trapezium**.

(ii) **No.** $MP \perp PA$ and $NA \perp PA$, so $MP \parallel NA$. M is 13 cm from line PA but N is only 8 cm from it; points on a line parallel to PA would be at equal distances. So MN is not parallel to PA.

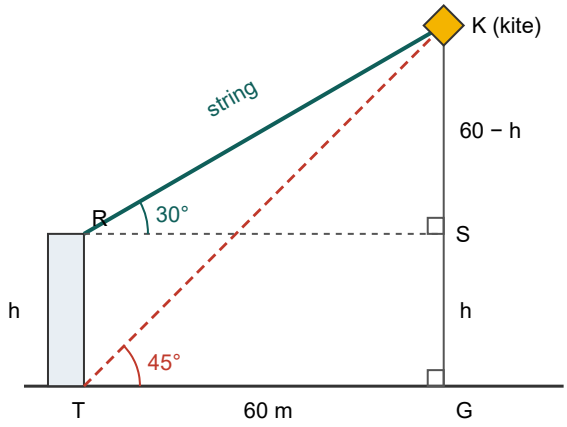
(iii) Tangents from T are equal: $TQ = TP = 80$ cm. So $TB = TQ - BQ = 80 - 35 = 45$ cm.

(iv) Draw $NS \perp MQ$ (S on MQ). Then SQBN is a rectangle: $NS = BQ = 35$ cm, $SQ = NB = 8$ cm, so $MS = 13 - 8 = 5$ cm.

$$MN^2 = NS^2 + MS^2 = 35^2 + 5^2 = 1225 + 25 = 1250 \Rightarrow MN = 25\sqrt{2} \text{ cm}$$

(The scheme also accepts TB = 56 cm if M, N, T are taken as a straight line and similar triangles are used.)

Q34 Let K be the kite, KG = 60 m its height, TR = h the building (T at the bottom, R on the roof), and RS ⊥ KG.



In right $\triangle KGT$: $\tan 45^\circ = \frac{KG}{TG} \Rightarrow 1 = \frac{60}{TG} \Rightarrow TG = 60$ m. So $RS = TG = 60$ m.

In right $\triangle KSR$: $\tan 30^\circ = \frac{KS}{RS} \Rightarrow \frac{1}{\sqrt{3}} = \frac{KS}{60} \Rightarrow KS = \frac{60}{\sqrt{3}} = 20\sqrt{3} = 34.6$ m.

Height of roof $h = KG - KS = 60 - 34.6 = 25.4$ m.

Length of string: $\sin 30^\circ = \frac{KS}{KR} \Rightarrow \frac{1}{2} = \frac{20\sqrt{3}}{KR} \Rightarrow KR = 40\sqrt{3} = 69.2$ m.

String = **69.2 m**; height of roof = **25.4 m**.

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Q35(a)

Class	f	cf
20–30	p	p
30–40	15	p + 15
40–50	25	p + 40
50–60	20	p + 60
60–70	q	p + q + 60
70–80	8	p + q + 68
80–90	10	p + q + 78

$p + q + 78 = 90 \Rightarrow p + q = 12$.

Median = 50 lies in the class 50–60: $l = 50$, $\frac{n}{2} = 45$, $cf = p + 40$, $f = 20$, $h = 10$.

$$50 = 50 + \frac{45 - (p + 40)}{20} \times 10 \Rightarrow \frac{5 - p}{2} = 0 \Rightarrow p = 5$$

$q = 12 - 5 = 7$. So $p = 5$, $q = 7$.

Q35(b) Mean by step-deviation, $a = 52.5$, $h = 15$, $u = \frac{x - 52.5}{15}$:

Class	f	x	u	fu
0–15	4	7.5	−3	−12
15–30	8	22.5	−2	−16
30–45	11	37.5	−1	−11
45–60	14	52.5	0	0
60–75	10	67.5	1	10
75–90	7	82.5	2	14
90–105	6	97.5	3	18
Total	**60**			**3**

$$\text{Mean} = a + \frac{\sum fu}{\sum f} \times h = 52.5 + \frac{3}{60} \times 15 = 52.5 + 0.75 = 53.25$$

Mode: the modal class is 45–60 (highest frequency 14). $l = 45$, $f_1 = 14$, $f_0 = 11$, $f_2 = 10$, $h = 15$.

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 45 + \frac{3}{28 - 21} \times 15 = 45 + \frac{45}{7} = 51.43 \text{ (approx.)}$$

Q36 (i) TR ⊥ AB, so $\angle TRB = \angle TRA = 90^\circ$. Hence $\theta + \angle CRT = 90^\circ$ and $\alpha + \angle PRT = 90^\circ$. Since $\angle PRT = \angle CRT$, we get $\theta = \alpha$.

(ii) In $\triangle PQR$ and $\triangle CBR$: $\angle PQR = \angle CBR = 90^\circ$ and $\angle PRQ = \alpha = \theta = \angle CRB$. So $\triangle PQR \sim \triangle CBR$ (AA).

(iii)(a) $AQ = PS = 9$ cm, so $QR = AB - AQ - BR = 65 - 9 - x = 56 - x$.

$$\frac{PQ}{CB} = \frac{QR}{BR} \Rightarrow \frac{35}{65} = \frac{56 - x}{x} \Rightarrow 35x = 3640 - 65x \Rightarrow 100x = 3640 \Rightarrow x = 36.4 \text{ cm}$$

(iii)(b)

$$\frac{\frac{1}{2} \times 35 \times (56 - x)}{\frac{1}{2} \times 65 \times x} = \frac{35^2}{65^2} \Rightarrow \frac{56 - x}{x} = \frac{35}{65} \Rightarrow 100x = 3640 \Rightarrow x = 36.4 \text{ cm}$$

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Q37 (i) Dots: 4, 8, 12, ... Here $8-4=12-8=4$, a constant difference, so they form an A.P. with $a=4$, $d=4$.

(ii) $a_n = a+(n-1)d = 4+4(n-1) = 4n$.

(iii)(a) $S_n = 220$: $\frac{n}{2}[2(4)+(n-1)4] = 220 \Rightarrow \frac{n}{2}(4n+4) = 220 \Rightarrow n(n+1) = 110$.

$n^2+n-110=0 \Rightarrow (n+11)(n-10)=0 \Rightarrow n=10$ ($n=-11$ rejected). **10 squares** are formed.

(iii)(b) $S_n = 100$: $2n(n+1) = 100 \Rightarrow n^2+n-50=0 \Rightarrow n = \frac{-1\pm\sqrt{201}}{2}$.

$\sqrt{201}$ is not a whole number, so n is not a natural number. **No**, it is not possible to complete squares using exactly 100 dots.

Q38 (i) $AC = \sqrt{(4+4)^2+(3-2)^2} = \sqrt{64+1} = \sqrt{65}$ units. Daily distance (to court and back) $= 2\sqrt{65}$ units.

(ii) Let the point on the x-axis divide AD in the ratio $k:1$. Its y-coordinate is $\frac{k(-2)+1(2)}{k+1} = 0 \Rightarrow k=1$. Ratio **1 : 1**.

(iii)(a) $BC = \sqrt{(4-4)^2+(-4-3)^2} = 7$ units; $BD = \sqrt{(4+5)^2+(-4+2)^2} = \sqrt{81+4} = \sqrt{85}$ units.

$BC \neq BD$, so Birla Mandir is **not** equidistant from Heera Bagh and Amar Jawan Jyoti.

(iii)(b) Suppose O(0, 0) divides AB in the ratio $k:1$, with A$(-4,2)$, B$(4,-4)$.

x-coordinate: $\frac{4k-4}{k+1} = 0 \Rightarrow k=1$. y-coordinate: $\frac{-4k+2}{k+1} = 0 \Rightarrow k=\frac{1}{2}$.

The two values of k differ, so no single ratio works: O does not lie on AB. Hence A, O and B are not collinear.

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