CLASS XI – MATHEMATICS (041)

CHAPTER 5 : LINEAR INEQUALITIES

PRACTICE PAPER – STEP-BY-STEP SOLUTIONS & MARKING SCHEME

Section A – Answer Key (1 mark each)

Q1	Q2	Q3	Q4	Q5	Q6	Q7
D	B	A	C	D	C	A
Q8	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**
B	A	C	B	D	A	C

SECTION – A (14 × 1 = 14)

Multiple Choice and Assertion–Reason Questions

Q1. Answer: (D) — 1 mark

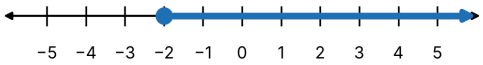
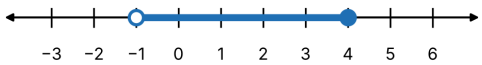


Fig. 1 has a **dark** (closed) circle at −2 and the line shaded to the right: $x \geq -2$.
$3x + 4 \geq -2 \Rightarrow 3x \geq -6 \Rightarrow x \geq -2$ ✓.
Check the others: $3x + 4 \leq -2$ gives $x \leq -2$; $3x + 4 > -2$ gives $x > -2$ (open circle); $-3x + 4 \geq -2$ gives $-3x \geq -6$, i.e. $x \leq 2$.

Q2. Answer: (B) — 1 mark



The circle at −1 is open (−1 is not included) and the circle at 4 is dark (4 is included).
So $-1 < x \leq 4$, i.e. the interval **$(-1, 4]$**.

Q3. Answer: (A) — 1 mark

$4x - 5 < 11 \Rightarrow 4x < 16 \Rightarrow x < 4$.
Natural numbers less than 4: **{1, 2, 3}**.

Q4. Answer: (C) — 1 mark

Divide both sides by −3 (a negative number), so the sign is reversed: $x \leq 12 \div (-3) \Rightarrow$ **$x \leq -4$**.

Q5. Answer: (D) — 1 mark

$3x - x > 5 + 7 \Rightarrow 2x > 12 \Rightarrow x > 6$.
Solution set = **$(6, \infty)$**.

Q6. Answer: (C) — 1 mark

Add 3 to all three parts: $-4 \leq 2x < 12$.
Divide by 2: $-2 \leq x < 6$. Solution set = **$[-2, 6)$**.

Q7. Answer: (A) — 1 mark

Multiply by 6 (LCM of 3 and 2): $2(2x - 1) \geq 3(x + 2) - 6$.
$4x - 2 \geq 3x + 6 - 6 = 3x \Rightarrow x \geq 2$. Solution set = **$[2, \infty)$**.

Q8. Answer: (B) — 1 mark

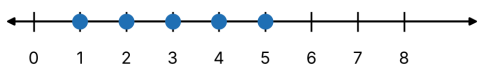


Fig. 3 shows the natural numbers 1, 2, 3, 4, 5 as solutions, and 6 is not a solution.
$3x \leq 16 \Rightarrow x \leq 16/3 = 5\frac{1}{3}$, so the natural number solutions are 1, 2, 3, 4, 5 ✓.
Check the others: $3x < 15$ gives 1–4; $3x \leq 12$ gives 1–4; $3x \leq 21$ gives 1–7.

Q9. Answer: (A) — 1 mark

Money left = 200 − 35 = ₹165. Let n be the number of notebooks: $18n \leq 165 \Rightarrow n \leq 9.17$.
n must be a whole number, so the maximum is **9**.

Q10. Answer: (C) **1 mark**

Subtract 1 from all parts: $-4 < 2x \leq 8$, then divide by 2: $-2 < x \leq 4$.
Integers: $-1, 0, 1, 2, 3, 4 \rightarrow$ **6** integers.

Q11. Answer: (B) **1 mark**

Let the smaller odd number be x. Then $x > 8$ and $x + (x + 2) < 36 \Rightarrow 2x < 34 \Rightarrow x < 17$.
So $8 < x < 17$ with x odd: $x = 9, 11, 13, 15$. The pairs are (9, 11), (11, 13), (13, 15), (15, 17) → **4** pairs.

Q12. Answer: (D) **1 mark**

$x + 5 > 2x - 1 \Rightarrow 6 > x$, i.e. $x < 6$.
$2x + 3 \geq 7 \Rightarrow 2x \geq 4 \Rightarrow x \geq 2$.
Common solution: $2 \leq x < 6$, i.e. **[2, 6)**.

Q13. Answer: (A) **1 mark**

$-2x < 8$: divide by -2 and reverse the sign $\Rightarrow x > -4$. Assertion is true.
Reason is the rule that says exactly this, and it is the reason the sign was reversed → option (A).

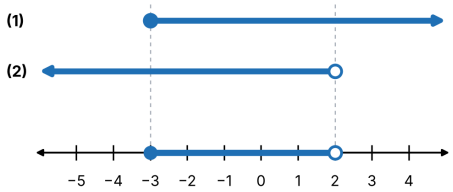
Q14. Answer: (C) **1 mark**

$3x + 2 \geq 8 \Rightarrow 3x \geq 6 \Rightarrow x \geq 2$. For natural numbers the solution set is {2, 3, 4, . . .}. Assertion is true.
The solution set of $ax + b \geq c$ is a ray such as $[k, \infty)$ or $(-\infty, k]$, which is not a bounded interval. Reason is false → option (C).

SECTION – B (4 × 2 = 8)

Very Short Answer Questions

Q15. 2 marks



(i) Graph (1) has a dark circle at −3 and the arrow points right: **x ≥ −3**. Graph (2) has an open circle at 2 and the arrow points left: **x < 2**. **[1]**

(ii) Values of x common to both satisfy −3 ≤ x < 2. Solution set = **[−3, 2)**. **[1]**

Q16. 2 marks

7x − 3 ≤ 4x + 9 ⇒ 7x − 4x ≤ 9 + 3 ⇒ 3x ≤ 12 ⇒ x ≤ 4. **[½]**

(i) x a natural number: solution set = **{1, 2, 3, 4}**. **[½]**

(ii) x a real number: solution set = **(−∞, 4]**. **[1]**

Q17. 2 marks

(A) Multiply by 6: 2(2x + 5) > 3(x − 1) + 6 ⇒ 4x + 10 > 3x + 3. **[1]**

⇒ x > −7. Solution set = **(−7, ∞)**. **[1]**

OR (B) 5x − 5 ≤ 6x + 3. **[1]**

⇒ −5 − 3 ≤ 6x − 5x ⇒ −8 ≤ x, i.e. x ≥ −8. Solution set = **[−8, ∞)**. **[1]**

Q18. 2 marks

(A) Subtract 6 from all parts: −15 ≤ 3x < 9. **[1]**

Divide by 3: **−5 ≤ x < 3**, i.e. x ∈ [−5, 3). **[1]**

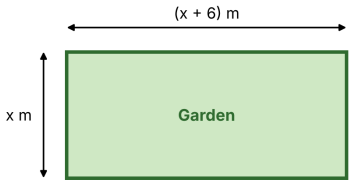
OR (B) Let x be the third mark: (56 + 68 + x)/3 ≥ 65. **[1]**

124 + x ≥ 195 ⇒ x ≥ 71. Minimum mark required = **71**. **[1]**

SECTION – C (3 × 3 = 9)

Short Answer Questions

Q19. 3 marks



(i) Perimeter = 2(length + breadth) = 2[(x + 6) + x] = **(4x + 12) m**. **[1]**

(ii) The fencing available is at most 60 m: $4x + 12 \leq 60 \Rightarrow 4x \leq 48 \Rightarrow x \leq 12$. Since a breadth must be positive, $0 < x \leq 12$. **[1]**

(iii) Greatest breadth = **12 m**; the corresponding length = x + 6 = **18 m**. **[1]**

Q20. 3 marks

(A) Multiply by 6: $2(x - 1) + 3(x + 2) \leq 24$. **[1]**

$2x - 2 + 3x + 6 \leq 24 \Rightarrow 5x + 4 \leq 24$. **[1]**

$5x \leq 20 \Rightarrow x \leq 4$. Solution set = **$(-\infty, 4]$**. **[1]**

OR (B) Multiply all parts by 3: $3 \leq 5 - 2x \leq 9$. **[1]**

Subtract 5: $-2 \leq -2x \leq 4$. **[1]**

Divide by −2 and reverse both signs: $1 \geq x \geq -2$, i.e. **$-2 \leq x \leq 1$**; solution set = $[-2, 1]$. **[1]**

Q21. 3 marks

(A) $2x + 5 \geq 1 \Rightarrow 2x \geq -4 \Rightarrow x \geq -2$ ...(1) **[1]**

$3x - 7 < 8 \Rightarrow 3x < 15 \Rightarrow x < 5$ ...(2) **[1]**

Common solution: $-2 \leq x < 5$, i.e. **$[-2, 5)$**. On the number line: a dark circle at −2, an open circle at 5, and the part between them shaded. **[1]**

OR (B) Revenue = ₹40x; cost = ₹(20x + 3000). Profit requires revenue > cost: $40x > 20x + 3000$. **[1]**

$20x > 3000 \Rightarrow x > 150$. **[1]**

Since x is a whole number of toys, the manufacturer must produce and sell at least **151 toys**. **[1]**

SECTION – D (1 × 5 = 5)

Long Answer Question

Q22. **5 marks**

(A) Let x litres of the 40% solution be added. Acid in the mixture = 40% of x + 10% of 300 = 0.4x + 30 litres; total mixture = (x + 300) litres. **[1]**

We need 20% of (x + 300) < 0.4x + 30 < 25% of (x + 300). **[1]**

Left part: 0.2x + 60 < 0.4x + 30 ⇒ 30 < 0.2x ⇒ x > 150. **[1]**

Right part: 0.4x + 30 < 0.25x + 75 ⇒ 0.15x < 45 ⇒ x < 300. **[1]**

Hence 150 < x < 300: more than **150 litres** but less than **300 litres** of the 40% solution must be added. **[1]**

OR (B) Let the shortest piece be x cm. Then the second piece = (x + 5) cm and the third piece = 3x cm. **[1]**

Total length available is 100 cm: x + (x + 5) + 3x ≤ 100 ⇒ 5x + 5 ≤ 100 ⇒ 5x ≤ 95 ⇒ x ≤ 19. **[1]**

Third piece at least 10 cm longer than the second: 3x ≥ (x + 5) + 10 ⇒ 2x ≥ 15 ⇒ x ≥ 7.5. **[1]**

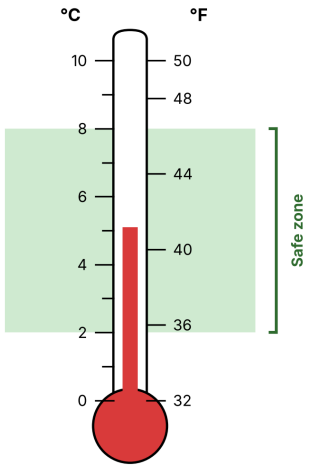
Combining: 7.5 ≤ x ≤ 19. **[1]**

The shortest piece can have any length from **7.5 cm to 19 cm** (both included). **[1]**

SECTION – E **(1 × 4 = 4)**

Case Study Based Question

Q23. **4 marks**



(i) The safe zone in Fig. 6 runs from 2 to 8 on the Celsius scale: **2 ≤ C ≤ 8**. **[1]**

(ii) F = (9/5)C + 32. Multiply 2 ≤ C ≤ 8 by 9/5: 3.6 ≤ (9/5)C ≤ 14.4; add 32: 35.6 ≤ F ≤ 46.4. Safe range = **35.6°F to 46.4°F**. **[1]**

(iii)(a) C = (5/9)(F − 32). Given 59 ≤ F ≤ 68 ⇒ 27 ≤ F − 32 ≤ 36. **[1]**

Multiply by 5/9: 15 ≤ C ≤ 20. The storage range is **15°C to 20°C**. **[1]**

OR (b) We need 2 ≤ (3x − 4)/2 ≤ 8 ⇒ 4 ≤ 3x − 4 ≤ 16. **[1]**

Add 4: 8 ≤ 3x ≤ 20 ⇒ **8/3 ≤ x ≤ 20/3**. **[1]**

— End of Solutions —