



B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL



MARKING SCHEME — MATHEMATICS CLASS XI,

SET-2

SECTION A (Q.1 – Q.20 : 1 mark each)

Q.1 (C) 16 $[2^4]$	1
Q.2 (A) ϕ [no natural number lies strictly between 1 and 2]	1
Q.3 (A) $(-\infty, 5)$	1
Q.4 (B) 8	1
Q.5 (B) $\frac{4\pi}{3}$	1
Q.6 (C) $\{x : x \in R, -2 < x \leq 5\}$	1
Q.7 (C) 11 $[45x \leq 500 \Rightarrow x \leq 11.1]$	1
Q.8 (B) $R - \{3\}$	1
Q.9 (B) B	1
Q.10 (C) 225°	1
Q.11 (C) $\text{₹ } 70$ $[30 + 8 \times 5]$	1
Q.12 (C) 4 $[2^2]$	1
Q.13 (B) $\{1, 2, 3\}$ $[x < 4, x \in N]$	1
Q.14 (A) $x = 3, y = 2$	1
Q.15 (C) 42 cm $[l = r\theta = 21 \times 2]$	1
Q.16 (A) $x + 1 < 0$ $[x < -1]$	1
Q.17 (B) $[2, \infty)$	1
Q.18 (C) 70 $[\frac{55 + 70 + x}{3} \geq 65]$	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 $A \times B = \{(1, a), (1, b), (2, a), (2, b)\}$ 1	2
$B \times A = \{(a, 1), (a, 2), (b, 1), (b, 2)\}$; the ordered pairs are different, so $A \times B \neq B \times A$ 1	

OR

$x + 2 = 5 \Rightarrow x = 3$ 1	
$y - 1 = 3 \Rightarrow y = 4$ 1	
Q.22 $f(x)$ is defined only when $4 - x \geq 0$, i.e. $x \leq 4$; domain = $(-\infty, 4]$ 1	2
$\sqrt{4 - x} \geq 0$ for all such x ; range = $[0, \infty)$ 1	
Q.23 $-47^\circ 30' = -\frac{95}{2}^\circ$ 1	2
$= -\frac{95}{2} \times \frac{\pi}{180} = -\frac{19\pi}{72}$ radians 1	
Q.24 60 revolutions per minute = 1 revolution per second, so in 5 seconds the wheel makes 5 revolutions 1	2
Angle turned = $5 \times 2\pi = 10\pi$ radians 1	

Q.25 $4x + 3 < 6x + 7 \Rightarrow -4 < 2x \Rightarrow x > -2$ 1 2

Solution set = $(-2, \infty)$; correct representation on the number line 1

OR

$$\frac{5-2x}{3} \leq \frac{x}{6} - 5 \Rightarrow 2(5-2x) \leq x-30 \Rightarrow 40 \leq 5x \text{ } 1\frac{1}{2}$$

$x \geq 8$, i.e. the solution set is $[8, \infty)$ $\frac{1}{2}$

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

Q.26 $A \cap B = \{2, 4\}$, so $(A \cap B)' = \{1, 3, 5, 6, 7, 8, 9\}$ 1 3

$A' = \{5, 6, 7, 8, 9\}$, $B' = \{1, 3, 5, 7, 9\}$ 1

$A' \cup B' = \{1, 3, 5, 6, 7, 8, 9\} = (A \cap B)'$; hence verified 1

Q.27 $A = \{S, C, H, O, L\}$ 1 3

$B = \{C, O, L, E, G\}$ 1

$A \cup B = \{S, C, H, O, L, E, G\}$, $A \cap B = \{C, O, L\}$, $B - A = \{E, G\}$ 1

OR

$A - B = \{2, 4\}$, $B - A = \{10, 12\}$, $A \cap B = \{6, 8\}$ $1\frac{1}{2}$

The intersection of any two of these sets is ϕ , so they are pairwise disjoint 1

Their union = $\{2, 4, 6, 8, 10, 12\} = A \cup B$ $\frac{1}{2}$

Q.28 In 40 minutes the hand turns through $\frac{40}{60}$ of a revolution, i.e. $\theta = \frac{2}{3} \times 2\pi = \frac{4\pi}{3}$ radians $1\frac{1}{2}$ 3

$l = r\theta = 1.5 \times \frac{4\pi}{3} = 2\pi = 6.28 \text{ cm}$ $1\frac{1}{2}$

Q.29 $60^\circ = 60 \times \frac{\pi}{180} = \frac{\pi}{3}$ radians $1\frac{1}{2}$ 3

$l = r\theta = 12 \times \frac{\pi}{3} = 4\pi \text{ cm} \approx 12.57 \text{ cm}$ $1\frac{1}{2}$

Q.30 $2(x-1) < x+5 \Rightarrow x < 7$ 1 3

$3(x+2) > 2-x \Rightarrow 4x > -4 \Rightarrow x > -1$ 1

Solution set = $(-1, 7)$; correct representation on the number line 1

Q.31 $68 < \frac{9C}{5} + 32 < 77$ 1 3

$36 < \frac{9C}{5} < 45$ 1

$20 < C < 25$; the temperature lies between 20°C and 25°C 1

OR

Acid in 1125 L = 45% of 1125 = 506.25 L ; let x litres of water be added 1

$$\frac{25(1125+x)}{100} < 506.25 < \frac{30(1125+x)}{100} \text{ } 1$$

$562.5 < x < 900$; more than 562.5 L but less than 900 L of water must be added 1

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

Q.32 Let $x \in (A \cup B)' \Rightarrow x \notin A \cup B \Rightarrow x \notin A$ and $x \notin B \Rightarrow x \in A' \cap B'$ $1\frac{1}{2}$ 5

Conversely $x \in A' \cap B' \Rightarrow x \notin A$ and $x \notin B \Rightarrow x \notin A \cup B \Rightarrow x \in (A \cup B)'$; hence the two sets are equal $1\frac{1}{2}$

Verification : $A \cup B = \{1, 2, 3, 5, 7, 9\}$, so $(A \cup B)' = \{4, 6, 8, 10\}$ 1

$A' = \{2, 4, 6, 8, 10\}$, $B' = \{1, 4, 6, 8, 9, 10\}$, $A' \cap B' = \{4, 6, 8, 10\}$ ✓ $\frac{1}{2}$

Correct Venn diagram $\frac{1}{2}$

Q.33 (a) $P = \{3, 6, 9, 12, 15\}$, $Q = \{5, 10, 15\}$ 1 5

(b) $P \cup Q = \{3, 5, 6, 9, 10, 12, 15\}$ — codes of items that are pens or files ; $P \cap Q = \{15\}$ — the code common to both groups $1\frac{1}{2}$

- (c) $P' = \{1, 2, 4, 5, 7, 8, 10, 11, 13, 14\}$, $Q - P = \{5, 10\}$ $1\frac{1}{2}$
 (d) $(P \cap Q)' = U - \{15\}$ and $P' \cup Q' = U - \{15\}$; hence verified 1

OR

- (a) $[-4, 6)$ 1 (b) $(0, 9]$ 1

Correct representation of both intervals on the number line 1

$$[-4, 6) \cap (0, 9] = (0, 6) \text{ 1}$$

$$[-4, 6) \cup (0, 9] = [-4, 9] \text{ 1}$$

$$\text{Q.34 } f(0) = 1 \Rightarrow b = 1; f(1) = 3 \Rightarrow a + b = 3 \text{ } 1\frac{1}{2} \quad 5$$

$$(a) a = 2, b = 1, \text{ so } f(x) = 2x + 1 \text{ 1}$$

$$(b) \text{ Domain} = \{0, 1, 2, 3\}, \text{ Range} = \{1, 3, 5, 7\} \text{ 1}$$

$$(c) f(10) = 2(10) + 1 = 21 \text{ 1}$$

$$(d) 2x + 1 = 15 \Rightarrow x = 7 \text{ } \frac{1}{2}$$

$$\text{Q.35 } 3x - 7 < 5 + x \Rightarrow 2x < 12 \Rightarrow x < 6 \text{ } 1\frac{1}{2} \quad 5$$

$$11 - 5x \leq 1 \Rightarrow -5x \leq -10 \Rightarrow x \geq 2 \text{ } 1\frac{1}{2}$$

Correct representation of $x < 6$ and $x \geq 2$ on two number lines 1

Common solution = $[2, 6)$ 1

OR

$$70 \leq \frac{70 + 75 + x}{3} < 80 \text{ } 1\frac{1}{2}$$

$$210 \leq 145 + x < 240 \text{ } 1\frac{1}{2}$$

$65 \leq x < 95$; he must score at least 65 but less than 95 marks 2

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

$$\text{Q.36 (i) } M \cap A = \{3, 4\} \text{ 1} \quad 4$$

$$(ii) M \cup A = \{1, 3, 4, 7, 8, 9, 11\} \text{ 1}$$

(iii) $A' = \{1, 2, 5, 6, 7, 9, 10, 12\}$ — those who have not joined the art club; $M - A = \{1, 7, 9\}$ — those in the music club only 2

OR

(iii) $(M \cap A)' = \{1, 2, 5, 6, 7, 8, 9, 10, 11, 12\}$; $M' \cup A'$ is the same set; hence verified 2

$$\text{Q.37 (i) } y = 150 + 6x \text{ 1} \quad 4$$

$$(ii) y = 150 + 6(40) = ₹ 390 \text{ 1}$$

$$(iii) 450 = 150 + 6x \Rightarrow x = 50; 50 \text{ units were consumed 2}$$

OR

(iii) Domain = $[0, 200]$; when $x = 0, y = 150$ and when $x = 200, y = 1350$, so range = $[150, 1350]$ 2

$$\text{Q.38 (i) } R = \{(1, 1), (2, 4), (3, 9), (4, 16)\} \text{ 1} \quad 4$$

$$(ii) \text{ Domain of } R = \{1, 2, 3, 4\}; \text{ Range of } R = \{1, 4, 9, 16\} \text{ 1}$$

(iii) Yes; every element of A has exactly one image in B , so R is a function.

$$\text{Total number of relations from } A \text{ to } B = 2^{16} = 65536 \text{ 2}$$

OR

$$(iii) n(A \times B) = 4 \times 4 = 16; \text{ relations containing exactly one ordered pair} = 16 \text{ 2}$$

Note : Competency-based / application questions (Q.7, 11, 15, 16, 18, 19, 20, 24, 27, 28, 29, 31, 33, 35, 36–38) $\approx$ 43 marks (54%), meeting the CBSE requirement of at least 50% competency-focused assessment.