



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
- ✓ Only the 2026-27 syllabus: questions on deleted topics are flagged

notesbazar.in

WHAT YOU GET

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

17

board papers

599

solved questions

10

years · 2016–26

14

chapters

14

diagrams

X Questions scattered across years



✓ All in one place, chapter-wise

X Don't know what to study first



✓ Weightage + most-asked topics

X One-line answers online



✓ Full solutions, board-style

X Old books carry deleted topics



✓ Only the 2026-27 syllabus

PART A**Chapter-wise****A**

- ✓ Weightage table
- ✓ Most-asked topics
- ✓ Every question + solution

PART B**Full papers****B**

- ✓ 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 · All India Set 1

2016 · 30/1


Complete Notes · Solved PYQs

CLASS 6–12 · ALL SUBJECTS

100%
 QUESTIONS
 SOLVED
Made for **board toppers**

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 43 Qs | 8. Introduction to Trigonometry 56 Qs |
| 2. Polynomials 26 Qs | 9. Some Applications of Trigonometry 36 Qs |
| 3. Pair of Linear Equations in Two Variables 32 Qs | 10. Circles 56 Qs |
| 4. Quadratic Equations 52 Qs | 11. Areas Related to Circles 35 Qs |
| 5. Arithmetic Progressions 55 Qs | 12. Surface Areas and Volumes 30 Qs |
| 6. Triangles 48 Qs | 13. Statistics 35 Qs |
| 7. Coordinate Geometry 52 Qs | 14. Probability 43 Qs |

Part B · Full board papers, each followed by its solutions

- | | |
|---------------------------------|---|
| 1. CBSE 2026 · 30/4/1 solutions | 9. CBSE 2022 · 30/1/1 · Term 2 solutions |
| 2. CBSE 2026 · 30/5/1 solutions | 10. CBSE 2022 · 30/3/1 · Term 2 solutions |
| 3. CBSE 2025 · 30/1/1 solutions | 11. CBSE 2020 · 30/1/1 solutions |
| 4. CBSE 2025 · 30/2/1 solutions | 12. CBSE 2020 · 30/3/1 solutions |
| 5. CBSE 2024 · 30/2/1 solutions | 13. CBSE 2019 · 30/2/1 solutions |
| 6. CBSE 2024 · 30/4/1 solutions | 14. CBSE 2019 · 30/5/1 solutions |
| 7. CBSE 2023 · 30/2/1 solutions | 15. CBSE 2018 · 30/1 solutions |
| 8. CBSE 2023 · 30/4/1 solutions | 16. CBSE 2017 · All India Set 1 solutions |
| | 17. CBSE 2016 · 30/1 solutions |

599 questions in all. Questions are taken from the CBSE Class 10 Mathematics board papers (Standard from 2020) and the solutions are our own. Questions on topics deleted from the 2026-27 syllabus are left out of Part A and marked in Part B.

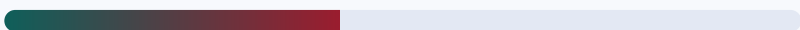
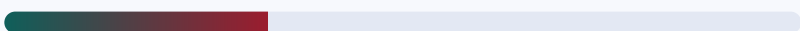
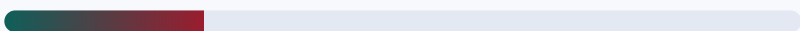
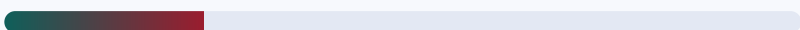
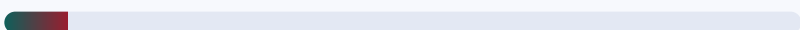
CHAPTER 1

Real Numbers

Board weightage 2016–2026

Year	2016	2017	2018	2019	2020	2022	2023	2024	2025	2026
Questions	–	–	3	6	6	–	7	6	8	7
Marks	–	–	6	12	12	–	15	12	12	14

Most asked topics

Proving irrationality		12
HCF		6
HCF × LCM		5
LCM application		4
HCF and LCM		3
Prime factorisation		3
Irrational numbers		1
HCF application		1

43 questions from 13 papers. Repeated questions are shown once with every year they were asked.

1 mark: MCQ and Assertion–Reason

CBSE 2026 · 30/4/1 · Q20

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

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 $\text{HCF} = 18m$: 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

1 mark

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

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

Solution**Answer: (C) 98**

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

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

CBSE 2025 · 30/1/1 · Q9

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**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

1 mark

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

- (A) 1.4142387954012... (B) $2.3\overline{26}$
(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 · 30/2/1 · Q4

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.

$\text{LCM}(16, 20, 50) = 2^4 \times 5^2 = 400 = 20^2$, 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

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

1 mark

The HCF of 40, 110 and 360 is:

(A) 40

(B) 110

(C) 360

(D) 10

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 2024 · 30/2/1 · Q5

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 $\times$ 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 · 30/4/1 · Q2

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

CBSE 2023 · 30/2/1 · Q4

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 · 30/4/1 · Q1

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. $\text{HCF}(4, 2) = 2$, $\text{LCM}(4, 2) = 4$. Ratio = $2 : 4 = 1 : 2$.

CBSE 2020 · 30/1/1 · Q2

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.

CBSE 2020 · 30/1/1 · Q5

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**

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

CBSE 2020 · 30/3/1 · Q1

1 mark

The HCF of 135 and 225 is

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

Solution**Answer: (c) 45**

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

CBSE 2020 · 30/3/1 · Q2

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 2019 · 30/2/1 · Q1

1 mark

If $\text{HCF}(336, 54) = 6$, find $\text{LCM}(336, 54)$.

Solution

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

CBSE 2019 · 30/5/1 · Q1

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

1 mark

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

Solution

Smallest prime = 2, smallest composite = 4. $\text{HCF}(2, 4) = 2$.

2 marks: very short answer

CBSE 2026 · 30/4/1 · Q24(a)

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)

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 $\text{HCF} = 5$.

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

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 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 · 30/4/1 · Q21

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.

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

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

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 · 30/4/1 · Q21

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 2019 · 30/2/1 · Q7

2 marks

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

Solution

The smallest such number is the LCM.

$306 = 2 \times 3^2 \times 17$, $657 = 3^2 \times 73$.

$\text{LCM} = 2 \times 3^2 \times 17 \times 73 = 22338$.

CBSE 2019 · 30/5/1 · Q10(a)

2 marks

Find the HCF of 612 and 1314 using prime factorisation.

Solution

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

CBSE 2018 · 30/1 · Q7

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 · 30/4/1 · Q31

3 marks

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

Solution

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

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

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

Greatest such number = 9360.

CBSE 2026 · 30/5/1 · Q31

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).

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

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

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

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 · 30/2/1 · Q30

3 marks

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

Solution

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

Squaring: $3b^2 = a^2$. So 3 divides a^2 , and therefore 3 divides a (3 is prime).

Let $a = 3c$. Then $3b^2 = 9c^2 \Rightarrow b^2 = 3c^2$, so 3 divides b^2 and hence b .

Now 3 divides both a and b , which contradicts that they are coprime.

Hence $\sqrt{3}$ is irrational.

CBSE 2024 · 30/2/1 · Q27 | CBSE 2023 · 30/4/1 · Q27 | CBSE 2019 · 30/5/1 · Q13 asked 3 times

3 marks

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

Solution

Suppose $\sqrt{5}$ is rational: $\sqrt{5} = \frac{a}{b}$, with a, b coprime integers, $b \neq 0$.

Squaring: $a^2 = 5b^2$. So 5 divides a^2 , hence 5 divides a (5 is prime). Let $a = 5c$.

Then $25c^2 = 5b^2 \Rightarrow b^2 = 5c^2$, so 5 divides b^2 and hence b .

So 5 is a common factor of a and b , contradicting that they are coprime.

Therefore $\sqrt{5}$ is irrational.

CBSE 2024 · 30/4/1 · Q30

3 marks

Prove that $\frac{2 - \sqrt{3}}{5}$ 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 2023 · 30/2/1 · Q26(a)

3 marks

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

Solution

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

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

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

$$\text{HCF} = 3 \times 5 \times 101 = 1515.$$

$$(\text{Check: } 1515 \times 90900 = 137713500 = 18180 \times 7575 \checkmark)$$

CBSE 2023 · 30/2/1 · Q26(b)

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

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

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

CBSE 2019 · 30/2/1 · Q13(a)

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 2018 · 30/1 · Q13

3 marks

Find HCF and LCM of 404 and 96 and verify that $\text{HCF} \times \text{LCM} = \text{Product of the two given numbers}$.

Solution

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

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

$$\text{HCF} \times \text{LCM} = 4 \times 9696 = 38784 \text{ and } 404 \times 96 = 38784 \checkmark$$

4 marks: case-based / source-based

CBSE 2020 · 30/3/1 · Q35(a)

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)

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.

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.

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

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

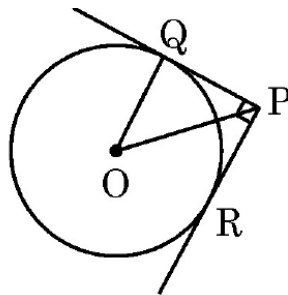
2. It is given that $\triangle ABC \sim \triangle EDF$. Which of the following is **not** true?

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

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

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

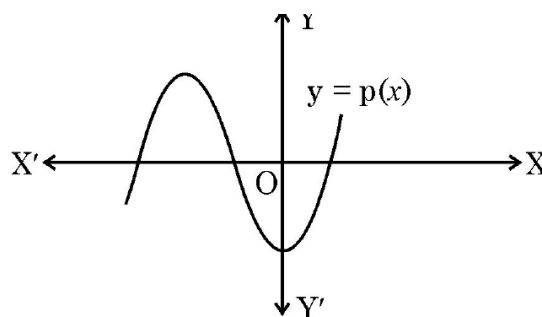
4.



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

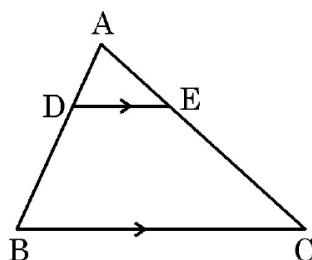
5. Observe the graph of polynomial $p(x)$. Number of zeroes of $p(x)$ is



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

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

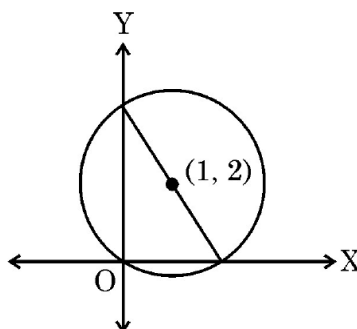
1



- (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. $\frac{1 + \tan^2 A}{1 + \cot^2 A}$ equals to:

1

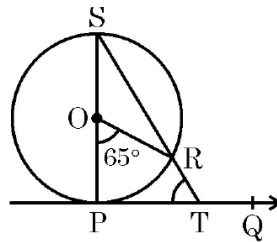
- (A) $\tan^2 A$
(B) -1
(C) $-\tan^2 A$
(D) $\cot^2 A$

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



- (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 $\angle POR = 65^\circ$, then $m\angle PTR$ is



- (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

- (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

- (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 $\widehat{PQ} = 11$ cm, then the value of θ is

- (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

- (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.
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.

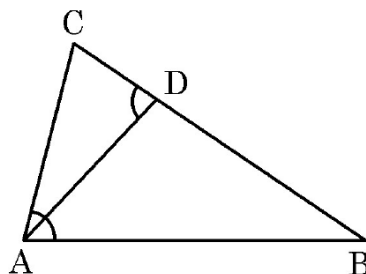
Reason (R): Sum of the any two irrational numbers is always irrational.

(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.

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: $\sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$ 2

OR

- (b) Evaluate: $\frac{3 \cos^2 30^\circ - 6 \csc^2 30^\circ}{\tan^2 60^\circ}$ 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 $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$. 2

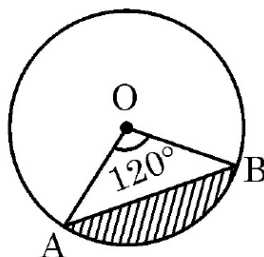
Section C · Short answer (3 marks each)

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

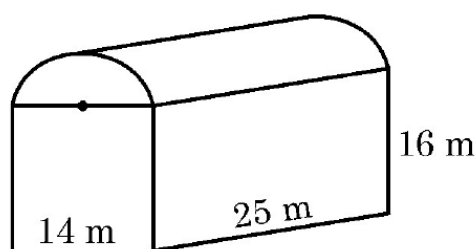
- (b) Solve the linear equations $3x + y = 14$ and $y = 2$ graphically. 3

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



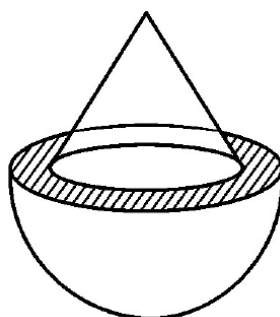
28. Prove that: $\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1}{\sec \theta - \tan \theta}$ 3

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 $14\text{ m} \times 25\text{ m} \times 16\text{ m}$.



OR

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



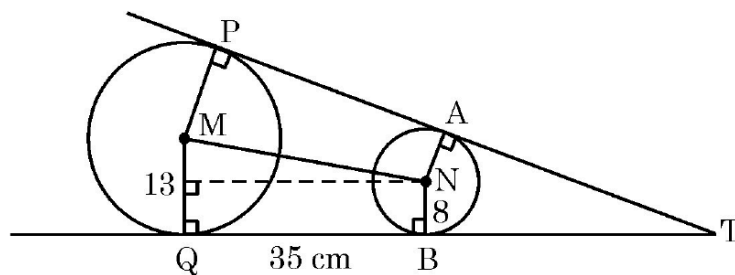
30. A bag contains 30 balls out of which ' m ' number of balls are blue in colour.
- Find the probability that a ball drawn at random from the bag is not blue.
 - If 6 more blue balls are added in the bag, then the probability of drawing a blue ball will be $\frac{5}{4}$ times the probability of drawing 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.

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.
- 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?

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.

- Name the quadrilateral MQBN. (1)
- Is MN parallel to PA? Justify your answer. (1)
- Find length TB. (1)
- 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 $\sqrt{3} = 1.73$)

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

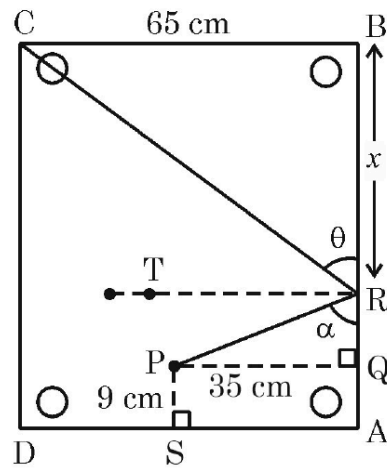
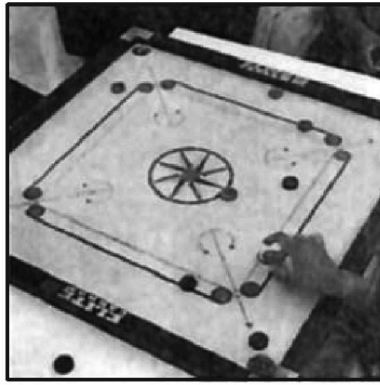
- (b) Find mean and mode of the following distribution:

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)

36.



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 $\angle CRB = \theta$.

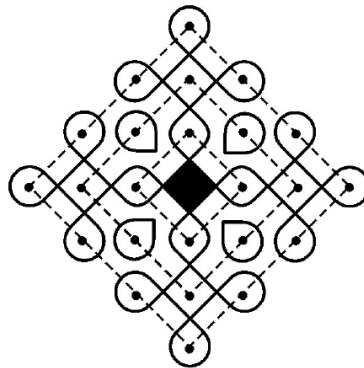
- (i) Using law of reflection i.e. $\angle PRT = \angle CRT$, prove that $\theta = \alpha$. (1)
- (ii) Prove that $\triangle PQR \sim \triangle CBR$ given that PQ is perpendicular to AB. (1)
- (iii) (a) Find the value of x using similarity of triangles. (2)

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.

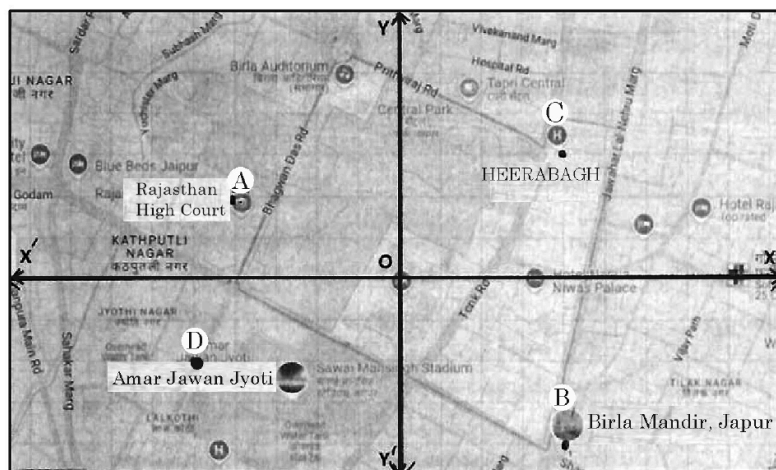
4



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.

- (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)

38.



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.

(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 $\perp$ 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**

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, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$:

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

Q9 Answer: (D) $\frac{77}{8} \text{ cm}^2$

Area of circle = $\frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$. Each sector = $\frac{154}{16} = \frac{77}{8} \text{ cm}^2$.

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) $\tan^2 A$

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

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 $\perp$ 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

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean} = 3(40) - 2(43) = 120 - 86 = 34.$$

Q19 Answer: (B)

A is true: $0 \leq 0.2p \leq 1 \Rightarrow p \leq 5$. 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

$$\begin{aligned} D &= q^2 - 2qr + r^2 - 4pr + 4p^2 + 4qr - 4pq = q^2 + 2qr + r^2 - 4p(q + r) + 4p^2 \\ &= (q + r)^2 - 4p(q + r) + (2p)^2 = (q + r - 2p)^2 \end{aligned}$$

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

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

$$\angle CAB = \angle CDA \text{ (given)}$$

$$\angle ACB = \angle DCA \text{ (common angle C)}$$

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 $(1 + \sin A)$:

$$\begin{aligned} \text{LHS} &= \sqrt{\frac{(1 + \sin A)^2}{1 - \sin^2 A}} = \sqrt{\frac{(1 + \sin A)^2}{\cos^2 A}} = \frac{1 + \sin A}{\cos A} \\ &= \frac{1}{\cos A} + \frac{\sin A}{\cos A} = \sec A + \tan A = \text{RHS} \end{aligned}$$

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

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

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.

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: $y = 2x + 6 \dots(1)$

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

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

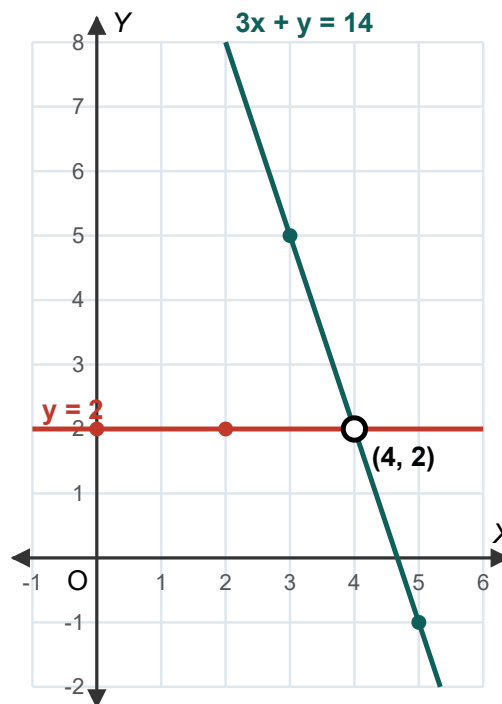
Then $y = 2(10) + 6 = 26.$

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.

Chord AB: draw $OM \perp AB$. Then $\angle AOM = 60^\circ$ and $AM = 21 \sin 60^\circ = \frac{21\sqrt{3}}{2}$, 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).

$$\text{Four walls} = 2(14 \times 16 + 25 \times 16) = 2(224 + 400) = 1248 \text{ m}^2.$$

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

$$\text{Curved surface} = \pi r l = \frac{22}{7} \times 7 \times 25 = 550 \text{ m}^2.$$

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

$$\text{Total cloth} = 1248 + 550 + 154 = 1952 \text{ m}^2.$$

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

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

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

$$\begin{aligned} \text{TSA} &= 2\pi r_2^2 + \pi r_1 l + \pi(r_2^2 - r_1^2) \\ &= \pi [2(100) + 5\sqrt{2}(15) + (100 - 50)] = \pi(250 + 75\sqrt{2}) \\ &= \pi(250 + 75 \times 1.4) = \pi(250 + 105) = 355\pi \text{ cm}^2 \end{aligned}$$

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

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

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

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 = ₹ $\frac{5400}{x}$.

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 = $\frac{5400}{10} = \text{₹ } 540$.

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 = $\frac{2100}{5} = \text{₹ } 420$ per metre.

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

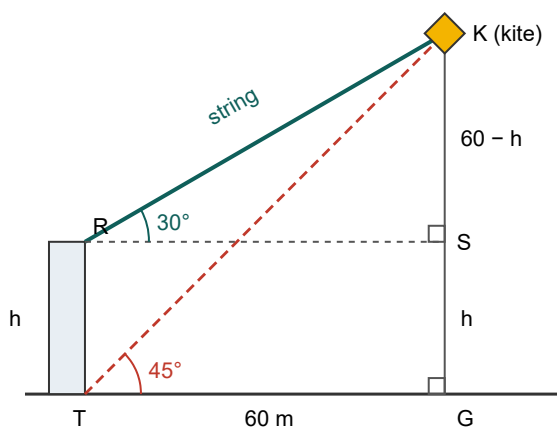
(ii) **No.** $MP \perp PA$ and $NA \perp PA$, so $MP \parallel NA$. M is 13 cm from line PA but N is only 8 cm from it; points on a line parallel to PA would be at equal distances. So MN is not parallel to PA.

(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.

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

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



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

Height of roof $h = KG - KS = 60 - 34.6 = 25.4 \text{ m}$.

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

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

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: $l = 50$, $\frac{n}{2} = 45$, $cf = p + 40$, $f = 20$, $h = 10$.

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

$$q = 12 - 5 = 7. \text{ So } p = 5, q = 7.$$

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) $TR \perp AB$, 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)

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

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.



All the best for your boards!

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