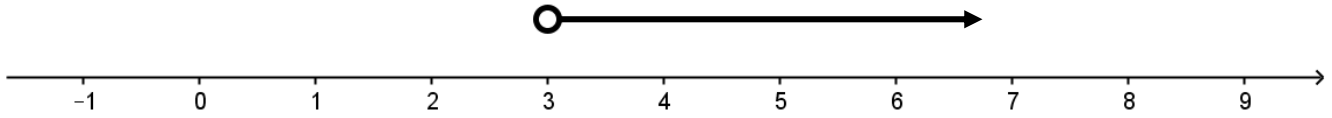**Worksheet 9 Memorandum: Inequalities**

**Grade 10 Technical Mathematics**

1.  a)  set builder notation  - the notation used to describe variables and their properties.

    b)  number line  - a line marked with set intervals to show a set of numbers

    c)  set  - a set is a collection of objects or numbers.

    d)  [ and ]  - square brackets show that the number is included in the interval (greater than or less than and equal to)

    e)  ( and )  - round brackets show that the number is not included in the

        interval (only greater than or less than, NOT equal to).

    f)  >  - means greater than

    g)  ≥  - means greater than and equal to

    h)  **O**  - means not included in the interval.


2.  a)  $[3; 6)$  $\rightarrow \{x \in R: 3 \leq x < 6\}$

    b)  $x \epsilon Z, x \epsilon (-4; 5]$  $\rightarrow \{x \in Z: -4 < x \leq 5\}$

    c)  $\{x \in R: x \geq 4\}$

    d)  $\{x \in R: -4 \leq x < 3\}$
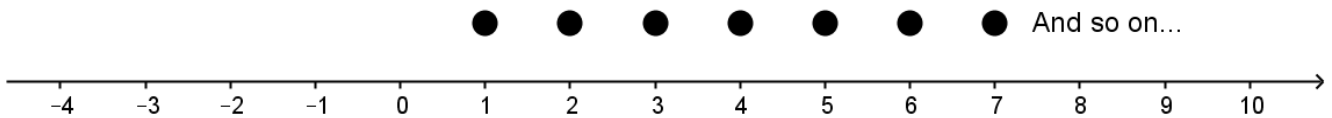
    e)  $\{x \in R: x < 2\}$


3.  a)  $x \in (-6; 2)$
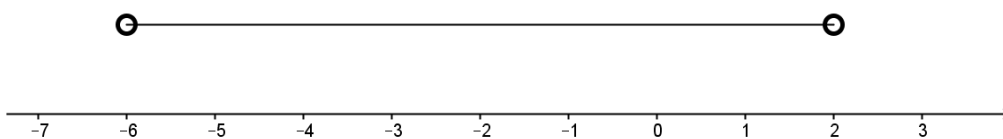
b) $\{x \in R : x > 3\}$



c) $y \in Z \text{ and } [-3; 7)$



d) $\{x \in N : x \geq -2\}$



And so on...
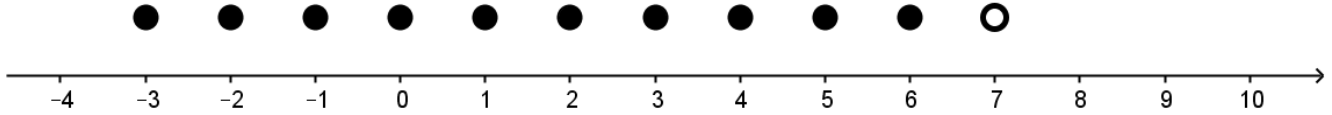
e) $\{x \in R : -4 < x \leq 5\}$
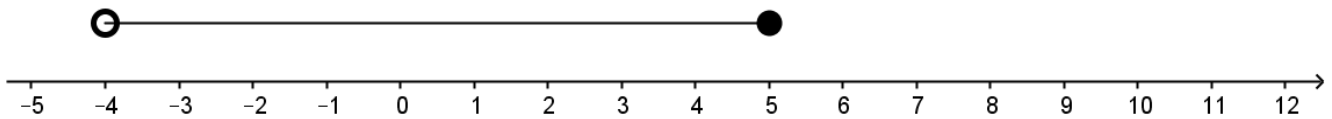


4.  a) $3x + 6 < 0$
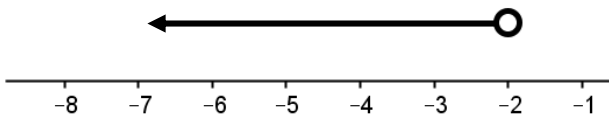
$3x < -6$
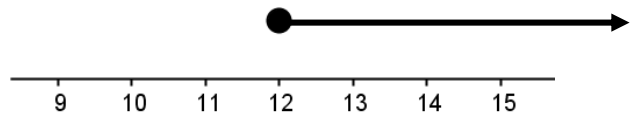
$x < -2$



b) $\frac{1}{3}x - 4 \geq 0$

$\frac{1}{3}x \geq 4$

$x \geq 12$
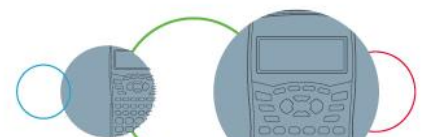


c) $5(x - 7) \leq 4$

$5x - 35 \leq 4$

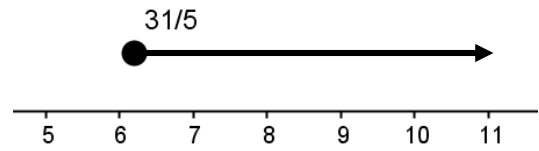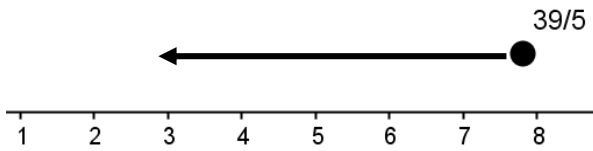$5x \leq 39$

$x \leq \frac{39}{5} \text{ or } 7\frac{4}{5}$

d) $5(7 - x) \leq 4$

$35 - 5x \leq 4$

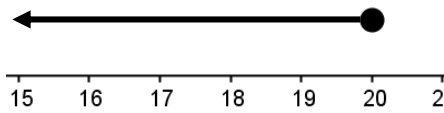$-5x \leq -31$

$x \geq \frac{31}{5} \text{ or } 6\frac{1}{5}$

39/5

31/5

e)   $3(x + 4) > 4(x - 2)$

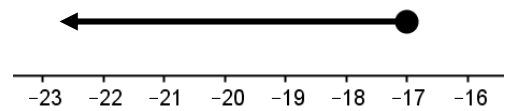$3x + 12 > 4x - 8$

$3x - 4x > -8 - 12$

$-x > -20$

$x < 20$

f)   $\frac{1}{2}(x - 7) \geq x + 5$

$\frac{1}{2}x - \frac{7}{2} \geq x + 5$

$\frac{1}{2}x - x \geq 5 + \frac{7}{2}$
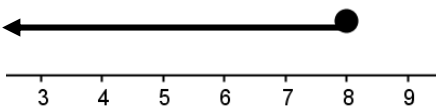
$-\frac{1}{2}x \geq 8\frac{1}{2}$

$x \leq -17$

g)   $6(x - 3) - 3(x + 2) \leq 0$
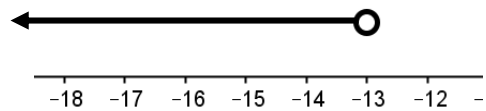
$6x - 18 - 3x - 6 \leq 0$

$3x \leq 24$

$x \leq 8$

h)   $(x + 3)(x - 5) < (x + 4)(x - 7)$

$x^2 + 3x - 5x - 15 < x^2 + 4x - 7x - 28$

$x^2 - x^2 + 3x - 5x - 4x + 7x < -28 + 15$

$x < -13$
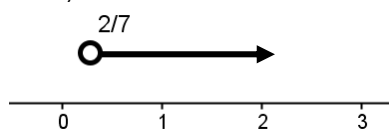
i)   $\frac{x+4}{3} + \frac{x-2}{4} > 1$

$\frac{4(x+4)+3(x-2)}{12} > \frac{12}{12}$
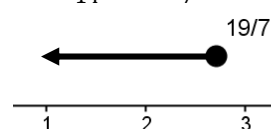
$4x + 16 + 3x - 6 > 12$

$7x > 2$

$x > \frac{2}{7}$

2/7

j)   $7(3 - x) - 4(x + 1) \geq 3(x - 7)$

$21 - 7x - 4x - 4 \geq 3x - 21$

$-11x - 3x \geq -21 - 21 + 4$

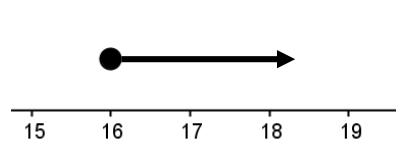$-14x \geq -38$

$x \leq \frac{38}{14} \ \ or \ 2\frac{5}{7}$

19/7

k) $(x-8)(x+9) \geq (x+4)(x-6)$

$x^2 + x - 72 \geq x^2 - 2x - 24$
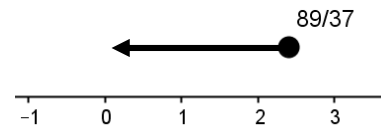
$x + 2x \geq -24 + 72$

$3x \geq 48$

$x \geq 16$



l) $\frac{3+x}{5} - \frac{x-6}{7} < 4 - x$

$\frac{7(3+x) - 5(x-6)}{35} < \frac{35(4-x)}{35}$

$21 + 7x - 5x + 30 < 140 - 35x$

$37x < 89$

$x < \frac{89}{37} \ or \ 2\frac{15}{37}$



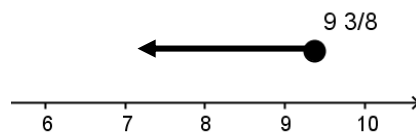m) $5(x-3) + 12(x-11) \leq x + 3$

$5x - 15 + 12x - 132 \leq x + 3$

$17x - x \leq 3 + 15 + 132$

$16x \leq 150$

$x \leq \frac{150}{16} \ \ or \ 9\frac{3}{8}$
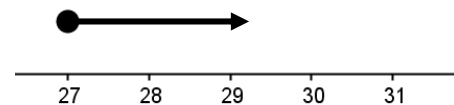


n) $\frac{1}{3}(x+3) - 3 \geq 7$

$\frac{1}{3}x + 1 - 3 \geq 7$

$\frac{1}{3}x \geq 9$

$x \geq 27$



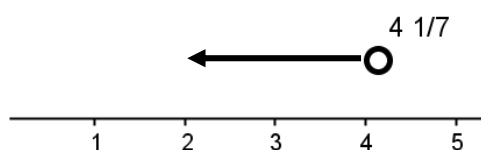o) $6(x-3) < 4(8-x) + 3(x-7)$

$6x - 18 < 32 - 4x + 3x - 21$

$6x + 4x - 3x < 32 - 21 + 18$

$7x < 29$

$x < \frac{29}{7} \ \ or \ 4\frac{1}{7}$



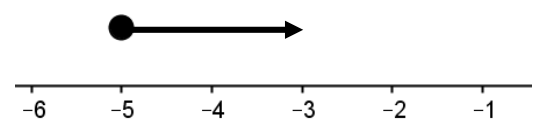p) $\frac{x-3}{2} - \frac{x-4}{3} \leq \frac{x+5}{5} + \frac{x-1}{6}$

$\frac{15(x-3) - 10(x-4)}{30} \leq \frac{6(x+5) + 5(x-1)}{30}$

$\frac{15x - 45 - 10x + 40}{30} \leq \frac{6x + 30 + 5x - 5}{30}$
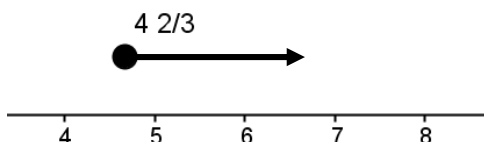
$5x - 11x \leq 25 + 5$

$-6x \leq 30$

$x \geq -5$

q) $(x - 5)(x + 2) \geq (x - 6)(x - 3)$

$x^2 - 3x - 10 \geq x^2 - 9x + 18$

$-3x + 9x \geq 18 + 10$

$6x \geq 28$

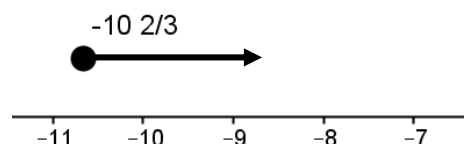$x \geq \frac{28}{6} \ \ or \ 4\frac{2}{3}$

4 2/3



| 4 | 5 | 6 | 7 | 8 |

r) $\frac{1}{2}(x + 4) - \frac{1}{4}(x - 4) \geq \frac{1}{3}$

$\frac{1}{2}x + 2 - \frac{1}{4}x + 1 \geq \frac{1}{3}$

$\frac{1}{4}x \geq \frac{1}{3} - 2 - 1$

$\frac{1}{4}x \geq -2\frac{2}{3}$

$x \geq -10\frac{2}{3}$

-10 2/3



| −11 | −10 | −9 | −8 | −7 |

5.  a)  Income > Cost will give profit          Let $x$ = the number of bottles sold

$\therefore 45x > 16000 + 17x$

$\therefore 45x - 17x > 16\ 000$

$\therefore 28x > 16\ 000$

$\therefore x > 571\frac{3}{7}$

$\therefore$ The company needs to sell at least 572 bottles in order to start making a profit.


b)  Cost < R22          Let $x$ = number of km
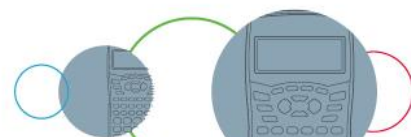
$\therefore 10 + 0.3x < 22$

$\therefore 0.3x < 12$

$\therefore x < 40$

$\therefore$ You can travel a maximum of 40km in the taxi.

c)    Area = length x breadth

$\therefore (x+2)(x-3) \le (x-4)(x+6)$

$\therefore x^2 - x - 6 \le x^2 + 2x - 24$

$\therefore -x - 2x \le -24 + 6$

$\therefore -3x \le -18$

$\therefore x \ge 6$

d)    When the first contract < the second contract, the first contact is better (cheaper)

$\therefore 150 + x < 2.5x$            Let $x$ = number of minutes

$\therefore 150 < 1.5x$

$\therefore 100 < x$

$\therefore$ The first contract will be better if you spend less than 100 minutes on the phone per month.

e)    $s \le ut + \frac{1}{2}at^2$                  $u = \frac{60km}{1h} = \frac{60 \times 1000m}{60 \times 60 \, seconds} = 16\frac{2}{3}m/s$

$150 \le 16\frac{2}{3}(3) + \frac{1}{2}a(3)^2$

$150 - 50 \le \frac{9}{2}a$

$\frac{100}{\frac{9}{2}} \le a$

$22\frac{2}{9} \, m/s^2 \le a$

OR $a \ge 22\frac{2}{9} \times \frac{60 \times 60}{1000} = 80km/h$

The bus needs to slow down at a minimum speed of 80km/h.