# CHAPTER:- 6 LINEAR INEQUALITIES

## EXERCISE:- 6.1

Q.1. $24x < 100$

$\frac{24x}{24} < \frac{100}{24}$ (25 / 6)

$x < 4\frac{1}{6}$

(i). when $x \in N$,
soln. set $= \{4, 3, 2, 1\}$

(ii). when $x \in Z$,
soln. set $= \{4, 3, 2, 1, 0, -1, -2, -3, \ldots\}$

Q.2. $-12x > 30$

$\frac{-12x}{12} > \frac{30}{-12}$ (5 / 2)

$x < -5/2$

(i). When $x \in N$,
soln set $= \{\}$ or $\phi$

(ii). When $x \in Z$,
soln set $= \{-3, -4, -5, \ldots\}$

Q.3. $5x - 3 < 7$

$5x - 3 + 3 < 7 + 3$

$5x < 10$

$\frac{5x}{5} < 10/5$

$x < 2$

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(i). When $x \in N$,
soln. set = $\{1\}$

(ii). When $x \in Z$,
soln. set = $\{1, 0, -1, -2, -3, \ldots\}$

Q.4. $3x + 8 > 2$

$3x + 8 - 8 > 2 - 8$

$3x > -6$

$\frac{3x}{3} > \frac{-6}{3} \Rightarrow x > -2$

(i). When $x \in N$,
soln. set = $\{1, 2, 3, 4, \ldots\}$

(ii). When $x \in Z$,
soln. set = $\{-1, 0, 1, 2, 3, 4, \ldots\}$

Q.5. $4x + 3 < 6x + 7$

soln. $4x + 3 < 6x + 7$

$4x - 4x + 3 < 6x + 7 - 4x$

$3 < 2x + 7$

$-7 + 3 < 2x + 7 - 7$

$-4 < 2x \Rightarrow -2 < x$

$\therefore$ soln. set = $\{x : x \in R, -2 < x\}$
or = $(-2, \infty)$

Q.6. $3x - 7 > 5x - 1$

$3x - 7 - 3x > 5x - 3x - 1$

$-7 > 2x - 1$

$-7 + 1 > 2x$

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$\Rightarrow \quad -6 > 2x$

$-3 > x$

Q.7. $3(x-1) \leq 2(x-3)$

Soln. $3(x-1) \leq 2(x-3)$

$3x - 3 \leq 2x - 6$

$3x - 2x - 3 \leq 2x - 6 - 2x$

$x - 3 \leq -6$

$x - 3 + 3 \leq -6 + 3$

$x \leq -3$

$\therefore$ Solution set $= [-3, -\infty)$

or $\{x : x \in R, \ x \leq -3\}$

Q.8. $3(2-x) \geq 2(1-x)$

Soln. $3(2-x) \geq 2(1-x)$

$6 - 3x \geq 2 - 2x$

$6 - 3x + 3x \geq 2 - 2x + 3x$

$6 \geq 2 + x$

$6 - 2 \geq 2 + x - 2$

$4 \geq x$

$\therefore$ Solution set $= [4, -\infty)$

or $\{x : x \in R, \ x \leq 4\}$

Q.9. $x + \frac{x}{2} + \frac{x}{3} < 11$

Soln. $\frac{6x + 3x + 2x}{6x} < 11$

$\frac{11x}{6} < 11$

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$\Rightarrow \frac{11x}{6} \times 6 < 11 \times 6$

$11x/11 < 66/11$

$x < 6$

$\therefore$ Solution set $= (6, -\infty)$
or $\{x : x \in R, x < 6\}$

Q.10. $x/3 > x/2 + 1$

soln $x/3 > (x+2)/2$

$x/3 \times 6 > (x+2)/2 \times 6$

$2x > 3(x+2)$

$2x > 3x + 6$

$2x - 3x > 3x + 6 - 3x$

$-x > 6 \Rightarrow x < 6$

$\therefore$ Soln set $= (6, -\infty)$
or $\{x : x \in R, x < 6\}$

Q.11. $\frac{3(x-2)}{5} \leq \frac{5(2-x)}{3}$

$\frac{3(x-2) \times 15}{5} \leq \frac{5(2-x) \times 15}{3}$

$3(x-2) \times 3 \leq 5(2-x)5$

$9x - 18 \leq 50 - 25x$

$9x - 18 + 25x \leq 50 - 25x + 25x$

$34x - 18 + 18 \leq 50 + 18$

$34x \leq 68$

$x \leq 68/34$

$x \leq 2$

$\therefore$ Solution set $= [2, -\infty)$ or $\{x : x \in R, x \leq 2\}$

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Q.12. $\frac{1}{2}\left(\frac{3x}{5}+4\right) \geq \frac{1}{3}(x-6)$

soln. $\frac{1}{2}\times 6^{3}\left(\frac{3x}{5}+4\right) \geq \frac{1}{3}\times 6^{2}(x-6)$

$\frac{9x}{5}+12 \geq 2x-12$

$\frac{9x}{5}\times 5+12\times 5 \geq 2x\times 5-12\times 5$

$9x+60 \geq 10x-60$

$9x+60+60 \geq 10x-60+60$

$-9x+9x+120 \geq 10x-9x$

$120 \geq x$

Solution set $= (-\infty, 120]$

or $\{x : x \in R,\ x \leq 120\}$

Q.13. $2(2x+3)-10 < 6(x-2)$

soln $4x+6-10 < 6x-12$

$4x-4 < 6x-12$

$2x-2 < 3x-6$

$2x-2x-2+6 < 3x+6-6-2x$

$4 < x$

Solution set $= (4, \infty)$

Q.14. $37-(3x+5) \geq 9x-8(x-3)$

soln. $37-(3x+5) \geq 9x-8(x-3)$

$37-3x-5 \geq 9x-8x+24$

$32-3x \geq x+24$

$32-24-3x+3x \geq x+3x+24-24$

$8 \geq 4x$

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$8/4 \geq x$

$2 \geq x$

Solution set = $[2, -\infty)$

or $\{x : x \in R, x \leq 2\}$

Q.15. $\frac{x}{4} < \frac{(5x-2)}{3} - \frac{(7x-3)}{5}$

$\frac{x}{4} \times 60 < \frac{(5x-2)}{3} \times 60 - \frac{(7x-3)}{5} \times 60$

$15x < 100x - 120 - 84x - 36$

$15x < 16x - 156$

$+156 + 15x - 15x < 16x - 15x - 156 + 156$

$156 < x$

Solution set = $(156, \infty)$

or $\{x : x \in R, x > 156\}$

Q.16. $\frac{(2x-1)}{3} \geq \frac{(3x-2)}{4} - \frac{(2-x)}{5}$

$\frac{(2x-1) \times 60^{20}}{3} \geq \frac{(3x-20) 60^{15}}{4} - \frac{(2-x)}{5} \times 60^{12}$

$40x - 20 \geq 45x - 300 - 24 + 12x$

$40x - 20 \geq 57x - 324$

$40x - 20 - 40x + 324 \geq 57x - 40x - 324 + 324$

$304 \geq 17x$

$\frac{304}{17} \geq x$

$17\frac{15}{17} \geq x$

Solution set = $[17\frac{15}{17}, -\infty)$

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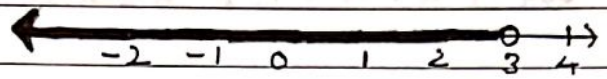
Q.17. $3x - 2 < 2x + 1$

soln. $3x - 2 < 2x + 1$

$3x - 2 - 2x^{+2} < 2x + 1 - 2x + 2$

$x < 3$



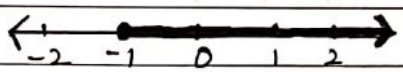

Q.18. $5x - 3 \geq 3x - 5$

soln. $5x - 3 - 3x + 3 \geq 3x - 3x + 3 - 5$

$2x \geq -2$

$x \geq -2/2$

$x \geq -1$



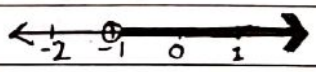

Q.19. $3(1 - x) < 2(x + 4)$

$3 - 3x < 2x + 8$

$3 - 8 - 3x + 3x < 2x + 3x + 8 - 8$

$-5 < 5x$

$-1 < x$




Q.20. $\frac{x}{2} < \frac{(5x - 2)}{3} - \frac{(7x - 3)}{5}$

soln $x/2 < (5x - 2)/3 - (7x - 3)/5$

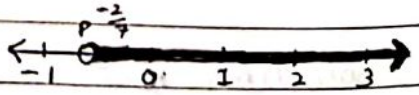
$\frac{x}{2} \times 30^{15} < \frac{(5x - 2)}{3} \times 30^{10} - \frac{(7x - 3)}{5} \times 30^{6}$

$15x < 50x - 20 - 42x + 18$

$15x < 8x - 2$

$7x < -2$

$x < -2/7$

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Q.21. least marks to be obtained to get 60 mark avg
= x (say)

then,

$$\frac{70 + 75 + x}{3} \geq 60$$

$$145 + x \geq 180$$

$$x \geq 180 - 145$$

$$x \geq 35$$

⇒ for at least 60 marks or more avg., he should get marks ≥ 35

⇒ Marks in 3rd subject ≥ 35.

Q.22. marks to be obtained in 5th subject to get 90 marks avg. or more = x (say)

then,

$$\frac{87 + 92 + 94 + 95 + x}{5} \geq 90$$

$$368 + x \geq 450$$

$$x \geq 450 - 368$$

$$x \geq 82$$

⇒ for A grade,
Marks in 5th subject ≥ 82

Q.23. let the odd no.s be x & x+2 respectively,
then, $x < 10$ (given).

$$x + (x+2) > 11$$

$$2x > 9 \Rightarrow x > 9/2 \Rightarrow x > 4\tfrac{1}{2}$$

∴ Solution set = {{5, 7}, {7, 9}}

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Q.24 let the numbers be $x$ & $x+2$ resp.,

$x > 5$, (given)

a/q, $x + (x+2) < 23$

$2x < 21$

$x < 10\frac{1}{2}$

$\therefore$ Solution set $= \{\{6, 8\}, \{8, 10\}, \{10, 12\}\}$

Q.25 let the shortest side be $x$,

then,

longest side $= 3x$

~~second~~ third side $= 3x - 2$

a/q, $x + 3x + 3x - 2 \text{ cm} \geq 61 \text{ cm}$

$7x \geq 63 \text{ cm}$

$x \geq 9 \text{ cm}$

$\therefore$ soln. set of shortest side $= \{9, 10, 11, 12, \ldots\}$

Minimum length of shortest side $= 9 \text{ cm}$.

Q.26 length of shortest board be $x$,

then, 2nd piece $= (x+3)$ & 3rd piece $= 2x$

a/q,

$x + (x+3) + 2x \leq 91$ & $2x \geq (x+3) + 5$

$4x \leq 88$ $\quad x \geq 8 \quad \ldots(iii)$

$x \leq 22 \quad \ldots(ii)$

from (i) & (iii),

$8 \leq x \leq 22$

$\therefore$ soln set of the shortest board $=$

$\{8, 9, 10, \ldots, 22\}$

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