CENTRAL BOARD OF SECONDARY EDUCATION

CBSE 2026-27

Mathematics (Standard)

Subject Code: 041 | Class X

Question Bank – Set 3

Questions in this Booklet

Ch.	Chapter	MCQs	A-R	VSA	SA	LA	CS	All
01	Real Numbers	4	2	1	1	1	1	**10**
02	Polynomials	3	1	1	1	1	2	**9**
03	Pair of Linear Equations in Two Variables	3	1	2	3	2	1	**12**
04	Quadratic Equations	3	1	2	2	3	1	**12**
05	Arithmetic Progressions	3	1	1	2	1	2	**10**
06	Coordinate Geometry	1	1	1	2	1	2	**8**
07	Triangles	4	1	3	1	2	1	**12**
08	Circles	3	2	2	3	2	1	**13**
09	Introduction to Trigonometry	7	2	4	3	1	1	**18**
10	Some Applications of Trigonometry	1	1	1	1	2	2	**8**
11	Areas Related to Circles	3	1	1	2	1	1	**9**
12	Surface Areas and Volumes	3	1	1	1	2	1	**9**
13	Statistics	3	1	1	2	3	1	**11**
14	Probability	6	1	2	1	1	1	**12**
	Total	**47**	**17**	**23**	**25**	**23**	**18**	**153**

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

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01. Real Numbers

Multiple Choice Questions (MCQs)

Q1. The HCF of 960 and 432 is: **[1]**

[Board 2026 30-1-1 Q1]

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

Q2. For any natural number n, 6^n ends with the digit: **[1]**

[Board 2026 30-1-1 Q3; Board 2026 30-2-1 Q3 (near-twin, 5 to the power n)]

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

Q3. A pair of irrational numbers whose product is a rational number is: **[1]**

[Board 2024 30-3-1 Q14]

(a) $(\sqrt{16}, \sqrt{4})$ (b) $(\sqrt{5}, \sqrt{2})$ (c) $(\sqrt{3}, \sqrt{27})$ (d) $(\sqrt{36}, \sqrt{2})$

Q4. If p and q are natural numbers and p is a multiple of q, then the HCF of p and q is: **[1]**

[Board 2023 30-2-1 Q4]

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

Assertion–Reason

Q5. **Assertion (A):** The number 5^n cannot end with the digit 0, where n is a natural number.
Reason (R): A number ends with 0 if its prime factorisation contains both 2 and 5. **[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 2025-26 Q19 (= MS 2025-26 Q19); Board 2023 30-5-1 Q20 (same assertion, different reason, key b)]

Q6. **Assertion (A):** HCF of any two consecutive even natural numbers is always 2.
Reason (R): Even natural numbers are divisible by 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.

[SQP 2024-25 Q19; SQP 2024-25 VIC Q19 (= MS 2024-25 Q19 and MS 2024-25 VIC Q19)]

Very Short Answer (VSA)

Q7. Two numbers are in the ratio $4 : 5$ and their HCF is 11. Find their LCM. **[2]**

[Board 2025 30-3-1 Q23(b); Board 2023 30-4-1 Q21 (ratio 2:3, LCM 180)]

Short Answer (SA)

Q8. The dimensions of a window are 156 cm $\times$ 216 cm. Arjun wants to fix a grill on the window, creating complete squares of the maximum possible size. Find the side length of each square and hence the number of squares formed. **[3]**

[Board 2026 30-5-1 Q31; SQP 2026-27 Q21(A) (VSA version)]

Long Answer (LA)

Q9. A craft teacher has three ribbons of lengths 252 cm, 396 cm and 540 cm. She wants to cut all three ribbons into pieces of one common length, as long as possible, so that no ribbon is left over.

(a) Find the length of each piece. [2 marks]

(b) How many pieces are obtained from each ribbon, and what is the total number of pieces? [2 marks]

(c) Find the LCM of 252 and 396, and verify that HCF $\times$ LCM = product of the two numbers. [1 mark] **[5]**

[New]

Case Study

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

[Board 2024 30-3-1 Q38 (adapted to the 1+1+2+2 format: (ii)(a) and (ii)(b) moved to (ii) and (iii))]

Ms. Mukta plays a prime number game with her class. She announces the number 2. The first student multiplies it by a prime number and passes the product to the second student. The second student multiplies it by a prime number and passes it on, and so on. The last student gets the product 173250.

(i) What is the least prime number used by the students? [1]

(ii) How many students are in the class? [1]

(iii) Express 173250 as a product of prime factors, and find the prime number that was used the maximum number of times. [2]

OR

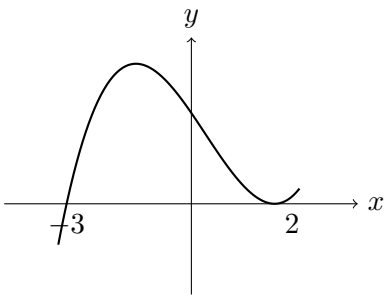
(iii) Find the sum of all the distinct prime numbers used by the students. [2]

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02. Polynomials

Multiple Choice Questions (MCQs)

Q1. The graph of $y = p(x)$ for a polynomial $p(x)$ is shown. The number of distinct zeroes of $p(x)$ is:



[1]

[Board 2026 30-2-1 Q4 (adapted: figure redrawn); Board 2026 30-1-1 Q4; Board 2025 30-1-1 Q10; Board 2023 30-1-1 Q1]

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

Q2. If α and β are the zeroes of the polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta = \alpha\beta$, then the value of p is: **[1]**

[SQP 2022-23 Q3 (= MS 2022-23 Q3); Board 2026 30-2-1 Q5 (identical); Board 2024 30-5-1 Q15 (near-twin, $kx^2 - 30x + 45k$)]

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

Q3. A quadratic polynomial having zeroes $-\sqrt{\frac{5}{2}}$ and $\sqrt{\frac{5}{2}}$ is: **[1]**

[SQP 2024-25 Q8; SQP 2024-25 VIC Q8; Board 2023 30-1-1 Q14 (near-twin, zeroes $\pm\frac{2}{3}$)]

(a) $x^2 - 5\sqrt{2}\,x + 1$ (b) $8x^2 - 20$ (c) $15x^2 - 6$ (d) $x^2 - 2\sqrt{5}\,x - 1$

Assertion–Reason

Q4. **Assertion (A):** If the zeroes of the polynomial $(2k-1)x^2+4x-3$ are reciprocal of each other, then $k=-1$.
Reason (R): If $a=c$, then the zeroes of the polynomial ax^2+bx+c, $a\neq 0$, are reciprocal of each other.**[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 2026-27 Q20 (= MS 2026-27 Q20)]

Very Short Answer (VSA)

Q5. If one zero of the polynomial $6x^2+37x-(k-2)$ is the reciprocal of the other, then find the value of k.**[2]**

[Board 2023 30-4-1 Q22; Board 2023 30-2-1 Q9 (MCQ twin, same question with options)]

Short Answer (SA)

Q6. If α and β are the zeroes of the quadratic polynomial $2x^2-8x+5$, then find the value of $\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)$.**[3]**

[SQP 2026-27 Q27 (= MS 2026-27 Q27)]

Long Answer (LA)

Q7. A company's profit (in Rs lakh) from selling x thousand units of a product is modelled by $P(x)=-x^2+12x-32$.

(a) Find the zeroes of $P(x)$. [2 marks]

(b) For which values of x does the company make a profit, that is, $P(x)>0$? [1 mark]

(c) Form a quadratic polynomial whose zeroes are twice the zeroes of $P(x)$. [2 marks] **[5]**

[New]

Case Study

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

[SQP 2021-22 Q41-Q45 (= MS 2021-22 Q41-Q45, Case Study 1; five 1-mark sub-parts restructured into the 1+1+2+2 format; adapted)]

Annie stood on a diving board 48 feet above the water level and then dived into the pool. Her height $h(t)$ (in feet) above the water level at time t seconds is given by $h(t)=-16t^2+8t+k$. Rita's and Anu's heights above the water are also modelled by polynomials, as described in the questions.
Based on the above information, answer the following questions:

(i) Find the value of k. [1]

(ii) At what time (in seconds) does Annie touch the water? Take $t>0$. [1]

(iii) Rita's height above the water is given by a polynomial $p(t)$ with zeroes -1 and 2, and $p(0)=48$. Find $p(t)$. [2]

OR

(iii) Anu's height above the water is given by a polynomial $q(t)$ whose zeroes have sum 1 and product -6, and $q(0)=48$. Find $q(t)$. [2]

Q9. Read the following passage carefully and answer the questions that follow. **[4]**

[SQP 2020-21 Q19 (= MS 2020-21 Q19; five 1-mark sub-parts restructured into the 1+1+2+2 format; adapted)]

A highway underpass is parabolic in shape. The cross-section is represented by a quadratic polynomial $p(x) = ax^2 + bx + c$, $a \neq 0$, whose graph is a parabola. The parabola is symmetric about a vertical line, the axis of symmetry, which passes through its vertex (the maximum or minimum point). The zeroes of the polynomial are the points where the parabola meets the x-axis.
Based on the above information, answer the following questions:

(i) Find the zeroes of the polynomial $x^2 - 2x - 8$ that represents the underpass. [1]

(ii) Find the number of zeroes of the polynomial $f(x) = (x-2)^2 + 4$. Give a reason. [1]

(iii) Find a quadratic polynomial whose one zero is 6 and the sum of whose zeroes is 0. [2]

OR

(iii) Find the zeroes of the polynomial $x^2 - 36$ and verify the relation between the zeroes and the coefficients. [2]

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03. Pair of Linear Equations in Two Variables

Multiple Choice Questions (MCQs)

Q1. The value of k for which the system of equations $3x - ky = 7$ and $6x + 10y = 3$ is inconsistent, is: **[1]**

[SQP 2024-25 Q2; SQP 2024-25 VIC Q2 (identical)]

(a) -10 (b) -5 (c) 5 (d) 7

Q2. Tarun solved a pair of linear equations in two variables and found that their only point of intersection is $(5, -1)$. One of the lines is $x - y = 6$. Which of the following could be the other line? (I) $3x - 3y = 18$; (II) $2x - 3y = 13$; (III) $2x - 3y = 16$. **[1]**

[SQP 2026-27 Q3 (MS 2026-27 Q3)]

(a) I only (b) II only (c) I and II (d) II and III

Q3. The pair of linear equations $2x = 5y + 6$ and $15y = 6x - 18$ represents two lines which are: **[1]**

[Board 2023 30/4/1 Q7]

(a) intersecting
(b) parallel
(c) coincident
(d) either intersecting or parallel

Assertion–Reason

Q4. **Assertion (A):** The pair of linear equations $px + 3y + 59 = 0$ and $2x + 6y + 118 = 0$ will have infinitely many solutions if $p = 1$.
Reason (R): If the pair of linear equations $px + 3y + 19 = 0$ and $2x + 6y + 157 = 0$ has a unique solution, then $p \neq 1$. **[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 30/2/1 Q20]

Very Short Answer (VSA)

Q5. Find the value(s) of k for which the pair of linear equations $kx + y = k^2$ and $x + ky = 1$ has infinitely many solutions. **[2]**

[SQP 2017-18 Q9 (MS 2017-18 Q9)]

Q6. For what value of p will the pair $(p-3)x + 3y = p$ and $px + py = 12$ have infinitely many solutions? **[2]**

[SQP 2018-19 Q12 (MS 2018-19 Q12)]

Short Answer (SA)

Q7. The monthly incomes of two persons are in the ratio $9 : 7$ and their monthly expenditures are in the ratio $4 : 3$. If each saves Rs 5000 per month, express the situation algebraically as a pair of linear equations and hence find their monthly incomes. **[3]**

[Board 2025 30/4/1 Q27; SQP 2025-26 Q31(A) (ratios $3 : 4$, $5 : 7$, Rs 15000); SQP 2024-25 VIC Q32(A) (5-mark, ratios $8 : 7$, $19 : 16$, Rs 2500; trimmed to 3 marks)]

Q8. Solve the following pair of linear equations graphically: $x - y + 1 = 0$ and $x + y = 5$. **[3]**

[Board 2024 30/3/1 Q28]

Q9. Rehana went to a bank to withdraw Rs 2000. She asked for Rs 50 and Rs 100 notes only and received 25 notes in all. Find how many notes of each denomination she received. **[3]**

[Board 2024 30/4/1 Q28]

Long Answer (LA)

Q10. Aarush bought 2 pencils and 3 chocolates for Rs 11, and Tanish bought 1 pencil and 2 chocolates for Rs 7 from the same shop. Represent this situation as a pair of linear equations and find the price of 1 pencil and of 1 chocolate graphically. **[5]**

[Board 2026 30/2/1 Q32]

Q11. Solve the following pair of linear equations graphically: $x + 2y = 3$ and $2x - 3y + 8 = 0$. **[5]**

[SQP 2024-25 Q32(A)]

Case Study

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

[Board 2023 30/6/1 Q36, adapted (sub-parts rebalanced to 1 + 1 + 2 with 2-mark OR)]

A coaching institute of Mathematics conducts classes in two batches, I and II. The monthly fees of poor and rich children are different. In batch I there are 20 poor and 5 rich children, and in batch II there are 5 poor and 25 rich children. The total monthly fee collected from batch I is Rs 9000 and from batch II is Rs 26000. Each poor child pays Rs x per month and each rich child pays Rs y per month.
Based on the above information, answer the following questions:

(i) Represent the given information in terms of x and y as a pair of linear equations. [1]

(ii) Find the monthly fee paid by a poor child. [1]

(iii) If batch II has 10 poor and 20 rich children, find its total monthly collection of fees. [2]

OR

(iii) Find the difference between the monthly fees paid by a rich child and by a poor child. [2]

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04. Quadratic Equations

Multiple Choice Questions (MCQs)

Q1. The nature of the roots of the quadratic equation $9x^2 - 6x - 2 = 0$ is: **[1]**

[SQP 2023-24 Q4]

(a) No real roots
(b) 2 equal real roots
(c) 2 distinct real roots
(d) More than 2 real roots

Q2. If the discriminant of the quadratic equation $3x^2 - 2x + c = 0$ is 16, then the value of c is: **[1]**

[Board 2024 30/4/1 Q4]

(a) 1 (b) 0 (c) -1 (d) $\sqrt{2}$

Q3. A quadratic equation whose roots are $(2 + \sqrt{3})$ and $(2 - \sqrt{3})$ is: **[1]**

[Board 2023 30/5/1 Q5]

(a) $x^2 - 4x + 1 = 0$ (b) $x^2 + 4x + 1 = 0$ (c) $4x^2 - 3 = 0$ (d) $x^2 - 1 = 0$

Assertion–Reason

Q4. **Assertion (A):** The quadratic equation $x^2 + 4x + 5 = 0$ has real roots.
Reason (R): The quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$, has real roots if $b^2 - 4ac \geq 0$. **[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 2025 (30/S/1) Q20]

Very Short Answer (VSA)

Q5. If Ritu were 5 years younger than what she really is, then the square of her age would have been 11 more than five times her present age. Find her present age. **[2]**

[SQP 2021-22 Term 2 Q6; Board 2024C (30/S/1) Q34(a) (near-twin, 5-mark version)]

Q6. Find the value(s) of k for which the equation $kx^2 - kx + 1 = 0$ has equal roots. **[2]**

[SQP 2016-17 Q7]

Short Answer (SA)

Q7. If α and β are the roots of $x^2 - 7x + 10 = 0$, find the quadratic equation whose roots are α^2 and β^2. **[3]**

[Board 2023 30/6/1 Q29(B) (OR)]

Q8. If one root of the quadratic equation $3x^2 + px + 4 = 0$ is $\frac{2}{3}$, then find the value of p and the other root of the equation. **[3]**

[SQP 2020-21 Q28]

Long Answer (LA)

Q9. Two pipes together can fill a tank in $\frac{15}{8}$ hours. The pipe with larger diameter takes 2 hours less than the pipe with smaller diameter to fill the tank separately. Find the time in which each pipe can fill the tank separately. **[5]**

[Board 2023 30/5/1 Q34(b) (OR)]

Q10. The denominator of a fraction is one more than twice its numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction. **[5]**

[Board 2024 30/3/1 Q32(b) (OR)]

Q11. The denominator of a fraction is 2 more than its numerator. If 2 is added to both its numerator and denominator, then the sum of the new fraction and the original fraction is $\frac{46}{35}$. Find the original fraction. **[5]**

[Board 2025C (30/S/1) Q34]

Case Study

Q12. Case Study: Tiling a rectangular floor **[4]**

[Board 2024 30/1/1 Q36]

A rectangular floor can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, then only 128 tiles are needed to cover the same floor.
Based on the above information, answer the following questions:

(i) Assuming the original length of each side of a tile is x units, make a quadratic equation from the above information. [1]

(ii) Write the corresponding quadratic equation in standard form. [1]

(iii) Find the value of x, the length of a side of a tile, by factorisation. [2]

OR

(iii) Solve the quadratic equation for x using the quadratic formula. [2]

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05. Arithmetic Progressions

Multiple Choice Questions (MCQs)

Q1. If $p-1$, $p+1$ and $2p+3$ are in A.P., then the value of p is **[1]**

[Board 2023 30/1/1 Q3]

(a) -2 (b) 4 (c) 0 (d) 2

Q2. In an A.P., if the first term $a = 7$, the nth term $a_n = 84$ and the sum of the first n terms $S_n = \frac{2093}{2}$, then n is equal to: **[1]**

[Board 2024 30/1/1 Q4]

(a) 22 (b) 24 (c) 23 (d) 26

Q3. If the sum of the first n terms of an A.P. is $3n^2 + n$ and its common difference is 6, then its first term is **[1]**

[Board 2023 30/6/1 Q18]

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

Assertion–Reason

Q4. **Assertion (A):** For the A.P. $3, 6, 9, \ldots, 198$, the 10^{th} term from the end is 168.
Reason (R): If a and l are the first and last terms of an A.P. with common difference d, then the n^{th} term from the end is $l-(n-1)d$. **[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 Q20]

Very Short Answer (VSA)

Q5. The A.P. $8, 10, 12, \ldots$ has 60 terms. Find the sum of its last 10 terms. **[2]**

[SQP 2025-26 Q21]

Short Answer (SA)

Q6. The sum of the first six terms of an A.P. is 42 and the ratio of its 10^{th} term to its 30^{th} term is $1:3$. Find the first term and the common difference. **[3]**

[SQP 2016-17 Q12; Board 2024 30/3/1 Q26(b) (OR)]

Q7. If the sum of the first m terms of an A.P. is equal to the sum of its first n terms ($m \neq n$), show that the sum of its first $(m+n)$ terms is zero. **[3]**

[SQP 2019-20 Q28; Board 2024 30/2/1 Q26(a) (OR)]

Long Answer (LA)

Q8. If the sum of the first 6 terms of an A.P. is 36 and the sum of its first 16 terms is 256, then find the sum of its first 10 terms. **[5]**

[Board 2023 30/6/1 Q34(B) (OR)]

Case Study

Q9. Read the following passage carefully and answer the questions that follow. **[4]**

[SQP 2022-23 Q37 (adapted: 1+2+1 rebalanced to 1+1+2 with 2-mark OR); Board 2024C 30-S-1 Q37 (near-twin, 50 trees, +20 per row)]

The school auditorium is to be constructed to accommodate at least 1500 people. The chairs are placed in concentric circular rows around a central stage, so that the first (innermost) row has 30 chairs and each succeeding row has 10 chairs more than the previous one.
Based on the above information, answer the following questions:

(i) How many chairs are there in the 10^{th} row? [1]

(ii) If there are 17 rows in the auditorium, how many chairs are there in the middle row? [1]

(iii) How many rows are needed to seat 1500 people? [2]

OR

(iii) How many chairs are still left to be arranged after the 10^{th} row, if 1500 chairs are to be arranged in the auditorium? [2]

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

[SQP 2024-25 Q36; SQP 2024-25 VIC Q36 (same case study, two variants)]

Ms. Sheela visited a store near her house and found that glass jars are arranged one above the other in a specific pattern. On the top layer there are 3 jars, in the next layer there are 6 jars, in the third layer from the top there are 9 jars, and so on till the 8th layer.
On the basis of the above situation, answer the following questions.

(i) Write an A.P. whose terms represent the number of jars in the different layers, starting from the top. Also find its common difference. [1]

(ii) Is it possible to arrange 34 jars in a layer if this pattern is continued? Justify your answer. [1]

(iii) If there are n rows of jars in a layer, find the expression for the total number of jars in terms of n. Hence find S_8. [2]

OR

(iii) The shopkeeper added 3 jars in each layer. How many jars are there in the 5th layer from the top? [2]

06. Coordinate Geometry

Multiple Choice Questions (MCQs)

Q1. The fourth vertex D of a parallelogram $ABCD$ whose three vertices are $A(-2,3)$, $B(6,7)$ and $C(8,3)$ is: **[1]**

[Board 2024 30-4-1 Q16; SQP 2022-23 Q5; SQP 2021-22 Q29 (near-twin parallelogram vertex questions)]

(a) $(0,1)$ (b) $(0,-1)$ (c) $(-1,0)$ (d) $(1,0)$

Assertion–Reason

Q2. **Assertion (A):** Mid-point of a line segment divides the line segment in the ratio $1 : 1$.
Reason (R): The ratio in which the point $(-3, k)$ divides the line segment joining the points $(-5, 4)$ and $(-2, 3)$ is $1 : 2$. **[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 2024 30-4-1 Q19]

Very Short Answer (VSA)

Q3. The coordinates of the end points of the line segment AB are $A(-2, -2)$ and $B(2, -4)$. P is the point on AB such that $BP = \frac{4}{7}AB$. Find the coordinates of point P. **[2]**

[Board 2025 30-5-1 Q22]

Short Answer (SA)

Q4. Find the ratio in which the y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$. Also find the point of intersection. **[3]**

[Board 2025 30-1-1 Q28; Board 2026 30-1-1 Q27 (near-twin, x-axis version)]

Q5. Find the coordinates of the points of trisection of the line segment joining the points $A(-1, 4)$ and $B(-3, -2)$.**[3]**

[Board 2026 30-2-1 Q27]

Long Answer (LA)

Q6. The line segment joining $A(1, -2)$ and $B(6, 8)$ is divided into three equal parts by the points P and Q, where P is nearer to A. (a) Find the coordinates of P and Q. (b) Show that $PQ = \frac{1}{3}AB$. (c) Find the point R on the y-axis which is equidistant from A and B. **[5]**

[New]

Case Study

Q7. Case Study: Wheat square in a triangular field **[4]**

[Board 2023 30-4-1 Q37 (adapted: parts restructured to 1+1+2; area part replaced by side length and diagonal)]

Jagdish has a field in the shape of a right-angled triangle AQC. He leaves a square space $PQRS$ inside the field for growing wheat and uses the rest for vegetables. Taking the corner O of the field plan as the origin, $P(-200, 0)$ and $Q(200, 0)$ are two vertices of the square on the x-axis, R and S lie directly above Q and P, and the line CA passes through S, where $A = (200, 800)$.
Based on the above information, answer the following questions:

(i) Find the coordinates of the vertices R and S of the square. [1]

(ii) Find the length of the side of the square $PQRS$. [1]

(iii) If S divides the line segment CA in the ratio $K : 1$, find the value of K. [2]

OR

(iii) Find the length of the diagonal PR of the square. [2]

Q8. Case Study: Garden with Ashoka saplings and rose plants **[4]**

[Board 2024 30-5-1 Q37 (adapted: parts restructured to 1+1+2; the OR moved to part iii)]

A garden is in the shape of a square $ABCD$ with each side 10 m. The gardener grew saplings of Ashoka trees on the boundary of the garden at a distance of 1 m from each other, and chose a triangular region PQR inside the garden to grow rose plants. On the students' chart of the garden, taking A as the origin, the vertices of $\triangle PQR$ read from the 1 m grid are $P(4, 6)$, $Q(3, 2)$ and $R(6, 5)$.
Based on the above information, answer the following questions:

(i) Taking A as the origin, write the coordinates of the vertices of $\triangle PQR$. [1]

(ii) Find the distance PQ. [1]

(iii) Find the distances QR and PR. Hence state whether $\triangle PQR$ is an isosceles triangle. [2]

OR

(iii) Find the coordinates of the point which divides the line segment joining P and R in the ratio $2 : 1$ internally. [2]

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07. Triangles

Multiple Choice Questions (MCQs)

Q1. A model of a boat is built to the scale $1 : 4$. The full-size boat has a width of 60 cm. The width of the scale model is **[1]**

[SQP 2020-21 Q18(a) (case-study sub-part adapted to a stand-alone MCQ)]

(a) 20 cm (b) 25 cm (c) 15 cm (d) 240 cm

Q2. A stick 5 m long casts a shadow 2 m long. At the same time, the shadow of a tree 12.5 m high is **[1]**

[SQP 2020-21 Q18(d) (case-study sub-part adapted to a stand-alone MCQ)]

(a) 3 m (b) 3.5 m (c) 4.5 m (d) 5 m

Q3. A square pyramid $TABCD$ has every edge (the four slant edges TA, TB, TC, TD and the four base edges) equal to 12 m. Points E and F are the midpoints of TA and TB respectively. The length EF is **[1]**

[SQP 2020-21 Q18(e) (case-study sub-part adapted to a stand-alone MCQ)]

(a) 24 m (b) 3 m (c) 6 m (d) 10 m

Q4. $ABCD$ is a trapezium with $AD \parallel BC$ and $AD = 4$ cm. The diagonals AC and BD intersect at O such that $\frac{AO}{OC} = \frac{DO}{OB} = \frac{1}{2}$. Then $BC =$ **[1]**

[SQP 2022-23 Q10]

(a) 6 cm (b) 7 cm (c) 8 cm (d) 9 cm

Assertion–Reason

Q5. **Assertion (A):** $ABCD$ is a trapezium with $DC \parallel AB$. E and F are points on AD and BC such that $EF \parallel AB$. Then $\frac{AE}{ED} = \frac{BF}{FC}$.
Reason (R): Any line parallel to the parallel sides of a trapezium divides the non-parallel sides proportionally. **[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) Q19]

Very Short Answer (VSA)

Q6. In $\triangle ABC$, D is a point on side BC such that $\angle ADC = \angle BAC$. Show that $CA^2 = CD \times CB$. **[2]**

[Board 2025 (30/2/1) Q24(a); Board 2025 (30/6/1) Q24 (same data form: $\angle APC = \angle BAC$); Board 2023 (30/4/1) Q33(A) (5-mark form); Board 2025 (30/3/1) Q18 (MCQ form, see 07-017)]

Q7. $ABCD$ is a parallelogram. Side AD is produced to a point E, and BE intersects CD at F. Prove that $\triangle ABE \sim \triangle CFB$. **[2]**

[Board 2025 (30/4/1) Q22(B) (OR); Board 2024 (30/4/1) Q33(a) (5-mark form, same figure)]

Q8. ABC is an isosceles triangle with $AB = AC$. E is a point on side CB produced, $AD \perp BC$ with D on BC, and $EF \perp AC$ with F on AC. Prove that $\triangle ABD \sim \triangle ECF$. **[2]**

[Board 2023C (30-C-1) Q22; see also SA 07-067 (3-mark form, Board 2023 (30/6/1) Q28)]

Short Answer (SA)

Q9. E is a point on side CB produced of an isosceles triangle ABC with $AB = AC$. If $AD \perp BC$ and $EF \perp AC$, prove that $\triangle ABD \sim \triangle ECF$. **[3]**

[Board 2023 (30/6/1) Q28; same question as 07-045 (2-mark form, Board 2023C Q22)]

Long Answer (LA)

Q10. State and prove the Basic Proportionality Theorem: if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio. **[5]**

[Board 2023 (30/1/1) Q32; Board 2024 (30/1/1) Q34(a) (OR); Board 2024 (30/2/1) Q33(a) (OR); Board 2024 (30/3/1) Q33; Board 2025 (30/5/1) Q33 (with converse stated); Board 2026 (30/1/1) Q34(A); Board 2026 (30/2/1) Q34(a); SQP 2023-24 Q33(a); SQP 2019-20 Q36 (4-mark, re-marked to 5)]

Q11. The sides AB, BC and the median AD of $\triangle ABC$ are proportional to the sides PQ, QR and the median PM of $\triangle PQR$ respectively, where D and M are midpoints of BC and QR. Show that $\triangle ABC \sim \triangle PQR$. **[5]**

[Board 2025 (30/3/1) Q34(b) (OR); Board 2023 (30/2/1) Q35(a) (OR); Board 2023 (30/4/1) Q33(B) (OR); Board 2024 (30/2/1) Q33(b) (OR); Board 2024 (30/4/1) Q33(b) (OR); Board 2024 (30/5/1) Q34(b) (OR)]

Case Study

Q12. Case Study: Measuring a flagpole with a mirror **[4]**

[New]

A class project measures the height of the school flagpole using a small plane mirror. The mirror lies flat on the ground at the point M, 8 m from the foot Q of the flagpole. Riya stands at the point D on the ground on the side of M away from the pole, with $DM = 2$ m. Her eyes are at E, 1.6 m above the ground. She looks down into the mirror and sees the top P of the pole. The light reflects at M, so the angle that EM makes with the ground equals the angle that PM makes with the ground.
Based on the above information, answer the following questions:

(i) Name the two similar triangles in the figure and the criterion used to show that they are similar. [1]

(ii) Write the proportion relating the corresponding sides of these two triangles. [1]

(iii) Find the height PQ of the flagpole. [2]

OR

(iii) The mirror is moved so that it is 6 m from the foot of the pole, and Riya's eyes are still 1.6 m above the ground. Find Riya's distance DM from the mirror, for which she again sees the top of the pole in the mirror. [2]

08. Circles

Multiple Choice Questions (MCQs)

Q1. PA and PB are tangents to a circle with centre O from an external point P, with $\angle APB = 90°$. If $AB = 3\sqrt{2}$ cm, then the diameter of the circle is: **[1]**

[Board 2025 30/6/1 Q9; near-twin Board 2024 30/2/1 Q14 (PA = 5 cm gives AB = 5 root 2 cm)]

(a) $3\sqrt{2}$ cm (b) $6\sqrt{2}$ cm (c) 3 cm (d) 6 cm

Q2. The maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is: **[1]**

[Board 2024 30/3/1 Q9; SQP 2024-25 VIC Q7 (= MS 2024-25 VIC Q7)]

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

Q3. Which of the following statements is not true? **[1]**

[SQP 2024-25 Q3 (= MS 2024-25 Q3); SQP 2024-25 VIC Q3; near-twin Board 2025 30/5/1 Q10 (which statement is false)]

(a) A number of secants can be drawn at any point on the circle.
(b) Only one tangent can be drawn at any point on a circle.
(c) A chord is a line segment joining two points on the circle.
(d) From a point inside a circle only two tangents can be drawn.

Assertion–Reason

Q4. **Assertion (A):** The tangents drawn at the end points of a diameter of a circle are parallel.
Reason (R): The lengths of tangents drawn to a circle from a point outside the circle 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.

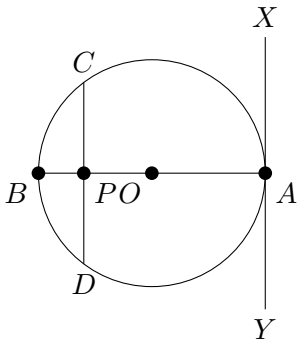
[Board 2025 30/4/1 Q20; near-twins Board 2024 30/1/1 Q19 (reason: diameter is the longest chord), Board 2025 30/1/1 Q7 (MCQ form)]

Q5. **Assertion (A):** A tangent to a circle is perpendicular to the radius through the point of contact.
Reason (R): The lengths of tangents drawn from an external point to a circle 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.

[Board 2023 30/2/1 Q19]

Very Short Answer (VSA)

Q6. AB is a diameter of a circle with centre O and radius 10 cm, and XAY is the tangent at A. A chord CD of the circle is parallel to XAY and lies at a distance of 16 cm from A. Find the length of CD.



[2]

[Board 2025 30/2/1 Q25]

Q7. A person stands at a point P outside a circular ground, at a distance of 26 m from the centre O. His distances from the points A and B on the ground are both 10 m, where PA and PB are tangents to the circle. Find the radius of the circular ground. **[2]**

[Board 2025 30/1/1 Q25]

Short Answer (SA)

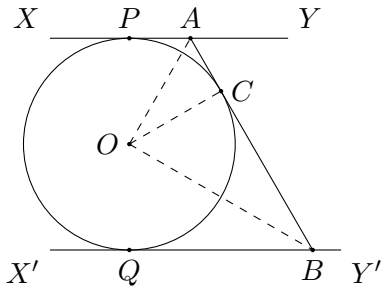
Q8. Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$. **[3]**

[Board 2026 30/2/1 Q29(b); Board 2023 30/1/1 Q29(a) (OR); Board 2023 30/6/1 Q32(A) (5-mark, adapted); SQP 2021-22 Term2 Q12 (OR, 4-mark, adapted); SQP 2023-24 Q29 (OR; = MS 2023-24 Q29 OR); near-twin Board 2026 30/3/1 Q31(a) (angle APB = 2 angle OAB)]

Q9. Prove that the lengths of tangents drawn from an external point to a circle are equal. **[3]**

[Board 2026 30/2/1 Q29(a); near-twin SQP 2024-25 Q33 (proof part of the LA question)]

Q10. In the figure, XY and $X'Y'$ are two parallel tangents to a circle with centre O, touching it at P and Q. A third tangent AB touches the circle at C, meeting XY at A and $X'Y'$ at B. Prove that $\angle AOB = 90°$.

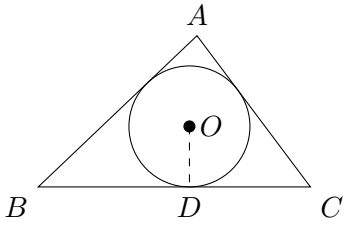


[3]

[SQP 2016-17 Q24 (adapted: 4 marks trimmed to 3); SQP 2017-18 Q18 (= MS 2017-18 Q18); MS 2022-23 Q30 OR (= SQP 2022-23 Q30 OR); Board 2025 30/5/1 Q31; SQP 2025-26 Q26 (= MS 2025-26 Q26)]

Long Answer (LA)

Q11. A triangle ABC is drawn to circumscribe a circle of radius 4 cm, so that the segments BD and DC into which BC is divided by the point of contact D are of lengths 10 cm and 8 cm respectively. If the area of $\triangle ABC$ is 90 cm^2, find the lengths of the sides AB and AC.



[5]

[Board 2023 30/5/1 Q33(a) (OR); SQP 2025-26 Q25 and MS 2025-26 Q25 (2-mark form, same numbers)]

Q12. PQ and PR are two tangents to a circle with centre O and radius 5 cm, touching it at Q and R. AB is another tangent to the circle at C, where C lies on OP; A lies on PQ and B lies on PR. If $OP = 13$ cm, find the lengths AB and PA. **[5]**

[Board 2026 30/5/1 Q35]

Case Study

Q13. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2023C 30/C/1 Q36]

In a park, four poles stand at positions A, B, C and D around a circular fountain with centre O. The cloth joining the poles AB, BC, CD and DA touches the circular fountain at P, Q, R and S respectively. The quadrilateral $ABCD$ therefore circumscribes the fountain.
Based on the above information, answer the following questions:

(i) If O is the centre of the circular fountain, then find $\angle OSA$. [1]

(ii) If $AB = AD$, write the name of the figure $ABCD$. [1]

(iii) If $DR = 7$ cm and $AD = 11$ cm, find the length of AP. [2]

OR

(iii) If $\angle QCR = 60^\circ$, find the measure of $\angle QOR$. [2]

09. Introduction to Trigonometry

Multiple Choice Questions (MCQs)

Q1. If $\tan\theta = \frac{5}{2}$, then $\frac{4\sin\theta + \cos\theta}{4\sin\theta - \cos\theta}$ is equal to **[1]**

[SQP 2024-25 Q6; SQP 2024-25 VIC Q6; near-twin Board 2023 30/1/1 Q6 (2tan A = 3)]

(a) $\frac{11}{9}$ (b) $\frac{3}{2}$ (c) $\frac{9}{11}$ (d) 4

Q2. The value of $\cot^2\theta - \frac{1}{\sin^2\theta}$ is **[1]**

[Board 2023 30/6/1 Q7; Board 2023C 30/C/1 Q6; SQP 2018-19 Q3 (1-mark form)]

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

Q3. If $\sin\theta + \cos\theta = \sqrt{2}$, then $\tan\theta + \cot\theta =$ **[1]**

[SQP 2022-23 Q8; SQP 2017-18 Q19 (3-mark OR form)]

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

Q4. If $4\tan\beta = 3$, then $\frac{4\sin\beta - 3\cos\beta}{4\sin\beta + 3\cos\beta} =$ **[1]**

[SQP 2021-22 Q18; SQP 2022-23 Q18 (variant 5 tan b = 4, key 1/3)]

(a) 0 (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$

Q5. Given that $\sin\theta = \frac{a}{b}$, then $\cos\theta$ is equal to **[1]**

[SQP 2023-24 Q11; Board 2026 30/1/1 Q9 (MS 2023-24 is the scheme of SQP 2023-24)]

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

Q6. If $\theta = 30^\circ$, then the value of $3\tan\theta$ is **[1]**

[SQP 2024-25 Q12; SQP 2024-25 VIC Q12]

(a) 1 (b) $\frac{1}{\sqrt{3}}$ (c) $\frac{3}{\sqrt{3}}$ (d) not defined

Q7. If $\tan(A+B)=\sqrt{3}$ and $\tan(A-B)=\dfrac{1}{\sqrt{3}}$, $0^\circ < A+B < 90^\circ$, $A > B$, then the values of A and B respectively are: **[1]**

[SQP 2026-27 Q8; SQP 2023-24 Q24 (VSA form; its scheme prints B = 45 deg, corrected to B = 15 deg); near-twins Board 2024 30/4/1 Q23(b), Board 2024C 30/S/1 Q25(a)]

(a) $60^\circ,\ 30^\circ$ (b) $60^\circ,\ 45^\circ$ (c) $45^\circ,\ 15^\circ$ (d) $60^\circ,\ 15^\circ$

Assertion–Reason

Q8. **Assertion (A):** For $0^\circ < \theta \le 90^\circ$, $\operatorname{cosec}\theta - \cot\theta$ and $\operatorname{cosec}\theta + \cot\theta$ are reciprocals of each other.
Reason (R): $\operatorname{cosec}^2\theta - \cot^2\theta = 1$. **[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 2023 30/6/1 Q20]

Q9. **Assertion (A):** If $\cos A + \cos^2 A = 1$, then $\sin^2 A + \sin^4 A = 1$.
Reason (R): $\sin^2 A + \cos^2 A = 1$. **[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.

[SQP 2025-26 Q20; MS 2025-26 Q20; near-twin Board 2023 30/2/1 Q22(b) (VSA form, same identity)]

Very Short Answer (VSA)

Q10. If $a\cos\theta + b\sin\theta = m$ and $a\sin\theta - b\cos\theta = n$, then prove that $a^2 + b^2 = m^2 + n^2$. **[2]**

[Board 2023 30/5/1 Q25(a)]

Q11. Evaluate $2\sin^2 30^\circ \sec 60^\circ + \tan^2 60^\circ$. **[2]**

[Board 2024 30/2/1 Q23(a)]

Q12. If $x\cos 60^\circ + y\cos 0^\circ + \sin 30^\circ - \cot 45^\circ = 5$, then find the value of $x + 2y$. **[2]**

[Board 2025 30/1/1 Q21(a)]

Q13. Evaluate $\dfrac{\tan^2 60^\circ}{\sin^2 60^\circ + \cos^2 30^\circ}$. **[2]**

[Board 2025 30/1/1 Q21(b)]

Short Answer (SA)

Q14. Prove that $\dfrac{\sec^3\theta}{\sec^2\theta - 1} + \dfrac{\operatorname{cosec}^3\theta}{\operatorname{cosec}^2\theta - 1} = \sec\theta\operatorname{cosec}\theta\,(\sec\theta + \operatorname{cosec}\theta)$. **[3]**

[Board 2026 30/2/1 Q28(a) (OR)]

Q15. If $\dfrac{\sec\alpha}{\operatorname{cosec}\beta} = p$ and $\dfrac{\tan\alpha}{\operatorname{cosec}\beta} = q$, then prove that $(p^2 - q^2)\sec^2\alpha = p^2$. **[3]**

[Board 2026 30/2/1 Q28(b) (OR)]

Q16. Ms. Isha wrote on the board $\dfrac{\cos\theta}{1-\sin\theta} + \dfrac{1-\sin\theta}{\cos\theta}$, and Jyoti simplified it as follows. Step 1: $\dfrac{\cos^2\theta + (1-\sin\theta)^2}{(1-\sin\theta)\cos\theta}$. Step 2: $\dfrac{\cos^2\theta + \cos^2\theta}{(1-\sin\theta)\cos\theta}$. Step 3: $\dfrac{2\cos^2\theta}{(1-\sin\theta)\cos\theta}$. Step 4: $\dfrac{2\cos\theta}{1-\sin\theta}$. Identify the step in which Jyoti has

made an error, rectify it and find the correct answer. **[3]**

[SQP 2026-27 Q31(A) (OR); MS 2026-27 Q31 (same paper)]

Long Answer (LA)

Q17. If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta = y\cos\theta$, prove that $x^2 + y^2 = 1$. **[5]**

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

Case Study

Q18. Read the following passage carefully and answer the questions that follow. **[4]**

[New]

A carpenter cuts a triangular bracket from a wooden board. The bracket is the right-angled triangle ABC with the right angle at B. The hypotenuse AC is 13 cm and the side BC is 5 cm. The angle at A is θ. Before marking the cut lines, he wants to check the trigonometric ratios of θ using these lengths.
Based on the above information, answer the following questions:

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

(ii) Find the value of $\cos\theta$. [1]

(iii) Find the value of $\tan\theta + \cot\theta$. [2]

OR

(iii) Verify that $\sec^2\theta - \tan^2\theta = 1$ for this angle θ. [2]

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10. Some Applications of Trigonometry

Multiple Choice Questions (MCQs)

Q1. At some time of the day, the length of the shadow of a tower is equal to its height. At that time the Sun's altitude is: **[1]**

[Board 2024 30/4/1 Q14]

(a) 30° (b) 45° (c) 60° (d) 90°

Assertion–Reason

Q2. **Assertion (A):** A ladder leaning against a wall stands at a horizontal distance of 6 m from the wall. If the ladder reaches a height of 8 m on the wall, then the length of the ladder is 10 m.
Reason (R): The ladder makes an angle of 60° with the ground. **[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 Q19]

Very Short Answer (VSA)

Q3. From the top of a watch-tower 15 m high, the angle of depression of a boat on the sea is 30°. Find the distance of the boat from the foot of the tower. **[2]**

[New]

Short Answer (SA)

Q4. If the angles of elevation of the top of a candle from two coins, distant a cm and b cm $(a > b)$ from its base and in the same straight line from it, are $30°$ and $60°$, then find the height of the candle. **[3]**

[MS/SQP 2020-21 Q32 (lead fold-in: the a and b are symbolic, so h squared = ab is derived, not contradictory; official MS question; classic NCERT Exemplar pattern)]

Long Answer (LA)

Q5. Two ships are sailing in the sea on either side of a lighthouse. The angles of depression to the two ships, as observed from the top of the lighthouse, are $60°$ and $45°$ respectively. If the distance between the ships is $100\left(\frac{1+\sqrt{3}}{\sqrt{3}}\right)$ m, find the height of the lighthouse. **[5]**

[Board 2025 30/2/1 Q32(a) (internal choice with Q32(b), see 10-037); near-twin Board 2024 30/2/1 Q34]

Q6. As observed from the top of a lighthouse 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from $30°$ to $45°$. Find the distance travelled by the ship during this period of observation. (Use $\sqrt{3} = 1.732$.) **[5]**

[Board 2023C 30/C/1 Q33; near-twin SQP 2016-17 Q13 (same 30 and 45 degree set-up)]

Case Study

Q7. Case Study: Radio station tower **[4]**

[Board 2026 30/1/1 Q37; near-twin Board 2023 30/6/1 Q37 (same tower, 36 cm and 30/45 degrees)]

Radio towers are used for transmitting a range of communication services, including radio and television. A radio station tower was built in two sections, A (top) and B (below A). The tower PA stands vertically with its base P on the ground, and it is supported by wires from a point O on the ground, where $PO = 6$ m.
From O, the angle of elevation of the top of section B is $30°$, and the angle of elevation of the top of section A is $60°$.
Based on the above information, answer the following questions:

(i) Find the length of the wire from O to the top of section B. [1]

(ii) Find the length of the wire from O to the top of section A. [1]

(iii) Find the distance AB between the tops of the two sections. [2]

OR

(iii) Find the area of $\triangle OPB$. [2]

Q8. Case Study: Fire at New Home Complex **[4]**

[Board 2024C 30/S/1 Q36 (the ball and fire-engine wording simplified; ladder data unchanged)]

Due to a short circuit, a fire has broken out in New Home Complex, mainly affecting two buildings X and Y. A fire engine is stationed at a point O between the two buildings, and the foot of a ladder is fixed at O. The ladder, inclined at $60°$ to the horizontal, first leans against the terrace (top) of building Y, whose top P is $12\sqrt{3}$ m above the ground. Then the foot of the same ladder is kept fixed at O, and it is made to lean against the terrace (top) R of the opposite building X at an angle of $45°$ with the ground. The points C, O and A (the feet of the buildings X and Y) lie on one straight line.
Based on the above information, answer the following questions:

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

(ii) Find the distance OA of building Y from O. [1]

(iii) Find the horizontal distance between the two buildings, CA. [2]

OR

(iii) Find the height RC of building X. [2]

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11. Areas Related to Circles

Multiple Choice Questions (MCQs)

Q1. The hour hand of a clock is 7 cm long. The angle swept by it between 7:00 a.m. and 8:10 a.m. is: **[1]**

[Board 2026 30/1/1 Q15; Board 2023 30/2/1 Q13 (7:20 to 7:55 form)]

(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$ (c) 35° (d) 70°

Q2. The length of an arc of a circle with radius 12 cm is 10π cm. The angle subtended by the arc at the centre of the circle is: **[1]**

[Board 2024 30/5/1 Q9; Board 2024 30/4/1 Q6 (area form, 60 pi = sector of radius 12 cm)]

(a) 120° (b) 6° (c) 75° (d) 150°

Q3. The area of the circle that can be inscribed in a square of 6 cm is **[1]**

[SQP 2022-23 Q12; SQP 2025-26 Q7 (VI variant)]

(a) 36π cm^2 (b) 18π cm^2 (c) 12π cm^2 (d) 9π cm^2

Assertion–Reason

Q4. **Assertion (A):** For a circle of radius r, the area of the minor segment cut off by a chord that subtends 60° at the centre is less than the area of the corresponding minor sector.
Reason (R): The minor segment is obtained by removing from the minor sector the triangle formed by the chord and the two radii, and this triangle has positive area. **[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)

Q5. The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes. (Use $\pi = \frac{22}{7}$.) **[2]**

[Board 2024 30/4/1 Q22 (a) (OR)]

Short Answer (SA)

Q6. Find the area of the minor segment of a circle of radius 42 cm, if the length of the corresponding arc is 44 cm. (Use $\pi = \frac{22}{7}$.) **[3]**

[SQP 2016-17 Q16; SQP 2018-19 Q20]

Q7. The minute hand of a wall clock is 18 cm long. Find the area of the face of the clock described by the minute hand in 35 minutes. (Use $\pi = \frac{22}{7}$.) **[3]**

[SQP 2024-25 Q30 (A); SQP 2024-25 VIC Q30 (A) (same question)]

Long Answer (LA)

Q8. A horse is tied to a peg at one corner of a square-shaped grass field of side 15 m by means of a 5 m long rope. Find the area of that part of the field in which the horse can graze. Also, find the increase in the grazing area if the length of the rope is increased to 10 m. (Use $\pi = 3.14$.) **[5]**

[Board 2023 30/5/1 Q35]

Case Study

Q9. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2024 30/3/1 Q36, adapted: part (iii) changed to the total grazed area (the printed "7 cm" is read as a typo and the ungrazed-area part is removed as it mixes square and circle areas)]

A stable owner has four horses. He usually ties each horse with a 7 m long rope to a peg at each corner of a square-shaped grass field of side 20 m, so that the horses can graze. Tying the ropes sometimes injures the horses, so he is considering a fence. Each rope is shorter than a side of the field, so the four grazing regions lie inside the field and do not overlap.
Based on the above information, answer the following questions:

(i) Find the area of the square-shaped grass field. [1]

(ii) Find the area of the grass field in which one horse can graze. (Use $\pi = \frac{22}{7}$.) [1]

(iii) Find the total area grazed by all four horses together. (Use $\pi = \frac{22}{7}$.) [2]

OR

(iii) If the length of each rope is increased from 7 m to 10 m, find the area grazed by one horse. (Use $\pi = 3.14$.) [2]

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12. Surface Areas and Volumes

Multiple Choice Questions (MCQs)

Q1. The total surface area of a solid hemisphere of diameter $2d$ is: **[1]**

[Board 2026 30/1/1 Q16; near-twin Board 2023 30/2/1 Q10]

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

Q2. A cone of the largest possible size is carved out from a solid cube of edge l. Its base is a circle inscribed in the top face of the cube and its vertex touches the centre of the bottom face. The volume of the cone is: **[1]**

[Board 2026 30/3/1 Q7; near-twin Board 2024 30/1/1 Q15 (cube of edge 2)]

(a) $\frac{\pi l^3}{12}$ (b) $\frac{\pi l^3}{3}$ (c) $l^3\left(1 - \frac{\pi}{4}\right)$ (d) $\frac{\pi l^3}{8}$

Q3. Two cubes, each of volume 64 cm^3, are joined end to end to form a solid cuboid. The surface area of the resulting cuboid is: **[1]**

[SQP 2026-27 Q11; near-twins Board 2026 30/2/1 Q19 and Board 2024 30/2/1 Q20 (assertion-reason forms)]

(a) 192 cm^2 (b) 160 cm^2 (c) 96 cm^2 (d) 80 cm^2

Assertion–Reason

Q4. **Assertion (A):** The total surface area of the top is the sum of the curved surface area of the hemisphere and the curved surface area of the cone.
Reason (R): The top is obtained by joining the plane surfaces of the hemisphere and the cone together. **[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 2023-24 Q19; MS 2023-24 Q19 (same paper)]

Very Short Answer (VSA)

Q5. A spherical paperweight is made to fit exactly inside a cubical box whose inner edge is 6 cm, touching all six faces. Find the surface area of the paperweight. (Take $\pi = \frac{22}{7}$.) **[2]**

[New]

Short Answer (SA)

Q6. Fifty circular discs, each of radius 7 cm and thickness 0.5 cm, are placed one above the other to form a solid cylinder. (i) Find the total surface area of the solid. (ii) Find the volume of space left in a cubical box of inner side 25 cm when the solid is placed inside it. (Take $\pi = \frac{22}{7}$.) **[3]**

[SQP 2016-17 Q31 (4-mark LA trimmed to 3-mark SA) (adapted)]

Long Answer (LA)

Q7. A vessel is in the form of an inverted cone of height 8 cm, and the radius of its open top is 5 cm. It is filled with water up to the brim. When lead shots, each a sphere of radius 0.5 cm, are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped into the vessel. **[5]**

[Board 2025 30/3/1 Q35]

Q8. The largest possible hemisphere is drilled out from a wooden cubical block of side 21 cm, such that the base of the hemisphere lies on one face of the cube. Find (i) the volume of wood left in the block; (ii) the total surface area of the remaining solid. (Take $\pi = \frac{22}{7}$.) **[5]**

[Board 2024C 30/S/1 Q35(a) (OR)]

Case Study

Q9. Read the following passage carefully and answer the questions that follow. **[4]**

[Board 2026 30/3/1 Q38 (lead fold-in: overruled the 3-solids drop — every part uses at most two solids at a time; official 2026 board question; the fountain = ball + pool, 2 solids)]

A model of Leafy Ball Fountain is to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled. The diameter of the spherical ball is 21 cm. Cylindrical pool - Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid base is 14 cm. Height of water filled is 7 cm.
Based on the above information, answer the following questions:

(i) Determine the total height of the fountain. [1]

(ii) Find the volume of the ball. [1]

(iii) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. [2]

OR

(iii) Find the sum of the outer curved surface area of the cylindrical part and surface area of the ball. [2]

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13. Statistics

Multiple Choice Questions (MCQs)

Q1. The upper limit of the modal class of the given distribution is:

Height (cm)	Below 140	Below 145	Below 150	Below 155	Below 160	Below 165
Number of girls	4	11	29	40	46	51

[1]

[SQP 2023-24 Q18; near-twin Board 2023 30/1/1 Q11 (modal class from a less-than table)]

(a) 165 (b) 160 (c) 155 (d) 150

Q2. If the mean and mode of a data are 12 and 21 respectively, then its median is: **[1]**

[Board 2026 30/1/1 Q17; near-twin Board 2025 30/1/1 Q12 (mode 15x and mean 18x)]

(a) 6 (b) 13.5 (c) 15 (d) 14

Q3. If $x \cdot \text{Median} + y \cdot \text{Mean} = z \cdot \text{Mode}$ is the empirical relationship between mean, median and mode, then the value of $x + y + z$ is: **[1]**

[Board 2025 30/5/1 Q16; near-twin Board 2023 30/4/1 Q6 (the empirical relation itself)]

(a) 6 (b) 3 (c) 2 (d) 1

Assertion–Reason

Q4. **Assertion (A):** If the mean of a data is 20 and its median is 22, then the mode estimated by the empirical relation is 26.
Reason (R): The empirical relation $\text{Mode} = 3\,\text{Median} - 2\,\text{Mean}$ holds exactly for every frequency distribution. **[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)

Q5. Mrs. Garg recorded the marks obtained by her students in the following table. She calculated the modal marks of the students of the class as 45. While printing the data, a blank was left. Find the missing frequency in the table given below.

Marks obtained	Number of students
0–20	5
20–40	10
40–60	(blank)
60–80	6
80–100	3

[2]

[SQP 2021-22 Term 2 Q5; MS 2021-22 Term 2 Q5 (same paper)]

Short Answer (SA)

Q6. The government rescued 100 people after a train accident. Their ages were recorded as below. Find their mean age.

Age (in years)	Number of people rescued
10–20	9
20–30	14
30–40	15
40–50	21
50–60	23
60–70	12
70–80	6

[3]

[Board 2024C 30/S/1 Q26; near-twins Board 2024 30/2/1 Q30 (marks out of 50), Board 2023 30/5/1 Q31]

Q7. The time (in minutes) spent per day on reading by 40 students is given below. Find the median time and interpret it.

Time (minutes)	0–10	10–20	20–30	30–40	40–50
Number of students	6	9	10	9	6

[3]

[New]

Long Answer (LA)

Q8. Find the mean and median of the following data.

Class	85–90	90–95	95–100	100–105	105–110	110–115
Frequency	15	22	20	18	20	25

[5]

[SQP 2024-25 Q35 (A) (= MS 2024-25 Q35); SQP 2024-25 VIC Q35 (A)]

Q9. The monthly expenditure on milk in 200 families of a housing society is given below. Find the value of x, and also find the median and mean expenditure on milk.

Monthly expenditure (Rs)	Number of families
1000–1500	24
1500–2000	40
2000–2500	33
2500–3000	x
3000–3500	30
3500–4000	22
4000–4500	16
4500–5000	7

[5]

[Board 2023 30/4/1 Q35; SQP 2024-25 Q35 (OR) and SQP 2024-25 VIC Q35 (OR) (same table; these ask for x and mean)]

Q10. A survey regarding the heights (in cm) of 50 girls of class X of a school was conducted and the following data was obtained. Find the mean and mode of the above data.

Height (cm)	Number of girls
120–130	2
130–140	8
140–150	12
150–160	20
160–170	8

[5]

[Board 2023C 30/C/1 Q34]

Case Study

Q11. Case Study: Weekly test scores **[4]**

[SQP 2026-27 Q38; MS 2026-27 Q38 and its OR variant (same paper; MS part labels swapped, see notes)]

A school conducted a weekly test for Class X students, before the pre-board examination, and recorded their scores (out of 50). To analyse performance patterns, the academic coordinator grouped the marks into intervals, as below.

Marks obtained	0–10	10–20	20–30	30–40	40–50
Number of students	3	6	12	15	14

The coordinator wants to judge the overall learning level, the most common performance range, and the consistency across the batch, for planning remedial sessions.
Based on the above information, answer the following questions:

(i) Identify the class with the most common performance range. [1]

(ii) Find the class interval containing the median. [1]

(iii) What is the average performance of the students? [2]

OR

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

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14. Probability

Multiple Choice Questions (MCQs)

Q1. If three coins are tossed simultaneously, the probability of getting at most one tail is: **[1]**

[Board 2023 30/2/1 Q11]

(a) $\frac{3}{8}$ (b) $\frac{4}{8}$ (c) $\frac{5}{8}$ (d) $\frac{7}{8}$

Q2. Two dice are thrown together. The probability of getting the difference of the numbers on their upper faces equal to 3 is: **[1]**

[Board 2023 30/4/1 Q11]

(a) $\frac{1}{9}$ (b) $\frac{2}{9}$ (c) $\frac{1}{6}$ (d) $\frac{1}{12}$

Q3. A card is drawn at random from a well shuffled pack of 52 cards. The probability that the card drawn is not an ace is: **[1]**

[Board 2023 30/4/1 Q18]

(a) $\frac{1}{13}$ (b) $\frac{9}{13}$ (c) $\frac{4}{13}$ (d) $\frac{12}{13}$

Q4. A bag contains 5 pink, 8 blue and 7 yellow balls. One ball is drawn at random from the bag. The probability of getting neither a blue nor a pink ball is: **[1]**

[Board 2023 30/6/1 Q11]

(a) $\frac{1}{4}$ (b) $\frac{2}{5}$ (c) $\frac{7}{20}$ (d) $\frac{13}{20}$

Q5. A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of getting a face card is: **[1]**

[Board 2023 30/6/1 Q15]

(a) $\frac{1}{2}$ (b) $\frac{3}{13}$ (c) $\frac{4}{13}$ (d) $\frac{1}{13}$

Q6. In a family of two children, the probability of having at least one girl is: **[1]**

[Board 2023C 30/C/1 Q3]

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{3}{4}$ (d) $\frac{1}{4}$

Assertion–Reason

Q7. **Assertion (A):** A fair die is thrown once. The probability of getting a prime number is $\frac{1}{2}$.
Reason (R): A natural number is a prime number if it has only two factors. **[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 2023C 30/C/1 Q20]

Very Short Answer (VSA)

Q8. Two dice are thrown at the same time. Find the probability that the product of the numbers appearing on them is a prime number. **[2]**

[SQP 2018-19 Q11; SQP 2026-27 Q25; MS 2018-19 Q11]

Q9. Two dice bearing the numbers $4, 6, 7, 9, 11, 12$ are rolled together. Find the probability that the product of the numbers obtained is an odd number. **[2]**

[SQP 2024-25 Q22 (A); SQP 2024-25 VIC Q22 (A)]

Short Answer (SA)

Q10. Two dice are thrown at the same time. Determine the probability that the difference of the numbers on the two dice is 2. **[3]**

[Board 2025 30/1/1 Q31]

Long Answer (LA)

Q11. A shopkeeper has a box of 40 mobile covers: 12 are red, 9 are blue, 11 are black and the rest are green. One cover is drawn at random from the box. Find the probability that the cover drawn is (i) green; (ii) not red; (iii) red or blue. The shopkeeper then adds 6 more black covers to the box and draws one cover again. (iv) Find the probability that it is black. Instead, the shopkeeper removes all the green covers from the original box of 40 and draws one cover at random. (v) Find the probability that it is blue. **[5]**

[New]

Case Study

Q12. Case Study: Rahul's lucky cards **[4]**

[Board 2025 30/2/1 Q37]

Rahul is a lucky charm for his cricket team. He has a jar of cards numbered from 10 to 74. Before each match, he draws one card at random from the jar. If the card bears an even number, the team wins. If the number is even and divisible by 5, they win by a big margin. If the number is an odd number less than 30, they win by a small margin. If the number is a prime number between 50 and 74, they lose.
Answer the following questions if Rahul draws a card today:

(i) What is the probability that Rahul draws a card with an even number? [1]

(ii) What is the probability that Rahul draws a card with an odd number less than 30? [1]

(iii) (a) What is the probability that Rahul draws a card with a prime number between 50 and 74? [2]

OR

(iii) (b) What is the probability that Rahul draws a card with an even number divisible by 5? [2]

Answer Key (MCQs and Assertion–Reason)

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

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

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

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

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

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

Ch. 07: Q1-(c), Q2-(d), Q3-(c), Q4-(c), Q5-(a)

Ch. 08: Q1-(d), Q2-(c), Q3-(d), Q4-(b), Q5-(b)

Ch. 09: Q1-(a), Q2-(d), Q3-(b), Q4-(a), Q5-(c), Q6-(c), Q7-(c), Q8-(a), Q9-(a)

Ch. 10: Q1-(b), Q2-(c)

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

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

Ch. 13: Q1-(d), Q2-(c), Q3-(c), Q4-(c)

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