MARKING SCHEME — MATHEMATICS (STANDARD) CLASS X

SET - 1

SECTION A (Q.1 – Q.20 : 1 mark each)

Q.1 (B) $x^3\,y^3$ 1

Q.2 (A) 2 [product of zeroes $= \frac{k}{2} = 1$] 1

Q.3 (C) $a = 0, b = -6$ 1

Q.4 (A) $x^2 - 9$ 1

Q.5 (A) 42 years [$y - 2 = 5(x - 2)$ and $y + 2 = 3(x + 2) + 8 \Rightarrow x = 10, y = 42$] 1

Q.6 (D) no solution 1

Q.7 (B) 6 1

Q.8 (A) $3x^2 - 10x + 3 = 0$ [$x + \frac{1}{x} = \frac{10}{3}$] 1

Q.9 (B) −8 [$D = 16 - 24$] 1

Q.10 (A) 2 1

Q.11 (A) ₹ 87 [a_{10} = 15 + 9 × 8 = 87] 1

Q.12 (C) −77 [10 + 29 × (−3)] 1

Q.13 (C) 42 m [$\frac{6}{4} = \frac{h}{28}$] 1

Q.14 (B) 60° 1

Q.15 (C) 3 cm [$\frac{2.4}{3.6} = \frac{2}{EC}$] 1

Q.16 (C) 10 1

Q.17 (A) $(0, 2)$ 1

Q.18 (C) $\sqrt{119}$ cm [$PQ^2 = 12^2 - 5^2$] 1

Q.19 (A) Both true, (R) correctly explains (A) 1

Q.20 (A) Both true, (R) correctly explains (A) 1

SECTION B (Q.21 – Q.25 : 2 marks each)

Q.21 $6^n = (2 \times 3)^n = 2^n \times 3^n$; its prime factorisation contains only the primes 2 and 3 ..... 1 2

A number ends with the digit 0 only if it has both 2 and 5 as prime factors ; since 5 does not occur, 6^n cannot end with 0 1

OR

Assume $5\sqrt{3}$ is rational, i.e. $5\sqrt{3} = \frac{a}{b}$, where a, b are integers, $b \neq 0$ ..... ½

Then $\sqrt{3} = \frac{a}{5b}$, which is rational 1

This contradicts the fact that $\sqrt{3}$ is irrational ; hence $5\sqrt{3}$ is irrational ..... ½

Q.22 $404 = 2^2 \times 101$, $96 = 2^5 \times 3$ ..... ½ 2

HCF = $2^2 = 4$; LCM = $2^5 \times 3 \times 101 = 9696$ 1

Verification : $4 \times 9696 = 38784 = 404 \times 96$ ..... ½

Q.23 $x^2 - 2x - 8 = (x - 4)(x + 2)$; zeroes are 4 and -2 ..... 1 2

Sum $= 2 = \frac{-(-2)}{1}$; Product $= -8 = \frac{-8}{1}$; relationship verified 1

Q.24 $PQ^2 = (10 - 2)^2 + (y + 3)^2 = 10^2$ 1 2

$(y + 3)^2 = 36 \Rightarrow y + 3 = \pm 6 \Rightarrow y = 3$ or $y = -9$ 1

Q.25 $OP \perp PQ$ (tangent ⊥ radius at the point of contact) ..... ½ 2

$r^2 = 25^2 - 24^2 = 625 - 576 = 49$ 1

Radius = 7 cm ..... ½

OR

$\angle OAP = 90°$; $\angle APO = \frac{80°}{2} = 40°$ 1

$\angle POA = 180° - 90° - 40° = 50°$ 1

SECTION C (Q.26 – Q.31 : 3 marks each)

Q.26 $\alpha + \beta = -\frac{1}{6}$, $\alpha\beta = -\frac{1}{3}$ 1 3

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = \frac{1}{36} + \frac{2}{3} = \frac{25}{36}$ 1

$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{25}{36} \div (-\frac{1}{3}) = -\frac{25}{12}$ 1

Q.27 $S_n = \frac{n}{2}[48 + (n - 1)(-3)] = 78$ 1 3

$n^2 - 17n + 52 = 0 \Rightarrow (n - 4)(n - 13) = 0 \Rightarrow n = 4$ or 13 1

Both answers are valid : the terms from the 5th to the 13th add up to zero, so both 4 and 13 terms give sum 78 1

OR

$a = 8$, $d = -5$, $n = 22$ ..... ½

$S_{22} = \frac{22}{2}[2(8) + 21(-5)] = 11[16 - 105]$ 1½

$= 11 \times (-89) = -979$ 1

Q.28 $AB = \sqrt{9 + 25} = \sqrt{34}$; similarly $BC = CD = DA = \sqrt{34}$ 1½ 3

Diagonals : $AC = \sqrt{4 + 64} = \sqrt{68}$ and $BD = \sqrt{64 + 4} = \sqrt{68}$ 1

All sides equal and diagonals equal $\Rightarrow$ ABCD is a square ..... ½

Q.29 Let the required ratio be $k : 1$ ..... ½ 3

$\frac{4k - 1}{k + 1} = 1 \Rightarrow 4k - 1 = k + 1 \Rightarrow k = \frac{2}{3}$, i.e. ratio $2 : 3$ 1½

Check with y-coordinates : $\frac{-3k + 7}{k + 1} = \frac{5}{\frac{5}{3}} = 3$ ✓ 1

Q.30 Correct figure : diameter AB, tangents at A and B ..... ½ 3

Tangent at A ⊥ OA and tangent at B ⊥ OB (tangent ⊥ radius at point of contact) 1½

Both tangents make 90° with the same straight line AB $\Rightarrow$ alternate interior angles are equal $\Rightarrow$ the tangents are parallel 1

Q.31 Tangents from an external point are equal : 3

$AP = AS$, $BP = BQ$, $CR = CQ$, $DR = DS$ 1½

Adding : $(AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)$ 1

i.e. $AB + CD = AD + BC$ ..... ½

OR

$\angle OAP = \angle OBP = 90°$ (tangent ⊥ radius) 1

In quadrilateral OAPB, $\angle AOB + \angle OAP + \angle APB + \angle OBP = 360°$ 1

$\angle APB + \angle AOB = 180°$, i.e. the angle between the tangents is supplementary to the angle subtended at the centre by the line segment joining the points of contact 1

SECTION D (Q.32 – Q.35 : 5 marks each)

Q.32 Let the fixed monthly subscription be ₹ x and the charge per live session be ₹ y. 5

$x + 20y = 1300$ and $x + 26y = 1600$ 1½

Subtracting : $6y = 300 \Rightarrow y = 50$ 1½

(a) $x = 1300 - 20 \times 50 = 300$; subscription = ₹ 300, charge per session = ₹ 50 ..... 1½

(b) Expected payment for 30 sessions = $300 + 30 \times 50 = ₹\,1{,}800$ ..... ½

Q.33 Let the original average speed be x km/h ; reduced speed = $(x - 200)$ km/h. 5

$\frac{600}{x-200} - \frac{600}{x} = \frac{30}{60} = \frac{1}{2}$ 1½

$\frac{600 \times 200}{x(x-200)} = \frac{1}{2} \Rightarrow x^2 - 200x - 240000 = 0$ 1½

$(x - 600)(x + 400) = 0$ 1

$x = 600$ (rejecting $x = -400$) ; original speed = 600 km/h ; original duration = $\frac{600}{600}$ = 1 hour 1

OR

Let the original speed of the train be x km/h.

$\frac{360}{x} - \frac{360}{x+5} = 1$ 1½

$360(x + 5) - 360x = x(x + 5) \Rightarrow x^2 + 5x - 1800 = 0$ 1½

$(x + 45)(x - 40) = 0$ 1

$x = 40$ (rejecting $x = -45$ as speed cannot be negative) ; speed = 40 km/h 1

Q.34 The instalments 1000, 1100, 1200, ... form an AP with $a = 1000$ and $d = 100$ 1 5

(a) $a_{30} = 1000 + 29 \times 100 = ₹\,3{,}900$ 1

(b) $S_{30} = \frac{30}{2}[2(1000) + 29(100)]$ 1½

$= 15 \times 4900 = ₹\,73{,}500$ ..... ½

(c) Since 73,500 < 1,18,000, the loan is NOT fully repaid after 30 instalments ; amount still due = 1,18,000 − 73,500 = ₹ 44,500 1

Q.35 Statement of Basic Proportionality Theorem ..... ½ 5

Correct figure and construction (join BE, CD ; draw EL ⊥ AB, DM ⊥ AC) 1

Correct proof that $\frac{AD}{DB} = \frac{AE}{EC}$ 2½

Application : $\frac{x}{x-2} = \frac{x+2}{x-1} \Rightarrow x(x - 1) = (x - 2)(x + 2) \Rightarrow -x = -4 \Rightarrow x = 4$ 1

OR

$BD = \frac{1}{2} BC$ and $QM = \frac{1}{2} QR$, so $\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ 1½

$\Delta ABD \sim \Delta PQM$ (SSS similarity) $\Rightarrow \angle B = \angle Q$ 1½

Now $\frac{AB}{PQ} = \frac{BC}{QR}$ with $\angle B = \angle Q \Rightarrow \Delta ABC \sim \Delta PQR$ (SAS similarity) 2

SECTION E (Q.36 – Q.38 : case study, 4 marks each)

Q.36 (i) $4x + 2y = 110$ and $3x + 4y = 170$ 1 4

(ii) Multiplying the first by 2 and subtracting : $5x = 50 \Rightarrow x = 10$; cost of one pen = ₹ 10 1

(iii) $y = \frac{110-40}{2} = 35$; cost of 3 pens and 2 notebooks = $30 + 70 =$ ₹ 100 ; she has exactly ₹ 100, so yes — it is just enough 2

OR

(iii) Number of notebooks for ₹ 175 = $\frac{175}{35} = 5$ 2

Q.37 (i) $x(2x) = 800 \Rightarrow 2x^2 = 800, i.e.\ x^2 - 400 = 0$ 1 4

(ii) $D = 0^2 - 4(1)(-400) = 1600 > 0 \Rightarrow$ two distinct real roots 1

(iii) $x^2 = 400 \Rightarrow x = 20$ (rejecting -20) ; breadth = 20 m, length = 40 m 2

OR

(iii) $2x^2 = 1250 \Rightarrow x^2 = 625 \Rightarrow x = 25$; breadth = 25 m, length = 50 m 2

Q.38 (i) $\Delta ABE \sim \Delta CDE$ by AA similarity (each has a right angle and ∠E is common) 4 1

(ii) Ratio of lamp-post to girl = $\frac{3.6}{0.9} = 4:1$ 1

(iii) Distance walked in 4 s = $1.2 \times 4 = 4.8$ m ; if shadow = s : $\frac{4.8+s}{s} = 4 \Rightarrow 3s = 4.8 \Rightarrow s = 1.6$ m 2

OR

(iii) If she is d m from the post and her shadow is s m : $\frac{d+s}{s} = 4 \Rightarrow s = \frac{d}{3}$; each second d increases by 1.2 m, so s increases by $\frac{1.2}{3} = 0.4$ m — a uniform rate of 0.4 m/s 2

Note : Competency-based / application questions (Q.5, 8, 11, 13, 19, 20, 21, 25, 27, 28, 32–34, 36–38) ≈ 43 marks (54%), meeting the CBSE requirement of at least 50% competency-focused assessment.