CENTRAL BOARD OF SECONDARY EDUCATION

CBSE 2026-27

Mathematics (Standard)

Subject Code: 041 | Class X

Marking Scheme – Sample Question Paper – Set 5

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions

1. This marking scheme gives value points and the mark split only; questions are in SQP Set 5.
2. Any other relevant answer, correctly worked, should be given due credit.
3. This question paper contains 38 questions. All questions are compulsory.
4. The question paper is divided into five Sections – A, B, C, D and E.
5. Section A comprises 18 Multiple Choice Questions (MCQs) of 1 mark each and Question Numbers 19 and 20 are Assertion–Reason based questions of 1 mark each.
6. Section B comprises 5 Very Short Answer (VSA) type questions of 2 marks each (Q.21–25).
7. Section C comprises 6 Short Answer (SA) type questions of 3 marks each (Q.26–31).
8. Section D comprises 4 Long Answer (LA) type questions of 5 marks each (Q.32–35).
9. Section E comprises 3 Case-Study based questions of 4 marks each (Q.36–38), with an internal choice in the 2-mark sub-part of each case study.
10. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C and 2 questions in Section D, and in the 2-mark sub-part of each question in Section E.
11. Use of calculators is not permitted.
12. Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.

Exam Pattern

Section	Type of Questions	No. of Qs	Marks each	Total Marks
A	Multiple Choice Questions & Assertion–Reason	20	1	20
B	Very Short Answer (VSA)	5	2	10
C	Short Answer (SA)	6	3	18
D	Long Answer (LA)	4	5	20
E	Case-Study Based	3	4	12
	Total	**38**		**80**

Unit-wise Weightage of Marks

Unit	Unit Name	Chapter	Marks
I	Number Systems	Real Numbers	6
II	Algebra	Polynomials; Pair of Linear Equations in Two Variables; Quadratic Equations; Arithmetic Progressions	20
III	Coordinate Geometry	Coordinate Geometry	6

Unit	Unit Name	Chapter	Marks
IV	Geometry	Triangles; Circles	15
V	Trigonometry	Introduction to Trigonometry; Some Applications of Trigonometry	12
VI	Mensuration	Areas Related to Circles; Surface Areas and Volumes	10
VII	Statistics & Probability	Statistics; Probability	11
	Total		**80**

SECTION – A

Section A consists of 20 questions of 1 mark each.

Q1. **[1]**

(c) $(\sqrt{3}, \sqrt{27})$. Both factors are irrational, and $\sqrt{3} \cdot \sqrt{27} = \sqrt{81} = 9$ is rational. In (a) and (d) one factor is rational.

Q2. **[1]**

(c) Multiply the first equation by a and the second by b, then subtract: $(a^2 - b^2)x = a(a^2 - b^2)$, so $x = a$. Then $bx + ay = 0$ gives $y = -b$. Check: $a \cdot a + b(-b) = a^2 - b^2$ and $ba + a(-b) = 0$. So $x + y = a - b$. **[1]**

Q3. **[1]**

(b) $(0, -1)$. In a parallelogram the diagonals bisect each other, so $A + C = B + D$ and $D = A + C - B = (-2 + 8 - 6,\ 3 + 3 - 7) = (0, -1)$.

Q4. **[1]**

(d) $40°$. $\angle BAT = 90°$, so $\angle CAB = 90° - 40° = 50°$. $\angle ACB = 90°$ (angle in a semicircle), so $\angle CBA = 90° - 50° = 40°$.

Q5. **[1]**

(d). $\tan^2\theta - \sec^2\theta = -1$, not 1. The other three equations are true. **[1]**

Q6. **[1]**

(b) 3 cm. $2\pi rh = 2 \times 3.14 \times r \times 5 = 31.4r = 94.2$, so $r = 3$ cm.

Q7. **[1]**

(d) 3. The sum of the seven observations is $2 + 9 + (x + 6) + (2x + 3) + 5 + 10 + 5 = 40 + 3x$, and $\dfrac{40 + 3x}{7} = 7$ gives $x = 3$. **[1]**

Q8. **[1]**

(c) q. Since $q \mid p$, q is a common divisor and it is the largest one, so $\text{HCF}(p, q) = q$.

Q9. **[1]**

(b) $(x+3)(-x+8)$. Its zeroes are -3 and 8. Option (c) has zeroes -8 and 3, and options (a) and (d) do not have zeroes -3 and 8.

Q10. **[1]**

(c) 6 m. EF is the midline of $\triangle TAB$, so $EF = \dfrac{1}{2}AB = \dfrac{1}{2} \times 12 = 6$ m. **[1]**

Q11. **[1]**

(b) $30\sqrt{3}$. $h = 30\tan 60° = 30\sqrt{3}$ m. **[1]**

Q12. **[1]**

(b) $60°$. Arc length $= r\theta$ with θ in radians, so $20 = \dfrac{60}{\pi}\theta$, giving $\theta = \dfrac{\pi}{3}$ rad $= 60°$. **[1]**

Q13. **[1]**

(b) $\frac{9}{4}$. MATHEMATICS has 11 letters, of which 4 are vowels (A, E, A, I), so the probability is $\frac{4}{11}$. Then $\frac{2}{2x+1} = \frac{4}{11}$ gives $2x + 1 = \frac{11}{2}$, so $x = \frac{9}{4}$. **[1]**

Q14. **[1]**

(a) $p = 35x$. We have $x = 24$ and $y = 105$. Then $p = \text{LCM}(24, 105) = 2^3 \cdot 3 \cdot 5 \cdot 7 = 840 = 35 \times 24$.

Q15. **[1]**

(c) 2 distinct real roots, because $D = 36 + 72 = 108 > 0$. **[1]**

Q16. **[1]**

(c) 8000 m^3. In 2 minutes the water moves $2000 \times \frac{2}{60} = \frac{200}{3}$ m. The volume is $3 \times 40 \times \frac{200}{3} = 8000\ \text{m}^3$.

Q17. **[1]**

(a) $\frac{11}{4}$. $d = \frac{19}{4} - 5 = -\frac{1}{4}$, so $a_{10} = 5 + 9\left(-\frac{1}{4}\right) = \frac{11}{4}$.

Q18. **[1]**

(d) For parallel lines, $\frac{5}{-15} = \frac{-3}{9} = -\frac{1}{3}$. The constant ratio $\frac{-2}{-5} = \frac{2}{5} \neq -\frac{1}{3}$, so the lines are distinct. **[1]**

Q19. **[1]**

(a) Both A and R are true, and R explains A. R is the Basic Proportionality Theorem applied to the trapezium, and it gives the ratio stated in A directly. **[1]**

Q20. **[1]**

(d) A is false, but R is true. The reason is true: $OB \perp TB$, so $\angle OBT = 90°$ and $\angle ABO = 90° - 75° = 15°$, not $25°$.

SECTION – B

Section B consists of 5 questions of 2 marks each.

Q21. **[2]**

Let $A(-2, 3)$, $B(8, 3)$, $C(6, 7)$. Then $AB^2 = 10^2 = 100$, $BC^2 = (8-6)^2 + (3-7)^2 = 20$ and $AC^2 = (-2-6)^2 + (3-7)^2 = 80$. **[1]**
Since $AC^2 + BC^2 = 80 + 20 = 100 = AB^2$, the points are the vertices of a right-angled triangle, right-angled at C. **[1]**

OR **[2]**

$AB^2 = (3-1)^2 + (4-1)^2 = 13$, $BC^2 = (1+8)^2 + (1-7)^2 = 117$ and $AC^2 = (3+8)^2 + (4-7)^2 = 130 = 13 + 117$, confirming the right angle at B. **[1]**
$\tan A = \dfrac{BC}{AB} = \sqrt{\dfrac{117}{13}} = 3$. **[1]**

Q22. **[2]**

Let AB be a diameter with tangents at A and B. The radius OA is perpendicular to the tangent at A, and OB is perpendicular to the tangent at B **[1]**
Since O lies on AB, both tangents are perpendicular to the same line AB, so they are parallel **[1]**

OR **[2]**

Let P be the external point, O the centre and A a point of contact. OP bisects $\angle APB$, so $\angle OPA = 30°$ **[1]**
In right $\triangle OAP$, $\tan 30° = \frac{OA}{PA}$, so $PA = \frac{3}{1/\sqrt{3}} = 3\sqrt{3}$ cm. Each tangent is $3\sqrt{3}$ cm **[1]**

Q23. **[2]**

Mode $= 3\,\text{Median} - 2\,\text{Mean}$ gives $39 = 3\,\text{Median} - 72$. **[1]**
$3\,\text{Median} = 111$, so Median $= 37$ litres. **[1]**

Q24. **[2]**

(i) In $\triangle ABD$ and $\triangle CBD$: $\angle ABD = \angle CBD$ and $\angle ADB = \angle CDB$ (given). So $\triangle ABD \sim \triangle CBD$ (AA). **[1]**

(ii) From the similarity with $A \leftrightarrow C$, $B \leftrightarrow B$, $D \leftrightarrow D$: $\dfrac{AB}{CB} = \dfrac{BD}{BD} = 1$, so $AB = BC$. **[1]**

Q25. **[2]**

The total number of balls is $4 + 3 + 2 = 9$. **[1/2]**

(i) $P(\text{red}) = \dfrac{4}{9}$. **[1/2]**

(ii) $P(\text{yellow}) = \dfrac{2}{9}$. **[1]**

SECTION – C

Section C consists of 6 questions of 3 marks each.

Q26. **[3]**

Let $\sqrt{5} = \dfrac{p}{q}$, where p, q are co-prime integers and $q \neq 0$. **[1]**

Then $p^2 = 5q^2$, so $5 \mid p$. Write $p = 5c$. **[1]**

Then $25c^2 = 5q^2$ gives $q^2 = 5c^2$, so $5 \mid q$. This contradicts that p and q are co-prime. Hence $\sqrt{5}$ is irrational. **[1]**

OR **[3]**

Let $\sqrt{3} = \dfrac{p}{q}$, where p, q are co-prime integers and $q \neq 0$. **[1]**

Then $3q^2 = p^2$, so $3 \mid p$. Write $p = 3a$. **[1]**

Substituting gives $9a^2 = 3q^2$, so $q^2 = 3a^2$ and $3 \mid q$. This contradicts that p and q are co-prime. Hence $\sqrt{3}$ is irrational. **[1]**

Q27. **[3]**

Let the usual speed be x km/h and the scheduled time y hours, so the distance is xy km. $(x + 6)(y - 4) = xy$ gives $-2x + 3y = 12$. **[1]**

$(x - 6)(y + 6) = xy$ gives $x - y = 6$. **[1]**

Solving: $x = 30$, $y = 24$, so the distance is $30 \times 24 = 720$ km. **[1]**

OR **[3]**

Let lot A have x and lot B have y chocolates. Then $\frac{2}{3}x + y = 400$, i.e. $2x + 3y = 1200$. **[1]**

Also $x + \frac{4}{5}y = 460$, i.e. $5x + 4y = 2300$. **[1]**

Solving gives $x = 300$ and $y = 200$, so Anuj had 500 chocolates. **[1]**

Q28. **[3]**

The three points of division are at $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of the way from A to B, i.e. in ratios $1 : 3$, $1 : 1$ and $3 : 1$. With $B - A = (4, 6)$, the method is clear. **[1]**

$\frac{1}{4}$ of the way: $(-2, 2) + \frac{1}{4}(4, 6) = \left(-1, \frac{7}{2}\right)$; mid-point: $(0, 5)$. **[1]**

$\frac{3}{4}$ of the way: $(-2, 2) + \frac{3}{4}(4, 6) = \left(1, \frac{13}{2}\right)$. **[1]**

Q29. **[3]**

By the alternate segment theorem, $\angle CBA = 180° - \angle PCA = 70°$ **[1]**

Ray BO coincides with ray BA (as O lies on AB), so $\angle OBC = \angle CBA = 70°$ **[1]**

In $\triangle OBC$, $OB = OC$, so $\angle BCO = \angle OBC = 70°$ **[1]**

Q30. **[3]**

The field is right-angled between its 7 m and 24 m sides, so its area is $\dfrac{1}{2} \times 24 \times 7 = 84$ m^2. **[1]**

The three angles of the triangle sum to $180°$, so the three grazed sectors together form one semicircle of radius 3.5 m:

area $= \frac{1}{2} \times \frac{22}{7} \times 3.5^2 = 19.25$ m^2. [1]
Ungrazed area $= 84 - 19.25 = 64.75$ m^2. [1]

Q31. **[3]**

Let the original speed be x km/h. Then $\frac{360}{x} - \frac{360}{x+5} = \frac{48}{60} = \frac{4}{5}$. [1]
So $x^2 + 5x - 2250 = 0$. [1]
$(x + 50)(x - 45) = 0$. Rejecting $x = -50$, the original speed is 45 km/h. [1]

SECTION – D

Section D consists of 4 questions of 5 marks each.

Q32. **[5]**

(a) $\alpha + \beta = 6$ and $\alpha\beta = k$, so $\alpha^2 + \beta^2 = 36 - 2k = 20$. [1]
Hence $k = 8$. [1]
(b) $x^2 - 6x + 8 = (x - 2)(x - 4)$, so the zeroes are 2 and 4. [1]
(c) The new zeroes are $\frac{1}{2}$ and $\frac{1}{4}$, with sum $\frac{3}{4}$ and product $\frac{1}{8}$. [1]
So the required polynomial is $8x^2 - 6x + 1$. [1]

OR **[5]**

(a) $\alpha + \beta = k + 6$ and $\alpha\beta = 2(2k - 1) = 4k - 2$. [1]
(b) Half the product is $\frac{4k-2}{2} = 2k - 1$. Setting $k + 6 = 2k - 1$ gives $k = 7$. [1] for the equation and [1] for $k = 7$.
(c) For $k = 7$, $p(x) = x^2 - 13x + 26$. [1]
Its zeroes have sum 13 and product 26, and $\frac{26}{2} = 13$, so the relation holds. [1]

Q33. **[5]**

Let the kite be at B, and let E be the point on the ground directly below it, so BE is the height of the kite. (Correct figure: 1 mark.)
From the right triangle AEB: $\frac{BE}{200} = \sin 30°$, so $BE = 100$ m. [1]
The kite is $100 - 50 = 50$ m above Mahesh's roof, so $BR = 50$ m where R is on BE at roof level. [1]
In right triangle BRD: $\frac{BR}{BD} = \sin 45°$, so $BD = \frac{50}{1/\sqrt{2}} = 50\sqrt{2}$ m. [1]
Distance between the kite and Mahesh $= 50\sqrt{2} \approx 70.7$ m. [1]

OR **[5]**

Let the lighthouse be $AB = h$ m, with the nearer ship C and the farther ship D on the ground in line with B, and $CD = 200$ m. (Correct figure: 1 mark.)
In right triangle ABC: $\tan 45° = \frac{h}{BC}$, so $BC = h$. [2]
In right triangle ABD: $\tan 30° = \frac{h}{h + 200}$, so $h\sqrt{3} = h + 200$. [2]
Hence $h = \frac{200}{\sqrt{3} - 1} = 100(\sqrt{3} + 1) \approx 273.2$ m. [1]

Q34. **[5]**

$\sum f_i = 65 + p + q = 100$, so $p + q = 35$. [1]
Class marks $5, 15, 25, 35, 45, 55$: $\sum f_i x_i = 60 + 15p + 675 + 700 + 45q + 330 = 1765 + 15p + 45q$. [2]
Mean $= 28$ gives $1765 + 15p + 45q = 2800$, i.e. $p + 3q = 69$. [1]
Solving with $p + q = 35$: $q = 17$ and $p = 18$. [1]

OR **[5]**

$N = 70$, $\frac{N}{2} = 35$. The cumulative frequencies are $15, 25, 37, \ldots$, so the median class is 30–45, with $l = 30$, $cf = 25$, $f = 12$, $h = 15$. **[1]**

Median $= 30 + \dfrac{35 - 25}{12} \times 15 = 30 + 12.5 = 42.5$. **[2]**

Mode: the modal class is 0–15 ($f_1 = 15$). The class before it is taken with frequency $f_0 = 0$, and $f_2 = 10$. **[1]**

Mode $= 0 + \dfrac{15 - 0}{2(15) - 0 - 10} \times 15 = 11.25$. **[1]**

Q35. **[5]**

From $x \sin\theta = y \cos\theta$, $x = \dfrac{y \cos\theta}{\sin\theta}$ **[1]**. Substituting in the first equation: $y \cos\theta \sin^2\theta + y \cos^3\theta = y \cos\theta(\sin^2\theta + \cos^2\theta) = y \cos\theta = \sin\theta \cos\theta$ **[2]**. Hence $y = \sin\theta$ **[1]**. Then $x \sin\theta = \sin\theta \cos\theta$ gives $x = \cos\theta$, so $x^2 + y^2 = \cos^2\theta + \sin^2\theta = 1$ **[1]**.

OR **[5]**

(i) $\sec^2\theta + \operatorname{cosec}^2\theta = \dfrac{\sin^2\theta + \cos^2\theta}{\sin^2\theta \cos^2\theta} = \dfrac{1}{\sin^2\theta \cos^2\theta}$ **[1]**. Also $(\tan\theta + \cot\theta)^2 = \left(\dfrac{\sin^2\theta + \cos^2\theta}{\sin\theta \cos\theta}\right)^2 = \dfrac{1}{\sin^2\theta \cos^2\theta}$ **[1]**. Both sides are positive for acute θ, so taking square roots gives the result **[1]**. (3 marks)

(ii) $\cos 45^\circ = \frac{1}{\sqrt{2}}$ and $\sec 30^\circ + \operatorname{cosec} 30^\circ = \frac{2}{\sqrt{3}} + 2 = \dfrac{2(1 + \sqrt{3})}{\sqrt{3}}$ **[1]**. The value is $\dfrac{\sqrt{3}}{2\sqrt{2}(1 + \sqrt{3})} = \dfrac{\sqrt{3}(\sqrt{3} - 1)}{4\sqrt{2}} = \dfrac{3\sqrt{2} - \sqrt{6}}{8} \approx 0.224$ **[1]**. (2 marks)

SECTION – E

Section E consists of 3 case-study based questions of 4 marks each, with an internal choice in the 2-mark sub-part of each.

Q36. **[4]**

(i) $x^2 - 2x - 8 = (x - 4)(x + 2)$, so the zeroes are 4 and -2. **[1]**

(ii) $(x - 2)^2 + 4 \geq 4 > 0$ for every real x, so the graph never meets the x-axis and the polynomial has 0 zeroes. **[1]**

(iii) If one zero is 6 and the sum is 0, the other zero is -6. **[1]**

The required polynomial is $(x - 6)(x + 6) = x^2 - 36$. **[1]**

OR

(iii) $x^2 - 36 = 0$ gives the zeroes 6 and -6. **[1]**

The sum is $0 = -\frac{0}{1}$ and the product is $-36 = \frac{-36}{1}$, so the relation is verified. **[1]**

Q37. **[4]**

(i) $\angle OAP = 90^\circ$, since the radius is perpendicular to the tangent at the point of contact **[1]**

(ii) In right $\triangle OAP$: $OP^2 = OA^2 + AP^2$, so $18^2 = 9^2 + AP^2$, $AP^2 = 243$ and $AP = 9\sqrt{3}$ m **[1]**

(iii) OR: $\angle OPA = \frac{1}{2} \times 60^\circ = 30^\circ$ **[1]**. In $\triangle OAP$, $\tan 30^\circ = \frac{OA}{PA}$, so $PA = \frac{9}{1/\sqrt{3}} = 9\sqrt{3}$ m **[1]**

Q38. **[4]**

(i) Radius $= \dfrac{35}{2} = 17.5$ cm. **[1]**

(ii) Circumference $= 2 \times \dfrac{22}{7} \times 17.5 = 110$ cm. **[1]**

(iii) OR: Each sector has central angle $\dfrac{360^\circ}{10} = 36^\circ$. **[1]**

Area of each sector $= \dfrac{36}{360} \times \dfrac{22}{7} \times 17.5^2 = 96.25$ cm^2. **[1]**

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