CENTRAL BOARD OF SECONDARY EDUCATION

CBSE 2026-27

Mathematics (Standard)

Subject Code: 041 | Class X

Question Bank – Set 1

Questions in this Booklet

Ch.	Chapter	MCQs	A-R	VSA	SA	LA	CS	All
01	Real Numbers	5	1	2	2	1	1	**12**
02	Polynomials	3	1	1	1	0	2	**8**
03	Pair of Linear Equations in Two Variables	4	1	1	2	1	1	**10**
04	Quadratic Equations	4	1	1	1	4	0	**11**
05	Arithmetic Progressions	3	1	2	2	2	1	**11**
06	Coordinate Geometry	1	1	1	2	0	2	**7**
07	Triangles	5	1	3	2	2	1	**14**
08	Circles	3	1	2	2	1	1	**10**
09	Introduction to Trigonometry	6	1	4	4	0	1	**16**
10	Some Applications of Trigonometry	2	1	1	2	2	1	**9**
11	Areas Related to Circles	3	1	2	2	1	1	**10**
12	Surface Areas and Volumes	3	1	2	2	3	1	**12**
13	Statistics	2	0	2	1	3	2	**10**
14	Probability	7	2	2	1	0	2	**14**
	Total	**51**	**14**	**26**	**26**	**20**	**17**	**154**

MCQs = Multiple Choice; A-R = Assertion–Reason; VSA = Very Short Answer; SA = Short Answer; LA = Long Answer; CS = Case Study / Source-based.

Contents

01. Real Numbers 3

02. Polynomials 4

03. Pair of Linear Equations in Two Variables 6

04. Quadratic Equations 7

05. Arithmetic Progressions 8

06. Coordinate Geometry 9

07. Triangles 11

08. Circles 13

09. Introduction to Trigonometry 14

10. Some Applications of Trigonometry 16

11. Areas Related to Circles 17

12. Surface Areas and Volumes 19

13. Statistics 21

14. Probability 23

Answer Key (MCQs and Assertion–Reason) 26

01. Real Numbers

Multiple Choice Questions (MCQs)

Q1. The greatest number which divides both 134 and 188, leaving remainders 4 and 6 respectively, is: **[1]**

[SQP 2026-27 Q1 (= MS 2026-27 Q1); Board 2024 30-5-1 Q10; Board 2023 30-1-1 Q24 (85, 72 variant)]

(a) 13 (b) 26 (c) 39 (d) 65

Q2. If $\text{HCF}(2520, 6600) = 120$ and $\text{LCM}(2520, 6600) = 252 \times k$, then the value of k is: **[1]**

[Board 2024 30-2-1 Q5; Board 2024 30-3-1 Q13 (adapted: stem HCF 40 corrected to 120)]

(a) 550 (b) 165 (c) 1650 (d) 1600

Q3. If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and $\text{LCM}(a, b, c) = 3780$, then x is equal to: **[1]**

[Board 2024 30-3-1 Q5; SQP 2025-26 Q1 (= MS 2025-26 Q1)]

(a) 1 (b) 2 (c) 3 (d) 0

Q4. If two positive integers p and q can be expressed as $p = 18a^2b^4$ and $q = 20a^3b^2$, where a and b are distinct prime numbers, neither of which is 2, 3 or 5, then $\text{LCM}(p, q)$ is: **[1]**

[Board 2024 30-1-1 Q5; Board 2024C S-1 Q2 (near-twin, LCM of prime powers) (adapted: a and b made distinct primes, neither 2, 3 nor 5)]

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

Q5. If the sum of two numbers is 1215 and their HCF is 81, then the possible number of pairs of such numbers is: **[1]**

[SQP 2021-22 Q21 (= MS 2021-22 Q21); SQP 2025-26 Q10 (= MS 2025-26 Q10)]

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

Assertion–Reason

Q6. **Assertion (A):** $\text{HCF}(36m^2, 18m) = 18m$, where m is a prime number.
Reason (R): The HCF of two numbers is always less than or equal to the smaller number. **[1]**
(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.

[Board 2026 30-5-1 Q20]

Very Short Answer (VSA)

Q7. Three bells toll at intervals of 5, 6 and 8 minutes respectively. They all toll together when a park opens for visitors at 10:00 a.m. How many more times will they toll together before the park closes at 7:00 p.m.? **[2]**

[SQP 2026-27 Q21(B) (OR); Board 2024 30-4-1 Q21; SQP 2020-21 Q21 (= MS 2020-21 Q21); Board 2023 30-2-1 Q26(b) and Board 2023 30-5-1 Q26(b) (3-mark versions)]

Q8. Prove that $2 - 5\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is an irrational number. **[2]**

[Board 2026 30-5-1 Q21; Board 2024 30-1-1 Q25(a); Board 2023 30-2-1 Q21; Board 2023C 30-C-1 Q21(a); Board 2024C S-1 Q22; SQP 2018-19 Q7 (OR, 7-sqrt5 variant)]

Short Answer (SA)

Q9. Prove that $\sqrt{2}$ is an irrational number. **[3]**

[Board 2023 30-6-1 Q27(B); Board 2025 30-4-1 Q26(A); Board 2026 30-2-1 Q26; Board 2026 30-3-1 Q28; SQP 2023-24 Q21 (2-mark version; MS 2023-24 Q21)]

Q10. Given that $\sqrt{3}$ is an irrational number, prove that $2 + 3\sqrt{3}$ is an irrational number. **[3]**

[SQP 2026-27 Q26 (= MS 2026-27 Q26); SQP 2022-23 Q26 (5+2sqrt3 variant); Board 2024 30-4-1 Q30 (5-2sqrt3 variant); Board 2025 30-3-1 Q27; Board 2024 30-5-1 Q26(b); SQP 2020-21 Q27; SQP 2019-20 Q27 (OR option 1)]

Long Answer (LA)

Q11. (a) Find the HCF and LCM of 408 and 1032 by the prime factorisation method, and verify that HCF $\times$ LCM $=$ product of the two numbers. [3 marks]

(b) Show that 12^n cannot end with the digit 0 for any natural number n. [2 marks] **[5]**

[New]

Case Study

Q12. Read the following passage carefully and answer the questions that follow. **[4]**

[New]

> Kabir designs a logo for his school's Mathematics club. The logo is a square tile of side $\sqrt{2}$ cm. He wants to print the area and the perimeter of the tile on the club's badge, and he wants to know whether these values are rational or irrational. You may use the fact that $\sqrt{2}$ is an irrational number.

(i) Find the area of the tile. [1]

(ii) Find the perimeter of the tile, and state whether it is rational or irrational. [1]

(iii) Prove that the perimeter of the tile is an irrational number. [2]

OR

(iii) Write a rational number lying between $\sqrt{2}$ and 2, and justify your answer. [2]

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02. Polynomials

Multiple Choice Questions (MCQs)

Q1. If the zeroes of the quadratic polynomial $x^2 + (a+1)x + b$ are 2 and -3, then: **[1]**

[Board 2023 30-6-1 Q17; Board 2023C 30-C-1 Q37 (iii)(a) (same sub-question inside the case study)]

(a) $a = -7, b = -1$ (b) $a = 5, b = -1$ (c) $a = 2, b = -6$ (d) $a = 0, b = -6$

Q2. The graph of a quadratic polynomial $p(x)$ passes through the points $(-6, 0)$, $(0, -36)$, $(4, -20)$ and $(6, 0)$. The zeroes of the polynomial are: **[1]**

[SQP 2024-25 Q1; SQP 2024-25 VIC Q1 (adapted: $(0, -30)$ changed to $(0, -36)$ so the four points lie on one quadratic)]

(a) $-6,\ 0$ (b) $4,\ 6$ (c) $-30,\ -20$ (d) $-6,\ 6$

Q3. If α, β are the zeroes of the polynomial $x^2 - 1$, then the value of $\alpha + \beta$ is: **[1]**

[Board 2023 30-4-1 Q8; Board 2023 30-6-1 Q6 (identical)]

(a) 2 (b) 1 (c) -1 (d) 0

Assertion–Reason

Q4. **Assertion (A):** Degree of a zero polynomial is not defined.
Reason (R): Degree of a non-zero constant polynomial is 0. **[1]**

(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.

[Board 2024 30-5-1 Q20]

Very Short Answer (VSA)

Q5. If α, β are the zeroes of the polynomial $p(x) = 5x^2 - 6x + 1$, then find the value of $\alpha + \beta + \alpha\beta$. **[2]**

[Board 2024 30-5-1 Q23]

Short Answer (SA)

Q6. Find the zeroes of the polynomial $3x^2 - 4x - 4$. Hence, write a polynomial each of whose zeroes is 2 more than the zeroes of $3x^2 - 4x - 4$. **[3]**

[SQP 2022-23 Q27 (= MS 2022-23 Q27); Board 2025 30-5-1 Q27 and Board 2025 30-6-1 Q27 (near-twins: transformed zeroes of $7x^2 + 18x - 9$ and $3x^2 - 4x - 4$)]

Case Study

Q7. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2023 30-5-1 Q38 (adapted: part (ii) replaced by time of maximum height, since the graph-choice item needs its figure)]

In a pool at an aquarium, a dolphin jumps out of the water, travelling at 20 cm per second. Its height above the water level after t seconds is given by the polynomial $h(t) = 20t - 16t^2$, where the height is measured in cm and $h(t) = 0$ means the dolphin is at the water level.
Based on the above information, answer the following questions:

(i) Find the zeroes of the polynomial $p(t) = 20t - 16t^2$. [1]

(ii) At what time (in seconds) does the dolphin reach its maximum height? [1]

(iii) Find the height of the dolphin at $t = \frac{3}{2}$ s. What does the result tell you about the dolphin? [2]

OR

(iii) How much distance has the dolphin covered before it hits the water level again? [2]

Q8. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2024 30-2-1 Q36]

A ball is thrown in the air so that t seconds after it is thrown, its height h metres above its starting point is given by the polynomial $h = 25t - 5t^2$. The graph of h against t is a downward-opening parabola that meets the t-axis at $t = 0$ and $t = 5$, with its highest point at $t = \frac{5}{2}$.
Based on the above information, answer the following questions:

(i) Write the zeroes of the given polynomial. [1]

(ii) Find the maximum height reached by the ball. [1]

(iii) After being thrown upward, how much time does the ball take to reach a height of 30 m? [2]

OR

(iii) Find the two different values of t at which the height of the ball is 20 m. [2]

03. Pair of Linear Equations in Two Variables

Multiple Choice Questions (MCQs)

Q1. The value of k for which the pair of linear equations $3x - y + 8 = 0$ and $6x - ky + 16 = 0$ has infinitely many solutions is: **[1]**

[Board 2024 30/2/1 Q1; Board 2023 30/2/1 Q6 (near-twin: coincident lines $3x - y + 8 = 0$, $6x - ry + 16 = 0$, answer $r = 2$)]

(a) -2 (b) 2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

Q2. The pair of equations $x = a$ and $y = b$ graphically represents lines which are: **[1]**

[Board 2023 30/2/1 Q8; Board 2024C 30/S/1 Q3 (same idea with $x = 2a$, $y = 3b$)]

(a) parallel (b) intersecting at (b, a)
(c) coincident (d) intersecting at (a, b)

Q3. The pair of equations $ax + 2y = 9$ and $3x + by = 18$, where a, b are integers, represent parallel lines if: **[1]**

[Board 2023 30/5/1 Q2; Board 2023C 30/C/1 Q4 (near-twin: $ax + 2y = 7$, $3x + by = 16$, answer $ab = 6$)]

(a) $a = b$ (b) $3a = 2b$ (c) $2a = 3b$ (d) $ab = 6$

Q4. Three chairs and one table cost Rs 900, whereas five chairs and three tables cost Rs 2100. If the cost of one chair is Rs x and the cost of one table is Rs y, the situation is represented algebraically as: **[1]**

[Board 2023 30/6/1 Q13; SQP 2020-21 Q4 (formation, 1-mark VSA-1 near-twin: $3x + y = 1500$, $6x + y = 2400$)]

(a) $3x + y = 900$, $3x + 5y = 2100$ (b) $x + 3y = 900$, $3x + 5y = 2100$
(c) $3x + y = 900$, $5x + 3y = 2100$ (d) $x + 3y = 900$, $5x + 3y = 2100$

Assertion–Reason

Q5. **Assertion (A):** The lines $x + y = 5$ and $2x + 2y = 9$ intersect at exactly one point.
Reason (R): If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, the pair of linear equations has no solution. **[1]**

(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.

[New]

Very Short Answer (VSA)

Q6. Solve the pair of linear equations algebraically: $101x + 102y = 304$ and $102x + 101y = 305$. **[2]**

[Board 2025 30/6/1 Q21(a); SQP 2022-23 Q21 (near-twin: $49x + 51y = 499$, $51x + 49y = 501$, answer $x = \frac{11}{2}$, $y = \frac{9}{2}$)]

Short Answer (SA)

Q7. The age of a father is twice the sum of the ages of his two children. After 20 years, his age will be equal to the sum of the ages of his two children at that time. Find the present age of the father. **[3]**

[Board 2023C 30/C/1 Q26]

Q8. Three years ago, Rashmi was thrice as old as Nazma. Ten years later, Rashmi will be twice as old as Nazma. Find their present ages. **[3]**

[Board 2024 30/1/1 Q29]

Long Answer (LA)

Q9. Determine graphically the coordinates of the vertices of the triangle formed by the lines $2x - 3y + 6 = 0$, $2x + 3y - 18 = 0$ and $x = 0$. **[5]**

[Board 2026 30/1/1 Q32, adapted: area of the triangle removed (deleted topic)]

Case Study

Q10. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2025 30/2/1 Q36, adapted (ii)(b) made exact; rebalanced to 1 + 1 + 2 with 2-mark OR]

A school is organising a cultural event and plans to rent chairs and tables from a local supplier. The rent for each chair is Rs 50 and for each table is Rs 200. The school spends Rs 30000 for renting chairs and tables, and the total number of items rented is 300. Let the school rent x chairs and y tables.
Based on the above information, answer the following questions:

(i) Write the pair of linear equations representing the given information. [1]

(ii) Find the number of tables rented by the school. [1]

(iii) If the school spends exactly Rs 27000 on the 300 items (chairs and tables), find the number of chairs and the number of tables rented. [2]

OR

(iii) What is the maximum number of tables that can be rented for Rs 30000 if no chairs are rented? [2]

04. Quadratic Equations

Multiple Choice Questions (MCQs)

Q1. For what values of k does the equation $9x^2 + 6kx + 4 = 0$ have equal roots? **[1]**

[SQP 2020-21 Q6 (adapted: 1-mark VSA converted to MCQ)]

(a) ± 2 (b) ± 3 (c) ± 4 (d) ± 1

Q2. If the quadratic equation $3x^2 - k\sqrt{3}\,x + 4 = 0$ has equal roots, then the value(s) of k is/are: **[1]**

[SQP 2017-18 Q2; MS 2017-18 Q2 (adapted: 1-mark VSA converted to MCQ)]

(a) ± 4 (b) $\pm 2\sqrt{3}$ (c) $\pm\sqrt{3}$ (d) ± 8

Q3. For what value(s) of k does the quadratic equation $x^2 + 2\sqrt{2}\,kx + 18 = 0$ have equal roots? **[1]**

[SQP 2019-20 Q20 (adapted: 1-mark VSA converted to MCQ)]

(a) ± 3 (b) ± 2 (c) ± 9 (d) $\pm\sqrt{3}$

Q4. If one root of the quadratic equation $kx^2 - 14x + 8 = 0$ is 2, then the value of k is **[1]**

[SQP 2018-19 Q2 (OR option 1; adapted: 1-mark VSA converted to MCQ)]

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

Assertion–Reason

Q5. **Assertion (A):** If the roots of $x^2 - 6x + k = 0$ are equal, then $k = 9$.
Reason (R): For equal roots the discriminant is zero, so $36 - 4k = 0$. **[1]**
(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.

[New]

Very Short Answer (VSA)

Q6. Find the discriminant of the quadratic equation $4x^2 - 5 = 0$ and hence comment on the nature of its roots. **[2]**

[Board 2023 30/4/1 Q23(B) (OR)]

Short Answer (SA)

Q7. Find the value of p for which the quadratic equation $px(x-2)+6=0$ has two equal real roots. **[3]**

[Board 2023 30/4/1 Q31]

Long Answer (LA)

Q8. A train covers a distance of 90 km at a uniform speed. Had its speed been 15 km/h more, it would have taken 30 minutes less for the journey. Find the original speed of the train. **[5]**

[SQP 2016-17 Q22 (4-mark, same numbers as Board version); Board 2024 30/4/1 Q34(a)]

Q9. A train travels at a certain average speed for a distance of 63 km and then travels a distance of 72 km at an average speed of 6 km/h more than its original speed. If it takes 3 hours to complete the total journey, what is the original average speed? **[5]**

[SQP 2025-26 Q32; Board 2023 30/5/1 Q34(a) (near-twin, different numbers)]

Q10. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/h from its usual speed and the time of the flight increased by 30 minutes. Find the scheduled duration of the flight. **[5]**

[SQP 2022-23 Q32 (OR); Board 2024 30/3/1 Q32(a) (near-twin, different numbers)]

Q11. The sum of the areas of two squares is 640 m^2 and the difference of their perimeters is 64 m. Find the sides of the two squares. **[5]**

[Board 2025 30/2/1 Q33(a); Board 2026 30/1/1 Q33(B) (near-twin, different numbers)]

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05. Arithmetic Progressions

Multiple Choice Questions (MCQs)

Q1. If the nth term of an A.P. is $7n-4$, then the common difference of the A.P. is **[1]**

[SQP 2024-25 Q4; SQP 2024-25 VIC Q4; Board 2023 30/5/1 Q3 (near-twin, $3n+7$)]

(a) 7 (b) $7n$ (c) -4 (d) 4

Q2. The 7^{th} term from the end of the A.P. $-8, -5, -2, \ldots, 49$ is: **[1]**

[Board 2024C 30-S-1 Q11; Board 2023 30/5/1 Q14 (near-twin); SQP 2016-17 Q2 (near-twin, adapted); SQP 2017-18 Q3 (near-twin, adapted)]

(a) 67 (b) 13 (c) 31 (d) 10

Q3. If $k+7$, $2k-2$ and $2k+6$ are three consecutive terms of an A.P., then the value of k is: **[1]**

[Board 2024C 30-S-1 Q4; Board 2023C 30-C-1 Q8 (near-twin, $x, 2x+9, 4x+3$)]

(a) 15 (b) 17 (c) 5 (d) 1

Assertion–Reason

Q4. **Assertion (A):** a, b, c are in Arithmetic Progression if and only if $2b = a + c$.
Reason (R): The sum of the first n odd natural numbers is n^2. **[1]**
(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.

[Board 2023 30/4/1 Q20]

Very Short Answer (VSA)

Q5. If 7 times the 7^{th} term of an A.P. is equal to 11 times its 11^{th} term, then find its 18^{th} term. **[2]**

[SQP 2018-19 Q8 (OR); SQP 2021-22 Term 2 Q1 (OR; variant with 7th and 5th terms)]

Q6. Find the 20^{th} term from the last term of the A.P. $3, 8, 13, \ldots, 253$. **[2]**

[SQP 2018-19 Q8 (OR option, first part)]

Short Answer (SA)

Q7. How many terms are there in an A.P. whose first term is -14 and fifth term is 2, if its last term is 62? **[3]**

[Board 2023 30/4/1 Q26(A) (OR)]

Q8. Which term of the A.P. $65, 61, 57, 53, \ldots$ is the first negative term? **[3]**

[Board 2023 30/4/1 Q26(B) (OR)]

Long Answer (LA)

Q9. The ratio of the 11^{th} term to the 17^{th} term of an A.P. is $3 : 4$. Find the ratio of the 5^{th} term to the 21^{st} term of the same A.P. Also, find the ratio of the sum of the first 5 terms to the sum of the first 21 terms. **[5]**

[Board 2023 30/1/1 Q35(a) (OR); Board 2023 30/6/1 Q34(A) (near-twin, different ratio)]

Q10. 250 logs are stacked in the following manner: 22 logs in the bottom row, 21 logs in the next row, 20 logs in the row next to it, and so on. In how many rows are the 250 logs placed, and how many logs are there in the top row? **[5]**

[Board 2023 30/1/1 Q35(b) (OR)]

Case Study

Q11. Read the following passage carefully and answer the questions that follow. **[4]**

[SQP 2025-26 Q36]

In a class, the teacher asked every student to write an example of an A.P. Two boys, Aryan and Roshan, wrote the progressions $-5, -2, 1, 4, \ldots$ and $187, 184, 181, \ldots$ respectively.
Based on the above information, answer the following questions:

(i) Find the sum of the common differences of the two progressions. [1]

(ii) Find the 34^{th} term of the progression written by Roshan. [1]

(iii) Find the sum of the first 10 terms of the progression written by Aryan. [2]

OR

(iii) Which term of the two progressions has the same value in both? Find that value. [2]

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06. Coordinate Geometry

Multiple Choice Questions (MCQs)

Q1. The line represented by $\frac{x}{4} + \frac{y}{6} = 1$ intersects the x-axis and the y-axis at P and Q respectively. The coordinates of the mid-point of the line segment PQ are: **[1]**

[Board 2025 30-3-1 Q6]

(a) $(2, 3)$ (b) $(3, 2)$ (c) $(2, 0)$ (d) $(0, 3)$

Assertion–Reason

Q2. **Assertion (A):** If the points $A(4, 3)$ and $B(x, 5)$ lie on a circle with centre $O(2, 3)$, then the value of x is 2.
Reason (R): Centre of a circle is the mid-point of each chord of the circle. **[1]**
(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.

[Board 2023 30-5-1 Q19]

Very Short Answer (VSA)

Q3. Prove that the abscissa of a point P which is equidistant from the points $A(7, 1)$ and $B(3, 5)$ is 2 more than its ordinate. **[2]**

[Board 2025 30-6-1 Q23; Board 2024 30-3-1 Q23(a) (OR); Board 2025 30-5-1 Q29 (near-twins: equidistant-point relation)]

Short Answer (SA)

Q4. A point $P(x, 7)$ divides the line segment joining $A(-5, 4)$ and $B(7, 9)$ in a certain ratio. Find the ratio and hence find the value of x. **[3]**

[Board 2026 30-3-1 Q30]

Q5. Find the coordinates of the points which divide the line segment joining $A(-2, 2)$ and $B(2, 8)$ into four equal parts. **[3]**

[Board 2025 30-3-1 Q26(b) (OR)]

Case Study

Q6. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2024C 30-S-1 Q38]

Partha, a software engineer, lives in Jerusalem for his work. He chooses an area of the city from where the bank, hospital, post office and supermarket can be easily reached. On a coordinate graph the bank is plotted as $A(9, 5)$, the hospital as $B(-3, -1)$ and the supermarket as $C(5, -5)$, so that A, B, C form a triangle. The post office E is the mid-point of the bank and the supermarket. The bus stand D is the mid-point of the hospital and the supermarket.

(i) Find the distance between the bank and the hospital. [1]

(ii) Find the coordinates of the post office E. [1]

(iii) Find the distance Partha must cover to reach the bus stand D from the bank. [2]

OR

(iii) Garment shops $P(1, a)$ and $Q(b, 3)$ lie between the bank and the hospital such that $BP = PQ = QA$. Find the values of a and b. [2]

Q7. Read the following passage carefully and answer the questions that follow. **[4]**

[SQP 2025-26 Q37 (OR variant (iii)(B) also given); MS 2025-26 Q37 (same paper)]

A group of Class X students goes to a picnic during winter holidays. The positions of three friends Aman, Kirti and Chahat are shown by the points $P(2, 5)$, $Q(4, 4)$ and $R(8, 3)$ on a coordinate graph sheet.

(i) Find the distance between P and R. [1]

(ii) Is Q the mid-point of PR? Justify by finding the mid-point of PR. [1]

(iii) Find the point on the x-axis which is equidistant from P and Q. [2]

OR

(iii) Let S be a point which divides the line segment PQ in the ratio $2 : 3$. Find the coordinates of S. [2]

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07. Triangles

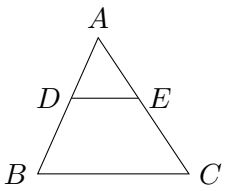
Multiple Choice Questions (MCQs)

Q1. The perimeters of two similar triangles are 56 cm and 70 cm. If one side of the first triangle is 14 cm, then the corresponding side of the second triangle, in cm, is **[1]**

[SQP 2026-27 Q6; SQP 2025-26 Q14; SQP 2021-22 Q16; Board 2024 (30/2/1) Q10; Board 2023 (30/6/1) Q8]

(a) 5 (b) 7.5 (c) 10 (d) 17.5

Q2. In $\triangle ABC$, D lies on AB, E lies on AC and $DE \parallel BC$. If $AD = 4$ cm, $AB = 9$ cm and $AC = 13.5$ cm, then EC is equal to



[1]

[Board 2024 (30/4/1) Q13; Board 2024 (30/5/1) Q17; Board 2023 (30/6/1) Q10; Board 2023C (30-C-1) Q10; Board 2023 (30/4/1) Q16; Board 2023 (30/2/1) Q12]

(a) 6 cm (b) 7.5 cm (c) 9 cm (d) 5.7 cm

Q3. In $\triangle ABC$, $DE \parallel BC$ with D on AB and E on AC. If $AD = 3$ cm, $BD = 4$ cm and $BC = 14$ cm, then DE equals **[1]**

[SQP 2021-22 Q17; Board 2024 (30/2/1) Q6; Board 2024 (30/3/1) Q12; Board 2023 (30/5/1) Q4]

(a) 7 cm (b) 6 cm (c) 4 cm (d) 3 cm

Q4. In $\triangle ABC$, $DE \parallel AB$ with D on AC and E on BC. If $AB = a$, $DE = x$, $BE = b$ and $EC = c$, then x in terms of a, b and c is **[1]**

[SQP 2023-24 Q8; SQP 2022-23 Q9]

(a) $\frac{ac}{b}$ (b) $\frac{ac}{b+c}$ (c) $\frac{ab}{c}$ (d) $\frac{ab}{b+c}$

Q5. $\triangle ABC \sim \triangle PQR$. If AM and PN are altitudes of $\triangle ABC$ and $\triangle PQR$ respectively and $AB^2 : PQ^2 = 4 : 9$, then $AM : PN =$ **[1]**

[SQP 2021-22 Q6; SQP 2022-23 Q6]

(a) 16 : 81 (b) 4 : 9 (c) 3 : 2 (d) 2 : 3

Assertion–Reason

Q6. **Assertion (A):** Every two similar triangles are congruent.
Reason (R): Corresponding angles of similar triangles are equal. **[1]**
(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.

[New]

Very Short Answer (VSA)

Q7. In the figure, X lies on PQ and Y lies on PR of $\triangle PQR$ such that $XY \parallel QR$. If $\frac{PQ}{XQ} = \frac{7}{3}$ and $PR = 6.3$ cm, find YR. **[2]**

[Board 2026 (30/2/1) Q22(b) (OR)]

Q8. AB and CD are two lines meeting at O, with A and D on one side of O and B and C on the other side, such that $OA \cdot OB = OC \cdot OD$. Show that $\angle A = \angle C$ and $\angle B = \angle D$, where $\angle A = \angle OAD$, $\angle C = \angle OCB$, $\angle D = \angle ODA$ and $\angle B = \angle OBC$. **[2]**

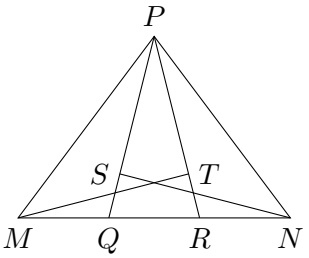
[Board 2025 (30/2/1) Q24(b) (OR)]

Q9. A 1.5 m tall boy walks away from the base of a 12 m high lamp post at a speed of 2.5 m/s. Find the length of his shadow after 3 seconds. **[2]**

[Board 2025 (30/4/1) Q22(A) (OR)]

Short Answer (SA)

Q10. In the given figure, Q and R lie on the base MN of $\triangle PMN$ in the order M, Q, R, N; S lies on PQ and T lies on PR; NS and MT are joined; $\triangle NSQ \cong \triangle MTR$ and $\angle 1 = \angle 2$. Prove that $\triangle PTS \sim \triangle PRQ$.



[3]

[SQP 2018-19 Q19 (OR option 1); SQP 2017-18 Q17 (OR option 1)]

Q11. $\triangle ABC \sim \triangle DEF$. The perimeters of $\triangle ABC$ and $\triangle DEF$ are 25 cm and 15 cm respectively. If $AB = 9$ cm, find DE. **[3]**

[SQP 2020-21 Q30 (OR option 1); SQP 2024-25 VIC Q26 (OR, part B, same concept with sides 4, 6, 9, 12 cm)]

Long Answer (LA)

Q12. Prove that a line drawn parallel to one side of a triangle, intersecting the other two sides in distinct points, divides those two sides in the same ratio. Hence, in $\triangle PQR$, a line LM meets PQ at L and PR at M with $LM \parallel QR$. If $PL = 5.7$ cm, $PQ = 15.2$ cm and $MR = 5.5$ cm, find PM. **[5]**

[SQP 2025-26 Q33; Board 2025 (30/2/1) Q34 (BPT with a parallel-line application, near-twin)]

Q13. Through the mid-point M of the side CD of a parallelogram $ABCD$, the line BM is drawn intersecting AC in L and AD produced in E. Prove that $EL = 2BL$. **[5]**

[Board 2023 (30/2/1) Q35(b) (OR); see SA 07-066 (3-mark form, Board 2023 (30/5/1) Q28(b))]

Case Study

Q14. Case Study: Triangular shelf unit **[4]**

[SQP 2024-25 Q37 (with its OR variant, part (iii)(B))]

Triangle is a very popular shape used in interior designing. A cabinet designed by an interior designer has a large triangle $\triangle ABC$ and a smaller triangle $\triangle DEF$ that holds a shelf. The point P lies on DE and the point Q lies on DF such that $PQ \parallel EF$.
Based on the above information, answer the following questions:

(i) Show that $\triangle DPQ \sim \triangle DEF$. [1]

(ii) If $DP = 50$ cm and $PE = 70$ cm, find $\dfrac{PQ}{EF}$. [1]

(iii) If $2AB = 5DE$ and $\triangle ABC \sim \triangle DEF$, show that $\dfrac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF}$ is constant. [2]

OR

(iii) If AM and DN are medians of $\triangle ABC$ and $\triangle DEF$ respectively, with M the midpoint of BC and N the midpoint of EF, prove that $\triangle ABM \sim \triangle DEN$. [2]

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08. Circles

Multiple Choice Questions (MCQs)

Q1. A quadrilateral $PQRS$ is drawn to circumscribe a circle. If $PQ = 12$ cm, $QR = 15$ cm and $RS = 14$ cm, then SP is equal to: **[1]**

[MS 2023-24 Q10 (= SQP 2023-24 Q10); near-twins Board 2023 30/2/1 Q15, SQP 2025-26 Q4 (= MS 2025-26 Q4), Board 2025 30/4/1 Q15]

(a) 15 cm (b) 14 cm (c) 12 cm (d) 11 cm

Q2. A circle is inscribed in $\triangle ABC$, touching AB, BC and CA at X, Z and Y respectively. If $AB = 12$ cm, $AY = 8$ cm and $CY = 6$ cm, then BC is: **[1]**

[Board 2025C 30/S/1 Q10; near-twin Board 2023 30/5/1 Q8 (isosceles triangle, BP = 6.5 cm)]

(a) 14 cm (b) 12 cm (c) 10 cm (d) 8 cm

Q3. The length of the tangent drawn from a point P, whose distance from the centre of a circle is 25 cm, to a circle of radius 7 cm is: **[1]**

[Board 2023C 30/C/1 Q15; SQP 2025-26 Q18 (= MS 2025-26 Q18, radius 9 cm, distance 41 cm); SQP 2024-25 VIC Q10 (= MS 2024-25 VIC Q10, radius 5 cm, distance 13 cm)]

(a) 22 cm (b) 24 cm (c) 25 cm (d) 28 cm

Assertion–Reason

Q4. **Assertion (A):** If two tangents are drawn to a circle from an external point P, touching it at A and B, then the radii OA and OB make equal angles with the line OP.
Reason (R): A parallelogram circumscribing a circle is a rhombus. **[1]**
(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.

[Board 2025 30/3/1 Q20]

Very Short Answer (VSA)

Q5. Two tangents inclined at an angle of 60° are drawn to a circle of radius 3 cm. Find the length of each tangent. **[2]**

[Board 2024 30/5/1 Q21(a) (OR); SQP 2020-21 Q9 (= MS 2020-21 Q9, 1 mark); SQP 2022-23 Q11 and MS 2022-23 Q11 (MCQ form); Board 2024C 30/S/1 Q5 (5 cm radius, MCQ); Board 2026 30/3/1 Q2 (MCQ)]

Q6. Prove that the tangents drawn at the ends of a diameter of a circle are parallel. **[2]**

[Board 2024 30/5/1 Q21(b) (OR); Board 2025 30/3/1 Q25]

Short Answer (SA)

Q7. A circle touches the side QR of $\triangle PQR$ at S, and touches the extended sides PQ and PR at M and N respectively. Prove that $PM = \frac{1}{2}(PQ + QR + PR)$. **[3]**

[Board 2026 30/1/1 Q29(B) (OR); SQP 2016-17 Q8 (adapted: 2-mark AR = half perimeter restated for 3 marks); Board 2023C 30/C/1 Q24 (2 marks); Board 2023 30/6/1 Q32(B) (5-mark form)]

Q8. AB is a diameter of a circle with centre O. The point Q lies on the line AB produced beyond B, and QPR is a tangent to the circle at P. Prove that $\angle QAP + \angle APR = 90°$. **[3]**

[Board 2023 30/2/1 Q31 (adapted: AB stated as a diameter, which the original proof needs)]

Long Answer (LA)

Q9. Two circles with centres O and O', of radii 6 cm and 8 cm respectively, intersect at two points P and Q such that OP and $O'P$ are tangents to the two circles at P. Find the length of the common chord PQ. **[5]**

[Board 2023 30/5/1 Q33(b) (OR) (lead reading: OP and O'P are tangents at P means each radius is perpendicular to the other circle's tangent line at P, i.e. angle OPO' = 90 degrees; answer verified)]

Case Study

Q10. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2023 30/1/1 Q38]

A circle with centre O and radius 75 cm has a tangent AB touching it at A, with B outside the circle. The segment OB meets the circle at Q. The point P lies on AB between A and B so that $PQ \parallel OA$, and $\angle ABO = 30°$.
Based on the above information, answer the following questions:

(i) Find the length of AB. [1]

(ii) Find the length of OB. [1]

(iii) Find the length of AP. [2]

OR

(iii) Find the length of PQ. [2]

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09. Introduction to Trigonometry

Multiple Choice Questions (MCQs)

Q1. If $4\sec\theta - 5 = 0$, then the value of $\cot\theta$ is **[1]**

[Board 2024 30/5/1 Q3]

(a) $\frac{3}{4}$ (b) $\frac{4}{5}$ (c) $\frac{5}{3}$ (d) $\frac{4}{3}$

Q2. The value of $\left(\sin^2\theta + \dfrac{1}{1+\tan^2\theta}\right)$ is **[1]**

[Board 2024C 30/S/1 Q9]

(a) 0 (b) 2 (c) 1 (d) -1

Q3. The value of $\tan^2\theta - \left(\dfrac{1}{\cos\theta} \times \sec\theta\right)$ is **[1]**

[Board 2025 30/1/1 Q5]

(a) 1 (b) 0 (c) -1 (d) 2

Q4. If $7\cos^2\theta + 3\sin^2\theta = 4$, then the value of θ is **[1]**

[Board 2025 30/2/1 Q1]

(a) 30° (b) 45° (c) 60° (d) 90°

Q5. If $\tan 3\theta = \sqrt{3}$, $0^\circ < 3\theta < 90^\circ$, then $\dfrac{\theta}{2}$ equals **[1]**

[Board 2025 30/3/1 Q1]

(a) 60° (b) 30° (c) 20° (d) 10°

Q6. $(\cot\theta + \tan\theta)$ equals **[1]**

[Board 2025 30/3/1 Q9]

(a) $\operatorname{cosec}\theta \sec\theta$ (b) $\sin\theta \sec\theta$ (c) $\cos\theta \tan\theta$ (d) $\sin\theta \cos\theta$

Assertion–Reason

Q7. **Assertion (A):** For an acute angle θ, $\sin\theta = \dfrac{3}{5} \Rightarrow \cos\theta = -\dfrac{4}{5}$.

Reason (R): For $0^\circ \le \theta \le 90^\circ$, $\sin^2\theta + \cos^2\theta = 1$. **[1]**

(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.

[Board 2025 30/5/1 Q19]

Very Short Answer (VSA)

Q8. Evaluate $\dfrac{5\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$. **[2]**

[Board 2023 30/4/1 Q25(A); near-twin Board 2024 30/4/1 Q23(a) (denominator sin squared 30 plus sin squared 60, which is 1)]

Q9. Evaluate $\dfrac{2\sin^2 60^\circ - \tan^2 30^\circ}{\sec^2 45^\circ}$. **[2]**

[SQP 2024-25 Q23; SQP 2024-25 VIC Q23]

Q10. If $\sin(A+B) = 1$ and $\cos(A-B) = \dfrac{\sqrt{3}}{2}$, $0^\circ < A + B \le 90^\circ$ and $A > B$, find the measures of angles A and B. **[2]**

[SQP 2022-23 Q25; near-twin SQP 2025-26 Q22 (both angles acute; A greater than B not stated)]

Q11. Find an acute angle θ when $\dfrac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta} = \dfrac{1-\sqrt{3}}{1+\sqrt{3}}$. **[2]**

[SQP 2022-23 Q25 (OR)]

Short Answer (SA)

Q12. Prove that $\dfrac{\tan A}{1-\cot A} + \dfrac{\cot A}{1-\tan A} = 1 + \sec A \operatorname{cosec} A$. **[3]**

[Board 2024 30/5/1 Q29; near-twins Board 2023 30/5/1 Q30, Board 2024 30/1/1 Q28, Board 2025 30/1/1 Q27(a), Board 2026 30/5/1 Q28 (ends 1 + tan A + cot A, same identity)]

Q13. Prove that $\left(\dfrac{1}{\cos\theta} - \cos\theta\right)\left(\dfrac{1}{\sin\theta} - \sin\theta\right) = \dfrac{1}{\tan\theta + \cot\theta}$. **[3]**

[Board 2023 30/2/1 Q27; Board 2025 30/3/1 Q28(b) (identical)]

Q14. Prove that $\dfrac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$. **[3]**

[Board 2023 30/4/1 Q29(A); Board 2024 30/3/1 Q30 (identical)]

Q15. Prove that $\dfrac{\cos A - \sin A + 1}{\cos A + \sin A - 1} = \operatorname{cosec} A + \cot A$. **[3]**

[SQP 2025-26 Q29 (OR, the valid alternative); SQP 2017-18 Q27 (4 marks, trimmed to 3, adapted); near-twin Board 2025 30/4/1 Q29(A) (reciprocal form,

cosec A - cot A)]

Case Study

Q16. Read the following passage carefully and answer the questions that follow. **[4]**

[New]

A solar panel of length 4 m is fixed on a metal frame on the flat roof of a school building. One end of the panel rests on the roof, and the panel is inclined to the roof at an angle θ. The other end of the panel is raised to a vertical height of 2 m above the roof. The engineer uses the position of the panel to plan the cables and the clear space under it. Assume that the panel is a straight line and that the roof is horizontal.
Based on the above information, answer the following questions:

(i) Find the value of $\sin\theta$. [1]

(ii) Write the measure of the angle θ. [1]

(iii) Find the horizontal distance on the roof between the end of the panel resting on the roof and the point directly below its raised end. [2]

OR

(iii) The panel is re-fixed at an angle of 45° with the roof, keeping its length 4 m. Find the vertical height of the raised end above the roof. [2]

10. Some Applications of Trigonometry

Multiple Choice Questions (MCQs)

Q1. The length of the shadow of a tower on level ground is $\sqrt{3}$ times the height of the tower. The altitude of the Sun is: **[1]**

[Board 2023 30/2/1 Q24(a) (2-mark VSA, same idea); Board 2024C 30/S/1 Q17; Board 2026 30/3/1 Q9]

(a) 45° (b) 30° (c) 60° (d) 15°

Q2. A vertical pole 7.5 m long casts a shadow 5 m long on the ground. At the same time, a tower casts a shadow 24 m long. The height of the tower is: **[1]**

[Board 2024 30/5/1 Q18; near-twin Board 2023C 30/C/1 Q11 (25 m tower)]

(a) 20 m (b) 40 m (c) 60 m (d) 36 m

Assertion–Reason

Q3. **Assertion (A):** The angle of elevation of the top of a 30 m high tower, observed from a point on the ground 30 m away from its foot, is 60°.
Reason (R): The angle of elevation of an object from a point is equal to the angle of depression of that point as seen from the object. **[1]**
(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.

[New]

Very Short Answer (VSA)

Q4. A ladder 8 m long rests against a vertical wall, making an angle of 60° with the ground. Find the height on the wall reached by the top of the ladder. **[2]**

[New]

Short Answer (SA)

Q5. A boy 1.7 m tall stands on horizontal ground 50 m away from a building. The angle of elevation of the top of the building from his eye is $60°$. Find the height of the building. (Use $\sqrt{3} = 1.73$.) **[3]**

[MS 2021-22 Term 2 Q10 (OR); SQP 2021-22 Term 2 Q10 (OR)]

Q6. A man standing on the top of a vertical observation tower sees a car moving at a uniform speed directly towards the tower. The angle of depression of the car changes from $30°$ to $45°$ in 12 minutes. How long, in minutes, will the car take to reach the foot of the tower from the point where its angle of depression is $45°$?**[3]**

[SQP 2018-19 Q27 (option 1) and MS 2018-19 Q27 (4-mark LA trimmed to 3 marks: the final time is asked only)]

Long Answer (LA)

Q7. The angles of depression of the top and the bottom of a building 50 m high, as observed from the top of a tower, are $30°$ and $60°$ respectively. Find the height of the tower and the horizontal distance between the building and the tower. **[5]**

[SQP 2020-21 Q34 (OR option 2); MS 2020-21 Q34 (OR); SQP 2017-18 Q28 and MS 2017-18 Q28 (4-mark version, same numbers)]

Q8. A boy whose eye level is 1.35 m above the ground spots a balloon moving with the wind in a horizontal line at some height above the ground. The angle of elevation of the balloon from his eyes at an instant is $60°$. After 12 seconds, the angle of elevation reduces to $30°$. If the speed of the wind is 3 m/s, find the height of the balloon above the ground. (Use $\sqrt{3} = 1.73$.) **[5]**

[SQP 2024-25 Q34; MS 2024-25 Q34; MS 2024-25 VIC Q34 (same question, VIC variant)]

Case Study

Q9. Case Study: Drone helping an ambulance **[4]**

[Board 2025 30/4/1 Q38 (adapted: the diagram part (i) is replaced by a numerical part, and the 45-degree timing is answered in seconds)]

A drone was used to help an ambulance reach a point P on a straight highway where there had been an accident. The ambulance travels along the highway at 60 km/h. The drone stopped at a point Q, 100 m vertically above P. At a particular instant the angle of depression of the ambulance, seen from Q, was $30°$.
Based on the above information, answer the following questions:

(i) Find the distance between the ambulance and P at this instant. (Use $\sqrt{3} = 1.73$.) [1]

(ii) Convert the speed of the ambulance into metres per second. [1]

(iii) Find the time, in seconds, in which the angle of depression changes from $30°$ to $45°$. [2]

OR

(iii) How long, in seconds, will the ambulance take to reach P from a point T on the highway at which the angle of depression from Q is $60°$? [2]

---

11. Areas Related to Circles

Multiple Choice Questions (MCQs)

Q1. If an arc subtends an angle of $90°$ at the centre of a circle, then the ratio of its length to the circumference of the circle is: **[1]**

[Board 2024 30/4/1 Q5]

(a) 2 : 3 (b) 1 : 4 (c) 4 : 1 (d) 1 : 3

Q2. If the length of an arc of a circle subtending an angle $60°$ at its centre is 22 cm, then the radius of the circle is: **[1]**

[Board 2024C 30/S/1 Q16]

(a) $\sqrt{21}$ cm (b) 21 cm (c) $\sqrt{42}$ cm (d) 42 cm

Q3. If a sector of a circle has an area of 40π sq. units and a central angle of $72°$, the radius of the circle is: **[1]**

[Board 2025 30/1/1 Q15]

(a) 200 units (b) 100 units (c) 20 units (d) $10\sqrt{2}$ units

Assertion–Reason

Q4. **Assertion (A):** If the radius of a sector of a circle is reduced to its half and the angle is doubled, then the perimeter of the sector remains the same.

Reason (R): The length of the arc subtending angle θ at the centre of a circle of radius r is $\dfrac{\pi r\theta}{180}$. **[1]**

(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.

[SQP 2024-25 Q20; SQP 2024-25 VIC Q20 (same question)]

Very Short Answer (VSA)

Q5. A chord of a circle of radius 14 cm subtends an angle of $90°$ at the centre. Find the area of the corresponding minor segment of the circle. (Use $\pi = \frac{22}{7}$.) **[2]**

[Board 2024C 30/S/1 Q23 (a) (OR)]

Q6. The length of the minute hand of a clock is 6 cm. Find the area swept by it when it moves from 7:05 p.m. to 7:40 p.m. (Use $\pi = \frac{22}{7}$.) **[2]**

[SQP 2022-23 Q24]

Short Answer (SA)

Q7. A chord of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding minor segment of the circle. (Use $\pi = 3.14$.) **[3]**

[Board 2025 30/3/1 Q29]

Q8. An arc of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding major sector. (Use $\pi = 3.14$.) **[3]**

[Board 2024 30/5/1 Q31]

Long Answer (LA)

Q9. A chord of a circle of radius 14 cm subtends an angle of $60°$ at the centre. Find the area of the corresponding minor segment of the circle. Also find the area of the major segment of the circle. (Use $\pi = \frac{22}{7}$.) **[5]**

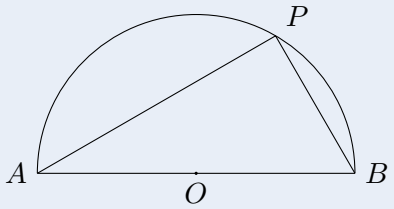
[Board 2023 30/1/1 Q34]

Case Study

Q10. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2025 30/6/1 Q36]

Anurag purchased a farmhouse in the form of a semicircle with diameter $AB = 70$ m and centre O, the midpoint of AB. He marks a point P on the arc such that $\angle PAB = 30°$, and joins AP and PB. This divides the farmhouse into three parts. Part I, between the chord PB and the arc PB, has mango saplings. Part II is the triangle APB, where tomatoes are grown. Part III, between the chord AP and the arc AP, has oranges.



Based on the above information, answer the following questions:

(i) What is the measure of $\angle POA$? [1]

(ii) Find the length of wire needed to fence the entire boundary of the farmhouse. (Use $\pi = \frac{22}{7}$.) [1]

(iii) Find the area of Part I, where the mango saplings are planted. (Use $\pi = \frac{22}{7}$.) [2]

OR

(iii) Find the length of wire needed to fence Part III. (Use $\pi = \frac{22}{7}$.) [2]

---

12. Surface Areas and Volumes

Multiple Choice Questions (MCQs)

Q1. A cap is cylindrical in shape, surmounted by a conical top. The cylindrical part and the conical part have the same base radius. If the volume of the cylindrical part is equal to that of the conical part, then the ratio of the height of the cylindrical part to the height of the conical part is: **[1]**

[Board 2024C 30/S/1 Q10]

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

Q2. A cone of the greatest possible volume is hollowed out from a solid wooden cylinder. The ratio of the volume of the remaining wood to the volume of the cone hollowed out is: **[1]**

[Board 2025 30/6/1 Q14]

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

Q3. If the volumes of two cubes are in the ratio $8 : 125$, then the ratio of their surface areas is: **[1]**

[Board 2025 30/3/1 Q12]

(a) $8 : 125$ (b) $4 : 25$ (c) $2 : 5$ (d) $16 : 25$

Assertion–Reason

Q4. **Assertion (A):** If two hemispheres of the same radius are joined along their bases, then a sphere is obtained.
Reason (R): The total surface area of a sphere of radius r is $3\pi r^2$. **[1]**
(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.

[Board 2025 30/1/1 Q20]

Very Short Answer (VSA)

Q5. A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy. (Take $\pi = \frac{22}{7}$.) **[2]**

[Board 2026 30/3/1 Q25]

Q6. Two glasses, each of inner radius 3 cm and height 10 cm, are filled with juice up to the brim. The first glass has a hemispherical raised bottom of radius 3 cm. The second glass has a conical raised bottom of base radius 3 cm and height 1.5 cm. Isha gets the first glass and her father Suresh gets the second. Who gets more juice, and by how much? **[2]**

[SQP 2019-20 Q26; MS 2019-20 Q26 (same paper)]

Short Answer (SA)

Q7. Water in a canal, 6 m wide and 1.5 m deep, flows at 10 km/h. How much area can it irrigate in 30 minutes if 8 cm of standing water is needed? **[3]**

[SQP 2017-18 Q21 (OR, option 1); MS 2017-18 Q21 (same paper)]

Q8. The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii. (Take $\pi = \frac{22}{7}$.) **[3]**

[Board 2024 30/1/1 Q31]

Long Answer (LA)

Q9. An empty cone of radius 3 cm and height 12 cm is filled with ice-cream. The lower part of the cone, which is $\frac{1}{6}$th of the volume of the cone, is left unfilled, and a hemisphere of ice-cream of radius 3 cm is formed on the top of the cone. Find the volume of the ice-cream. (Take $\pi = \frac{22}{7}$.) **[5]**

[SQP 2025-26 Q34 (OR); Board 2023 30/1/1 Q31(b) (same figures, 3-mark version)]

Q10. A tent is in the shape of a right circular cylinder surmounted by a conical top. The height and radius of the cylindrical part are 3 m and 14 m respectively, and the total height of the tent is 13.5 m. A provision of 26 m^2 of canvas is kept for stitching and wastage. (i) Find the area of canvas required for the tent. (ii) Find the cost of the canvas at Rs 250 per m^2. (Take $\pi = \frac{22}{7}$.) **[5]**

[SQP 2026-27 Q34(A) (OR); near-twins SQP 2023-24 Q34 (OR, Rs 500 per m2) and Board 2023 30/C/1 Q32(a) (inner painting at Rs 2 per m2)]

Q11. Water flows through a cylindrical pipe of internal diameter 2 cm into a cylindrical tank of base radius 40 cm at the rate of 0.7 m/s. By how much will the water rise in the tank in half an hour? **[5]**

[SQP 2020-21 Q35; MS 2020-21 Q35 (same paper)]

Case Study

Q12. Case Study: Metallic grain silo **[4]**

[SQP 2024-25 Q38; near-twin SQP 2024-25 VIC Q38 (same passage; (iii)(B) variant is the OR part)]

Farmer Girdhar has decided to build a new metallic silo to store his harvested grains. The silo is in the shape of a right circular cylinder with a cone mounted on top of it. The conical part has base radius 1.5 m and height 2 m. The cylindrical part has radius 1.5 m and height 7 m.
Based on the above information, answer the following questions:

(i) Calculate the slant height of the conical part of one silo. [1]

(ii) Find the curved surface area of the conical part of one silo. (Take $\pi = \frac{22}{7}$.) [1]

(iii) The metal sheet used to make the curved cylindrical part costs Rs 2000 per m^2. Find the cost of the metal sheet used to make the curved cylindrical part of one silo. [2]

OR

(iii) Find the total capacity of one silo to store grains. [2]

13. Statistics

Multiple Choice Questions (MCQs)

Q1. The median of a set of 9 distinct observations is 20.5. If each of the observations of the set is increased by 2, then the median of the new set: **[1]**

[SQP 2025-26 Q17; near-twin Board 2024 30/2/1 Q12 (value of each observation increased by 2)]

(a) is increased by 2
(b) is decreased by 2
(c) is two times the original number
(d) remains same as that of original observations

Q2. If the value of each observation of a statistical data is increased by 3, then the mean of the data: **[1]**

[Board 2023 30/1/1 Q15; near-twin Board 2023 30/5/1 Q18 (mean decreases when every term is decreased by 2)]

(a) remains unchanged
(b) increases by 3
(c) increases by 6
(d) increases by $3n$

Very Short Answer (VSA)

Q3. The marks of 42 students in a class test are grouped as below. Find the mode of the marks.

Marks	0–10	10–20	20–30	30–40	40–50
Number of students	5	10	18	6	3

[2]

[New]

Q4. A survey recorded the hours of reading per week of some students:

Hours per week	0–10	10–20	20–30	30–40
Number of students	2	3	k	5

If the mean of the data is 24, find the value of k. **[2]**

[New]

Short Answer (SA)

Q5. The median of the following data is 16. Find the missing frequencies a and b, if the total of the frequencies is 70.

Class	0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40
Frequency	12	a	12	15	b	6	6	4

[3]

[SQP 2020-21 Q31; MS 2020-21 Q31 (same paper)]

Long Answer (LA)

Q6. An SBI health insurance agent found the following data for the distribution of ages of 100 policy holders. Find the modal age and median age of the policy holders.

Age (years)	Number of policy holders
15–20	2
20–25	4
25–30	18
30–35	21
35–40	33
40–45	11
45–50	3
50–55	6
55–60	2

[5]

[Board 2026 30/2/1 Q35]

Q7. Find the mean and mode of the following distribution.

Class	0–10	10–20	20–30	30–40	40–50	50–60	60–70
Frequency	3	6	11	10	13	3	4

[5]

[Board 2026 30/3/1 Q32(b) (OR to Q32(a), 13-053)]

Q8. The median of the following data is 137. Find the values of x and y, given that the total of the frequencies is 68.

Class	Frequency
65–85	4
85–105	5
105–125	x
125–145	20
145–165	14
165–185	y
185–205	4

[5]

[Board 2026 30/3/1 Q32(a) (OR to Q32(b), 13-052)]

Case Study

Q9. Case Study: 100 m race **[4]**

[SQP 2020-21 Q20 (same data, in MCQ sub-part form); Board 2024 30/5/1 Q38 (shape used here)]

A stopwatch was used to find the time that a group of students took to run 100 m. The times are grouped as below.

Time (in seconds)	0–20	20–40	40–60	60–80	80–100
Number of students	8	10	13	6	3

Based on the above information, answer the following questions:

(i) Write the median class of the above data. [1]

(ii) How many students took less than 60 seconds to finish the race? [1]

(iii) Find the mean time taken by the students to finish the race. [2]

OR

(iii) Find the mode of the given data. [2]

Q10. Case Study: BINGO **[4]**

[Board 2024 30/1/1 Q37]

BINGO is a game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it. A participant cancels a number on the card when the number on a ball selected at random is called out, and the player who cancels all the numbers on the card says BINGO and wins. In one game 48 balls were used before Tara said "BINGO". The numbers announced are grouped as below.

Numbers announced	0–15	15–30	30–45	45–60	60–75
Number of times	8	9	10	12	9

Based on the above information, answer the following questions:

(i) Write the median class. [1]

(ii) When the first ball was picked up, what was the probability of calling out an even number? [1]

(iii) Find the median of the given data. [2]

OR

(iii) Find the mode of the given data. [2]

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14. Probability

Multiple Choice Questions (MCQs)

Q1. Which of the following numbers cannot be the probability of an event? **[1]**

[Board 2023 30/5/1 Q17; Board 2026 30/5/1 Q10 (near-twin: $\frac{10}{0.2} = 50$)]

(a) 0 (b) $\frac{7}{0.01}$ (c) 0.07 (d) $\frac{0.07}{3}$

Q2. Two coins are tossed simultaneously. The probability of getting at least one head is: **[1]**

[Board 2025 30/6/1 Q8; Board 2023 30/5/1 Q15 (near-twin: at least one tail, same answer)]

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) 1

Q3. A letter of the English alphabet is chosen at random. The probability that it is a letter of the word MATHEMATICS is: **[1]**

[SQP 2021-22 Q20; MS 2021-22 Q20]

(a) $\frac{4}{13}$ (b) $\frac{9}{26}$ (c) $\frac{5}{13}$ (d) $\frac{11}{26}$

Q4. A card is drawn from a well shuffled deck of cards. The probability that the card drawn is neither a king nor a queen is: **[1]**

[SQP 2021-22 Q26; MS 2021-22 Q26]

(a) $\frac{11}{13}$ (b) $\frac{12}{13}$ (c) $\frac{11}{26}$ (d) $\frac{11}{52}$

Q5. A pair of dice is tossed. The probability of not getting the sum eight is: **[1]**

[SQP 2025-26 Q8; MS 2025-26 Q8]

(a) $\frac{5}{36}$ (b) $\frac{31}{36}$ (c) $\frac{5}{18}$ (d) $\frac{5}{9}$

Q6. If the probability of a letter chosen at random from the letters of the word MATHEMATICS to be a vowel is $\frac{2}{2x+1}$, then x is equal to: **[1]**

[SQP 2025-26 Q15; MS 2025-26 Q15]

(a) $\frac{4}{11}$ (b) $\frac{9}{4}$ (c) $\frac{11}{4}$ (d) $\frac{4}{9}$

Q7. T-shirts marked with numbers 4 to 99 are placed in a box. Gunika randomly takes out a T-shirt from this box. The probability that she gets a T-shirt marked with a number that is either a perfect square or a perfect cube is: **[1]**

[SQP 2026-27 Q9; MS 2026-27 Q9]

(a) $\frac{1}{12}$ (b) $\frac{1}{32}$ (c) $\frac{11}{96}$ (d) $\frac{5}{48}$

Assertion–Reason

Q8. **Assertion (A):** The probability of selecting a number at random from the numbers 1 to 20 is 1.
Reason (R): For any event E, if $P(E) = 1$, then E is called a sure event. **[1]**
(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.

[Board 2025 30/1/1 Q19]

Q9. **Assertion (A):** In an experiment of throwing a die, the events E_1: getting a number less than 3 and E_2: getting a number greater than 3 are complementary events.
Reason (R): If two events E and F are complementary, then $P(E) + P(F) = 1$. **[1]**
(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.

[Board 2025 30/6/1 Q20]

Very Short Answer (VSA)

Q10. Jayanti throws a pair of dice and records the product of the numbers appearing on the dice. Pihu throws one die and records the square of the number that appears on it. Who has the better chance of getting the number 36? Justify your answer. **[2]**

[SQP 2019-20 Q25 (OR option 1); MS 2019-20 Q25]

Q11. An integer is chosen from the integers strictly between 70 and 100. Find the probability that it is (a) a prime number, (b) divisible by 7. **[2]**

[SQP 2019-20 Q25 (OR option 2); MS 2019-20 Q25 (OR). The source says "between 70 and 100"; the scheme counts 29 integers, so the question is taken as 71 to 99 inclusive.]

Short Answer (SA)

Q12. Three unbiased coins are tossed simultaneously. Find the probability of getting: (i) at least one head; (ii) exactly two tails; (iii) at most one tail. **[3]**

[Board 2024 30/4/1 Q27(a); Board 2024 30/5/1 Q30 (near-twin: same three-coin setting)]

Case Study

Q13. Case Study: Making purple **[4]**

[Board 2023 30/5/1 Q37]

A middle school ran a spinner game as a fund-raiser at its Christmas Carnival. Spinner I is divided into three equal sectors labelled R (Red), G (Green) and Y (Yellow). Spinner II is divided into three equal sectors labelled R (Red), B (Blue) and G (Green). Each spinner is spun once.
A participant "wins" when one spinner shows Red and the other shows Blue, because red and blue make purple. One such outcome is written as RB, meaning Spinner I shows R and Spinner II shows B. Writing outcomes as

(Spinner I, Spinner II), each outcome is a pair of letters.
Based on the above information, answer the following questions:

(i) List all possible outcomes of the game. [1]

(ii) Find the probability of "making purple", that is, of winning the game. [1]

(iii) (a) For each win, a participant gets Rs 10, but a participant who loses has to pay Rs 5 to the school. If 99 participants play, find the net amount the school collects. [2]

OR

(iii) (b) If the same amount of Rs 5 is paid by a losing participant to the school and paid by the school to a winning participant, find the net amount the school collects from the 99 participants. [2]

Q14. Case Study: Computers in schools **[4]**

[Board 2023 30/2/1 Q38 (adapted: parts reordered to fit the CS pattern; "no more than 20" used as the internal-choice part)]

Computer-based learning (CBL) refers to any teaching methodology that makes use of computers for transmitting information. At the elementary level, computer applications can be used to display multimedia lesson plans. A survey was done on 1000 elementary and secondary schools of Assam, and the schools were classified by the number of computers they have:

Number of computers	1–10	11–20	21–50	51–100	101 and more
Number of schools	250	200	290	180	80

One school is chosen at random. Based on the above information, answer the following questions:

(i) Find the probability that the chosen school has more than 100 computers. [1]

(ii) Find the probability that the chosen school has 10 or fewer computers. [1]

(iii) (a) Find the probability that the chosen school has 50 or fewer computers. [2]

OR

(iii) (b) Find the probability that the chosen school has no more than 20 computers. [2]

Answer Key (MCQs and Assertion–Reason)

Ch. 01: Q1-(b), Q2-(a), Q3-(c), Q4-(d), Q5-(c), Q6-(b)

Ch. 02: Q1-(d), Q2-(d), Q3-(d), Q4-(b)

Ch. 03: Q1-(b), Q2-(d), Q3-(d), Q4-(c), Q5-(d)

Ch. 04: Q1-(a), Q2-(a), Q3-(a), Q4-(a), Q5-(a)

Ch. 05: Q1-(a), Q2-(c), Q3-(b), Q4-(b)

Ch. 06: Q1-(a), Q2-(c)

Ch. 07: Q1-(d), Q2-(b), Q3-(b), Q4-(b), Q5-(d), Q6-(d)

Ch. 08: Q1-(d), Q2-(c), Q3-(b), Q4-(b)

Ch. 09: Q1-(d), Q2-(c), Q3-(c), Q4-(c), Q5-(d), Q6-(a), Q7-(d)

Ch. 10: Q1-(b), Q2-(d), Q3-(d)

Ch. 11: Q1-(b), Q2-(b), Q3-(d), Q4-(d)

Ch. 12: Q1-(b), Q2-(c), Q3-(b), Q4-(c)

Ch. 13: Q1-(a), Q2-(b)

Ch. 14: Q1-(b), Q2-(c), Q3-(a), Q4-(a), Q5-(b), Q6-(b), Q7-(d), Q8-(a), Q9-(d)