



**B.K. BIRLA CENTRE FOR EDUCATION**

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



**MARKING SCHEME — MATHEMATICS CLASS XI (80 MARKS)**

**SET - A**

**SECTION A (Q.1 – Q.20 : 1 mark each)**

|                                                                                      |   |
|--------------------------------------------------------------------------------------|---|
| Q.1 (C) $\{-3, 3\}$                                                                  | 1 |
| Q.2 (C) 8 $[2^3]$                                                                    | 1 |
| Q.3 (B) $\{x : x \in R, -3 \leq x < 5\}$                                             | 1 |
| Q.4 (A) A                                                                            | 1 |
| Q.5 (A) $\{25, 50, 75\}$                                                             | 1 |
| Q.6 (D) 64 $[2^6]$                                                                   | 1 |
| Q.7 (A) $x = 2, y = 3$                                                               | 1 |
| Q.8 (C) $R - \{-2, 2\}$                                                              | 1 |
| Q.9 (A) $[0, \infty)$                                                                | 1 |
| Q.10 (D) ₹ 122 $[50 + 12 \times 6]$                                                  | 1 |
| Q.11 (C) $\frac{\pi}{4}$                                                             | 1 |
| Q.12 (A) $210^\circ$                                                                 | 1 |
| Q.13 (A) 11 cm $[\theta = \frac{\pi}{2}, l = r\theta = 7 \times \frac{\pi}{2} = 11]$ | 1 |
| Q.14 (B) $(-\infty, -3)$                                                             | 1 |
| Q.15 (A) $\{1, 2\}$ $[x < 3, x \in N]$                                               | 1 |
| Q.16 (B) $2x - 1 \geq 3$ $[x \geq 2]$                                                | 1 |
| Q.17 (A) 70 $[\frac{62 + 48 + x}{3} \geq 60]$                                        | 1 |
| Q.18 (A) $[-2, 2)$                                                                   | 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 $A \times B = \{(1, 3), (1, 4), (2, 3), (2, 4), (3, 3), (3, 4)\}$ ..... 1     | 2 |
| $n(A \times B) = 6$ , so the number of relations from A to B is $2^6 = 64$ ..... 1 |   |

**OR**

|                                                                                                    |   |
|----------------------------------------------------------------------------------------------------|---|
| $\frac{x}{3} + 1 = \frac{5}{3} \Rightarrow \frac{x}{3} = \frac{2}{3} \Rightarrow x = 2$ ..... 1    |   |
| $y - \frac{2}{3} = \frac{1}{3} \Rightarrow y = 1$ ..... 1                                          |   |
| Q.22 $f(x)$ is defined only when $x - 1 \geq 0$ , i.e. $x \geq 1$ ; domain = $[1, \infty)$ ..... 1 | 2 |
| $\sqrt{x - 1} \geq 0$ for all such $x$ ; range = $[0, \infty)$ ..... 1                             |   |
| Q.23 $520^\circ = 520 \times \frac{\pi}{180}$ radians ..... 1                                      | 2 |
| $= \frac{26\pi}{9}$ radians ..... 1                                                                |   |

Q.24  $\theta = \frac{l}{r} = \frac{22}{100} = 0.22 \text{ radian} \dots 1$  2

$\theta = 0.22 \times \frac{180}{\pi} = 0.22 \times \frac{180 \times 7}{22} = 12.6^\circ = 12^\circ 36' \dots 1$

Q.25  $5x - 3 < 3x + 1 \Rightarrow 2x < 4 \Rightarrow x < 2 \dots 1$  2

(i)  $x \in \{\dots, -2, -1, 0, 1\}$  (ii)  $x \in (-\infty, 2)$   $\dots 1$

**OR**

$3(x - 1) \leq 2(x - 3) \Rightarrow 3x - 3 \leq 2x - 6 \Rightarrow x \leq -3 \dots 1$

Solution set =  $(-\infty, -3]$  ; correct representation on the number line  $\dots 1$

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

Q.26  $A \cup B = \{2, 3, 4, 5, 6, 7, 8\}$  , so  $(A \cup B)' = \{1, 9, 10\} \dots 1$  3

$A' = \{1, 3, 5, 7, 9, 10\}$  ,  $B' = \{1, 4, 6, 8, 9, 10\} \dots 1$

$A' \cap B' = \{1, 9, 10\} = (A \cup B)'$  ; hence verified  $\dots 1$

Q.27  $A = \{2, 4, 6, 8, 10\}$  ,  $B = \{3, 6, 9\} \dots 1$  3

$A \cup B = \{2, 3, 4, 6, 8, 9, 10\} \dots 1$

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

**OR**

$A - B = \{1, 2\}$  ,  $B - A = \{5, 6\}$  ,  $A \cap B = \{3, 4\} \dots 1\frac{1}{2}$

The intersection of any two of these sets is  $\phi$  , so they are pairwise disjoint  $\dots 1$

Their union =  $\{1, 2, 3, 4, 5, 6\} = A \cup B \dots \frac{1}{2}$

Q.28  $\theta = \frac{l}{r} = \frac{21}{75} = 0.28 \text{ radian} \dots 1\frac{1}{2}$  3

$l = r\theta = 75 \times 1.2 = 90 \text{ cm} \dots 1\frac{1}{2}$

Q.29 360 revolutions per minute = 6 revolutions per second  $\dots 1$  3

One revolution =  $2\pi$  radians  $\dots 1$

Angle turned in one second =  $6 \times 2\pi = 12\pi$  radians  $\dots 1$

Q.30  $5(2x - 7) - 3(2x + 3) \leq 0 \Rightarrow 4x \leq 44 \Rightarrow x \leq 11 \dots 1$  3

$2x + 19 \leq 6x + 47 \Rightarrow -28 \leq 4x \Rightarrow x \geq -7 \dots 1$

Solution set =  $[-7, 11]$  ; correct representation on the number line  $\dots 1$

Q.31 Let  $x$  litres of the 30% solution be added ; total mixture =  $(600 + x)$  litres, 3

acid =  $72 + 0.3x \dots 1$

$\frac{15(600 + x)}{100} < 72 + 0.3x < \frac{18(600 + x)}{100} \dots 1$

Solving :  $x > 120$  and  $x < 300$  ; hence more than 120 L but less than 300 L must be added  $\dots 1$

**OR**

Shortest side =  $x$  cm, longest =  $3x$  cm, third =  $(3x - 2)$  cm  $\dots 1$

$x + 3x + (3x - 2) \geq 61 \Rightarrow 7x \geq 63 \dots 1$

$x \geq 9$  ; minimum length of the shortest side = 9 cm  $\dots 1$

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

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

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

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

$A' = \{1, 3, 5, 7\}$  ,  $B' = \{5, 6, 7, 8\}$  ,  $A' \cup B' = \{1, 3, 5, 6, 7, 8\} \checkmark \dots \frac{1}{2}$

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

Q.33 (a)  $M = \{2, 4, 6, 8, 10, 12\}$ ,  $S = \{3, 6, 9, 12\}$  ..... 1 5

(b)  $M \cup S = \{2, 3, 4, 6, 8, 9, 10, 12\}$  — students in at least one team ;  $M \cap S = \{6, 12\}$  — students in both teams .....  $1\frac{1}{2}$

(c)  $M' = \{1, 3, 5, 7, 9, 11\}$ ,  $S - M = \{3, 9\}$  .....  $1\frac{1}{2}$

(d)  $(M \cup S)' = \{1, 5, 7, 11\}$  and  $M' \cap S' = \{1, 5, 7, 11\}$  ; hence verified ..... 1

**OR**

(a)  $(-5, 3]$  ..... 1 (b)  $[2, 7)$  ..... 1

Correct representation of both intervals on the number line ..... 1

$(-5, 3] \cap [2, 7) = [2, 3]$  ..... 1

$(-5, 3] \cup [2, 7) = (-5, 7)$  ..... 1

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

(a) Subtracting :  $a = 2$  and hence  $b = -1$  , so  $f(x) = 2x - 1$  ..... 1

(b) Domain =  $\{-1, 0, 1, 2\}$  , Range =  $\{-3, -1, 1, 3\}$  ..... 1

(c)  $f(5) = 2(5) - 1 = 9$  ..... 1

(d)  $2x - 1 = 9 \Rightarrow x = 5$  .....  $\frac{1}{2}$

Q.35  $2(2x + 3) - 10 < 6(x - 2) \Rightarrow 4x - 4 < 6x - 12 \Rightarrow x > 4$  .....  $1\frac{1}{2}$  5

$\frac{2x-3}{4} + 6 \geq 2 + \frac{4x}{3} \Rightarrow 3(2x - 3) + 72 \geq 24 + 16x \Rightarrow 39 \geq 10x \Rightarrow x \leq 3.9$  .....  $1\frac{1}{2}$

Correct representation of  $x > 4$  and  $x \leq 3.9$  on two number lines ..... 1

There is no value of  $x$  satisfying both ; hence the solution set is  $\phi$  ..... 1

**OR**

$8.2 < \frac{8.48 + 8.35 + x}{3} < 8.5$  .....  $1\frac{1}{2}$

$24.6 < 16.83 + x < 25.5$  .....  $1\frac{1}{2}$

$7.77 < x < 8.67$  ; the third reading must lie between 7.77 and 8.67 ..... 2

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

Q.36 (i)  $C \cap B = \{2, 3\}$  ..... 1 4

(ii)  $C \cup B = \{1, 2, 3, 5, 6, 8, 9\}$  ..... 1

(iii)  $C' = \{4, 6, 7, 9, 10\}$  — those who do not play cricket ;  $B - C = \{6, 9\}$  — those who play only badminton ..... 2

**OR**

(iii)  $(C \cup B)' = \{4, 7, 10\}$  ;  $C' \cap B' = \{4, 7, 10\}$  ; hence verified ..... 2

Q.37 (i)  $y = 200 + 2x$  ..... 1 4

(ii)  $y = 200 + 2(30) = ₹ 260$  ..... 1

(iii)  $350 = 200 + 2x \Rightarrow x = 75$  ; data consumed = 75 GB ..... 2

**OR**

(iii) Domain =  $[0, 100]$  ; when  $x = 0, y = 200$  and when  $x = 100, y = 400$ , so range =  $[200, 400]$  ..... 2

Q.38 (i)  $R = \{(1, 2), (2, 4), (3, 6)\}$  ..... 1 4

(ii) Domain of  $R = \{1, 2, 3\}$  ; Range of  $R = \{2, 4, 6\}$  ..... 1

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

Total number of relations from  $A$  to  $B = 2^9 = 512$  ..... 2

**OR**

(iii)  $n(A \times B) = 3 \times 3 = 9$  ; relations containing exactly one ordered pair = 9  
..... 2