PRACTICE PAPER

ICSE CLASS 10 – MATHEMATICS

Chapter 4 : Linear Inequations (in one variable)

STEP-BY-STEP SOLUTIONS & MARKING SCHEME · Maximum Marks: 40

Rules used:

Adding / subtracting the same number, or multiplying / dividing by a **positive** number, keeps the sign of inequality.

Multiplying / dividing by a **negative** number **reverses** the sign. | On the number line: ○ = end-point not included (< or >), ● = end-point included (≤ or ≥).

"and" ⇒ take the part common to both (∩) | "or" ⇒ take all points that satisfy either one (∪).

SECTION A (20 Marks)

Question 1 [8 × 1 = 8]

Part	Ans.	Working
(i)	**(a)**	$3x < 12 \Rightarrow x < 4$; for $x \in N$ the solution set is {1, 2, 3}.
(ii)	**(c)** $x \le -4$	Dividing by −2 reverses the sign: $x \le -4$.
(iii)	**(b)** 4	$3x < 13 \Rightarrow x < 4\frac{1}{3}$; the largest integer less than $4\frac{1}{3}$ is 4.
(iv)	**(b)**	Dividing $-4x < 12$ by −4 reverses the sign, giving $x > -3$. So (A) is false and (R) is true.
(v)	**(d)**	Hollow circle at −2 (not included) and solid circle at 4 (included): $-2 < x \le 4$.
(vi)	**(c)** 5	$-4 < 2x \le 6 \Rightarrow -2 < x \le 3$; for $x \in Z$ the solution set is {−1, 0, 1, 2, 3}, which has 5 elements.
(vii)	**(a)** 3	$-3x < -6 \Rightarrow x > 2$ (sign reversed); the smallest integer greater than 2 is 3.
(viii)	**(d)**	$x - 1 > 2 \Rightarrow x > 3$; with $x \le 6$ the common part is $3 < x \le 6$, so (A) is true. (R) is also true, but it only describes the convention for the graph and does not explain the solution in (A).

Question 2 [4 + 4 + 4 = 12]

(i)

$7 - 2(x - 3) > 3x - 12 \Rightarrow 7 - 2x + 6 > 3x - 12 \Rightarrow 13 - 2x > 3x - 12 \Rightarrow 25 > 5x \Rightarrow \mathbf{x < 5}$

Correct simplification to $x < 5$ [1]

(a) $x \in N$: solution set = **{1, 2, 3, 4}** [1]

(b) $x \in W$: solution set = **{0, 1, 2, 3, 4}** [1]

(c) $x \in R$: solution set = **$\{x : x < 5, x \in R\}$** [1]

(ii)

$-7 < 3x - 4 \le 11 \Rightarrow$ (adding 4 to each part) $-3 < 3x \le 15$ [1]

Dividing each part by 3: $-1 < x \le 5$ [1]

Solution set = **$\{x : -1 < x \le 5, x \in R\}$** [1]

Number line: [1]



(iii)

(a) Multiplying by 6: $42 - 4x < 18 - x \Rightarrow 24 < 3x \Rightarrow x > 8$ [1]

The smallest integer greater than 8 is **9** (check: $x = 8$ gives $1\frac{2}{3} < 1\frac{2}{3}$, which is false) [1]

(b) Multiplying by 12: $3(3y + 1) - 4(y - 2) \le 24 \Rightarrow 9y + 3 - 4y + 8 \le 24$ [1]

$5y \le 13 \Rightarrow y \le 2.6$; the largest integer is **2** [1]

SECTION B (20 Marks) — any two questions

Question 3 [3 + 3 + 4 = 10]

(i)

$3x - 4 < x + 6 \Rightarrow 2x < 10 \Rightarrow x < 5$ [1]

$x + 6 \le 2x + 9 \Rightarrow -3 \le x$ [1]

So $-3 \le x < 5$, $x \in Z$. Solution set = **{−3, −2, −1, 0, 1, 2, 3, 4}** [1]

(ii)

Multiplying each part by 4: $-10 < 2x - 1 \le 3$ [1]

Adding 1 and dividing by 2: $-9 < 2x \le 4 \Rightarrow -4.5 < x \le 2$ [1]

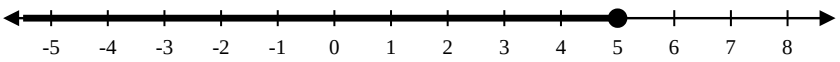
$x \in Z \Rightarrow$ solution set = **{−4, −3, −2, −1, 0, 1, 2}** [1]

(iii)

P: $5x - 3 \le 3x + 7 \Rightarrow 2x \le 10 \Rightarrow x \le 5$. Q: $4x + 1 > 2x - 5 \Rightarrow 2x > -6 \Rightarrow x > -3$.

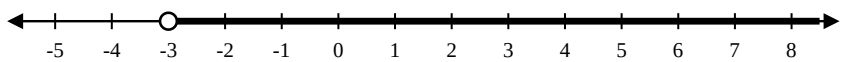
(a) $P = \{x : x \le 5, x \in R\}$ [1]

P



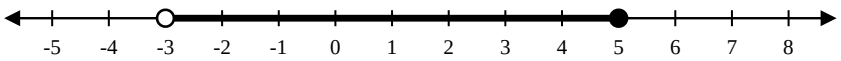
(b) $Q = \{x : x > -3, x \in R\}$ [1]

Q



(c) $P \cap Q$ = **{x : −3 < x ≤ 5, x ∈ R}** [1]

P∩Q



(d) $P' \cap Q = Q - P$ = elements of Q not in P = **x > 5** [1]

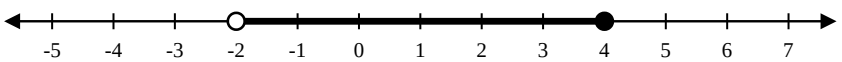
Question 4 [3 + 3 + 4 = 10]

(i)

$3(x - 2) \ge 5x - 14 \Rightarrow 3x - 6 \ge 5x - 14 \Rightarrow 8 \ge 2x \Rightarrow x \le 4$ [1]

$2x + 3 > -1 \Rightarrow 2x > -4 \Rightarrow x > -2$ [1]

Common solution: **−2 < x ≤ 4** [1]

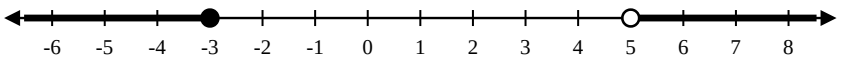


(ii)

$4 - 3x \ge 13 \Rightarrow -3x \ge 9 \Rightarrow x \le -3$ (sign reversed) [1]

$2x - 3 > 7 \Rightarrow 2x > 10 \Rightarrow x > 5$ [1]

Solution set = **{x : x ≤ −3 or x > 5, x ∈ R}** [1]

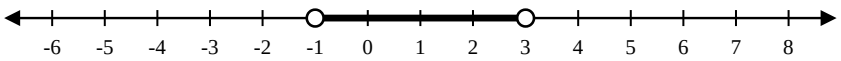


(iii)

(a) P = **{x : −4 ≤ x < 3, x ∈ R}**; Q = **{x : −1 < x ≤ 6, x ∈ R}** [1]

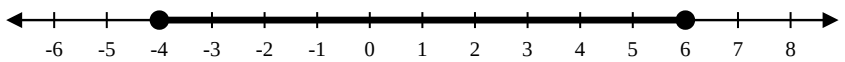
(b) P ∩ Q = numbers common to both = **{x : −1 < x < 3, x ∈ R}** [1]

P∩Q



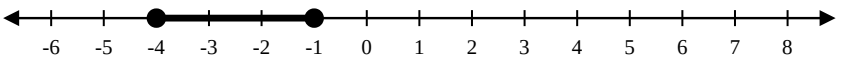
(c) P ∪ Q = numbers in P or Q or both = **{x : −4 ≤ x ≤ 6, x ∈ R}** [1]

P∪Q



(d) P − Q = numbers in P but not in Q = **{x : −4 ≤ x ≤ −1, x ∈ R}** (−1 is in P but not in Q, so it is included) [1]

P−Q



Question 5 [3 + 3 + 4 = 10]

(i)

(a) A = **{x : x ≥ −2, x ∈ R}** (solid circle at −2, arrow to the right) [1]

B = **{x : −4 ≤ x ≤ 2, x ∈ Z}** = {−4, −3, −2, −1, 0, 1, 2} [1]

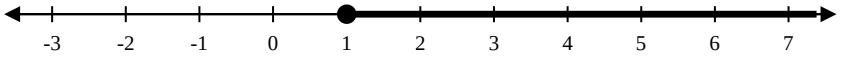
(b) A ∩ B = elements of B which are ≥ −2 = **{−2, −1, 0, 1, 2}** [1]

(ii)

Multiplying by 10: 2(2x + 3) − 5(x − 1) ≤ 10 ⇒ 4x + 6 − 5x + 5 ≤ 10 [1]

−x + 11 ≤ 10 ⇒ −x ≤ −1 ⇒ **x ≥ 1** (sign reversed on dividing by −1) [1]

Number line (x ∈ R): [1]

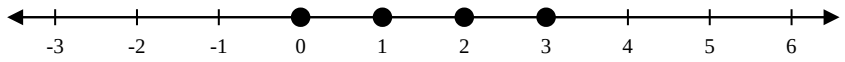


(iii)

−3 ≤ 2x − 1 < 7 ⇒ −2 ≤ 2x < 8 ⇒ **−1 ≤ x < 4** [1]

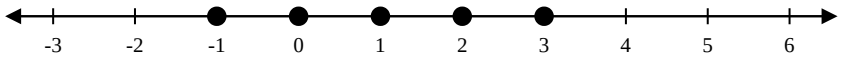
(a) x ∈ W: {0, 1, 2, 3} [1]

W



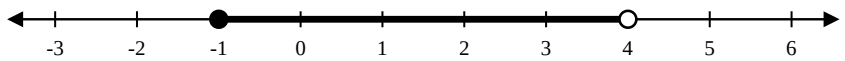
(b) x ∈ Z: {−1, 0, 1, 2, 3} [1]

Z



(c) x ∈ R: {x : −1 ≤ x < 4, x ∈ R} [1]

R



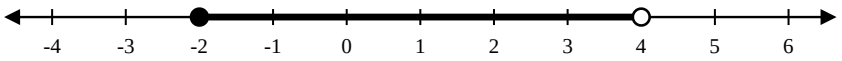
Question 6 [3 + 3 + 4 = 10]

(i)

$-3 < 5 - 2x \le 9 \Rightarrow$ (subtracting 5) $-8 < -2x \le 4$ [1]

Dividing each part by -2 reverses both signs: $4 > x \ge -2$, i.e. $\mathbf{-2 \le x < 4}$ [1]

Number line: [1]



(ii)

A: $-2 \le 3x + 1 < 16 \Rightarrow -3 \le 3x < 15 \Rightarrow -1 \le x < 5$; A = {−1, 0, 1, 2, 3, 4} [1]

B: $5x - 7 \ge 2x - 1 \Rightarrow 3x \ge 6 \Rightarrow x \ge 2$; B = {2, 3, 4, 5, …} [1]

(a) A ∩ B = **{2, 3, 4}** (b) A − B = **{−1, 0, 1}** [1]

(iii)

Let the three consecutive natural numbers be n, n + 1 and n + 2.

$3n + 2(n + 2) > 40$ [1]

$5n + 4 > 40 \Rightarrow 5n > 36 \Rightarrow n > 7.2$ [1]

The smallest natural number greater than 7.2 is n = 8 [1]

The numbers are **8, 9 and 10** (check: $3 \times 8 + 2 \times 10 = 44 > 40$, whereas for 7, 8, 9 we get 21 + 18 = 39, which is not greater than 40) [1]

— End of Solutions —