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Ch# 03

Theory of Quadratic Functions

Quadratic Functions:-

A quadratic function is a polynomial function of degree two. It is typically expressed in standard form:

$$f(x) = ax^2 + bx + c$$

where a, b and c are real numbers, and $a \neq 0$.

Ex 3.1

Q1:- (i) $f(x) = x^2 + 6x + 13$

Sol:- $f(x) = x^2 + 6x + 9 + 4$

$f(x) = x^2 + 6x + (3)^2 + 4$

$f(x) = (x+3)^2 + 4$

$f(x) = [x-(-3)]^2 + 4$

Vertex is at $(-3, 4)$

Here, $a = 1 > 0$

So, Function $f(x)$ has minimum value, which is 4 at $x = -3$. Ans.

(ii) $f(x) = x^2 + 4x$

Sol:- $f(x) = x^2 + 4x + (2)^2 - (2)^2$

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$f(x) = (x+2)^2 - 4$

$f(x) = [x-(-2)]^2 - 4$

vertex $= (-2, -4)$

Hence, $a = 1 > 0$.

So, function $f(x)$ has minimum value of -4 at $x = -2$. Ans.

(iii) $f(x) = -x^2 + 8x + 13$

sol: $f(x) = -(x^2 - 8x - 13)$

$= -(x^2 - 8x - 13 + (4)^2 - (4)^2)$

$= -[(x-4)^2 - 13 - (16)]$

$= -[(x-4)^2 - 13 - 16]$

$= -[(x-4)^2 - 29]$

$f(x) = -(x-4)^2 + 29$

vertex $= (4, 29)$

Hence, $a = -1 < 0$

So, function $f(x)$ has maximum value 29 at $x = 4$. Ans.

(iv) $f(x) = -x^2 - 3x - 5$

sol: $f(x) = -(x^2 + 3x + 5)$

$= -\left[x^2 + 3x + \left(\frac{3}{2}\right)^2 + 5 - \left(\frac{3}{2}\right)^2\right]$

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$$= -\left[\left(x+\frac{3}{2}\right)^2 + 5 - \frac{9}{4}\right]$$

$$= -\left[\left(x+\frac{3}{2}\right)^2 + \frac{20-9}{4}\right]$$

$$= -\left[\left(x+\frac{3}{2}\right)^2 + \frac{11}{4}\right]$$

$$= -\left[x-\left(\frac{-3}{2}\right)^2 - \frac{11}{4}\right]$$

vertex is at $= \left(\frac{-3}{2}, \frac{-11}{4}\right)$

$a = -1 < 0$

so, $f(x)$ has maximum value of $\frac{-11}{4}$ at $x = \frac{-3}{2}$. Ans

(ii) $f(x) = 3x^2 + 6x - 13$

Sol: $f(x) = 3(x^2 + 2x) - 13$

$$= 3(x^2 + 2x + 1^2 - 1^2) - 13$$

$$= 3[(x^2 + 2x + 1) - 1] - 13$$

$$= 3(x+1)^2 - 3 - 13$$

$$= 3(x+1)^2 - 16$$

$$f(x) = 3[x-(-1)]^2 - 16$$

$a = 3 > 0$

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So, $f(x)$ has minimum value of -16 at $x=-1$. Ans.

(vii) $f(x) = -2x^2 - x + 21$

Sol: $f(x) = -2\left(x^2 + \frac{x}{2}\right) + 21$

$= -2\left[x^2 + \frac{x}{2} + \left(\frac{x}{4}\right)^2\right] + 21 - \left(\frac{1}{4}\right)^2$

$= -2\left[\left(x+\frac{1}{4}\right)^2 + 21\right] - \frac{1}{16}$

$= -2\left(x+\frac{1}{4}\right)^2 + \frac{\cancel{2}}{\cancel{16}} + 21$

$= -2\left(x+\frac{1}{4}\right)^2 + \frac{1}{8} + 21$

$= -2\left(x+\frac{1}{4}\right)^2 + \frac{1+168}{8}$

$= -2\left(x+\frac{1}{4}\right)^2 + \frac{169}{8}$

$f(x) = -2\left[x - \left(-\frac{1}{4}\right)\right]^2 + \frac{169}{8}$

vertex is at $= \left(-\frac{1}{4}, \frac{169}{8}\right)$

Hence, $a = -2 < 0$

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So, $f(x)$ has maximum value of $\frac{169}{8}$ at $x = -\frac{1}{4}$. Ans.

Q28- (ii) $f(x) = x^2 - 4x$

sol:- Let, $y = x^2 - 4x$

Now take x and y intercept.

y-Intercept

put $x = 0$

$y = (0)^2 - 4(0)$

$y = 0 - 0$

$\boxed{y = 0}$ $(0,0)$

x-Intercept

put $y = 0$.

$0 = x^2 - 4x$

$0 = x(x-4)$

$\boxed{x = 0}$, $x - 4 = 0$

$(4,0)$ $\boxed{x = 4}$

Finding vertex,

$h = \frac{-b}{2a} = \frac{-(-4)}{2(1)}$

$h = \frac{4}{2}$ $\boxed{h = 2}$

$k = \frac{4(a)(b) - b^2}{4a}$

$= \frac{4(1)(-0) - (-4)^2}{4(1)}$

$k = \frac{0 - 16}{4}$

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$k = -\frac{16}{4}$

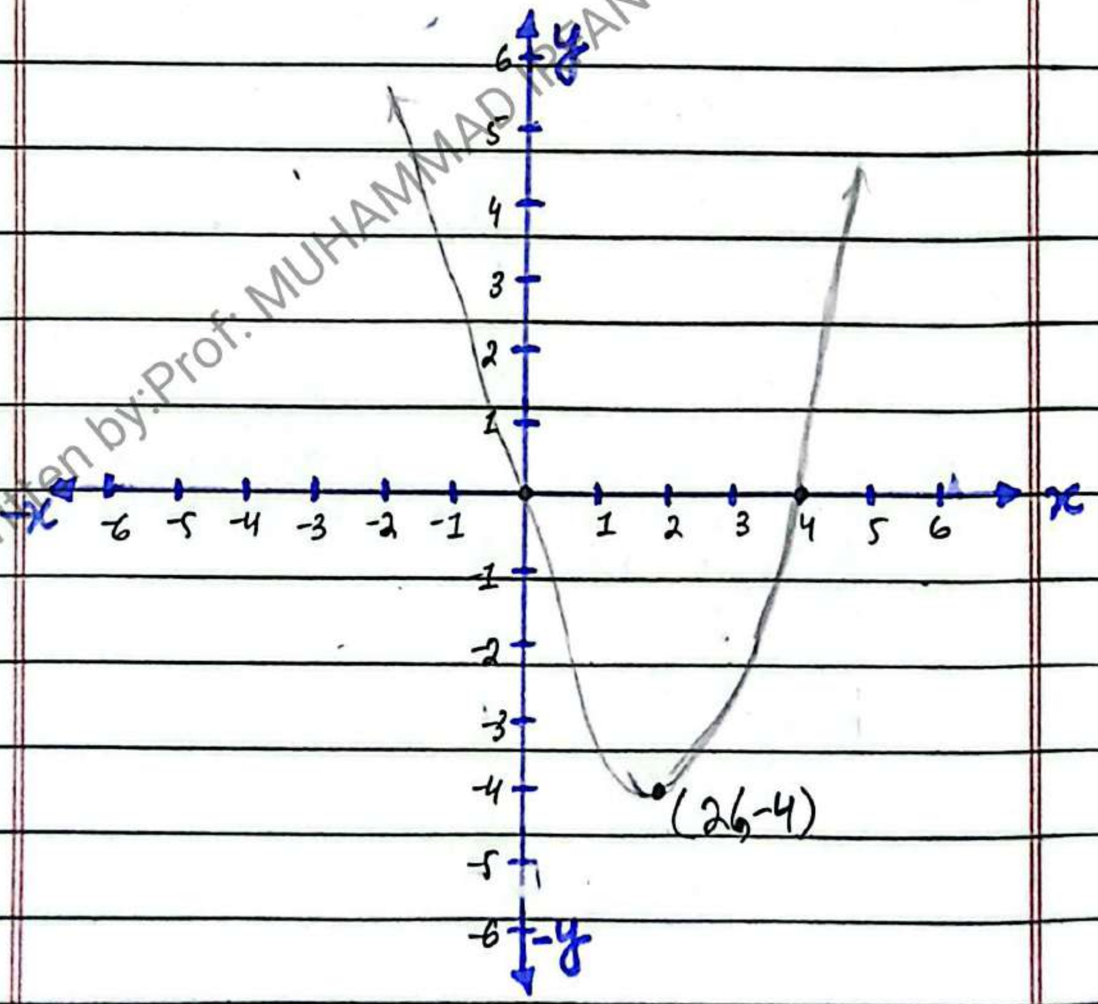
$\boxed{k = -4}$

vertex $= (2, -4)$

Domain of $f(x)$: Set of all real numbers $= (-\infty, +\infty)$.

Range of $f(x)$: Minimum value is -4. Range is all real no. above -4.

$= [-4, \infty)$



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(iii) $f(x) = x^2 - 5x + 6$

Sol: Let, $y = x^2 - 5x + 6$

Taking x, y Intercept.

y-intercept

put $x = 0$

$y = (0)^2 - 5(0) + 6$

$y = 0 - 0 + 6$

$\boxed{y = 6}$

$(0, 6)$.

x-intercept.

put $y = 0$

$0 = x^2 - 5x + 6$

$0 = x^2 - 3x - 2x + 6$

$0 = x(x-3) - 2(x-3)$

$0 = (x-3)(x-2)$

$x - 3 = 0$, $x - 2 = 0$

$\boxed{x = 3}$, $\boxed{x = 2}$

$(3, 0)$, $(2, 0)$.

Finding vertex:-

$h = \frac{-b}{2a} = \frac{-(-5)}{2(1)}$

$h = \frac{5}{2}$ $h = 2.5$

$k = \frac{4(a)(c) - b^2}{4a}$

$= \frac{4(1)(6) - (-5)^2}{4}$

$= \frac{24 - 25}{4}$

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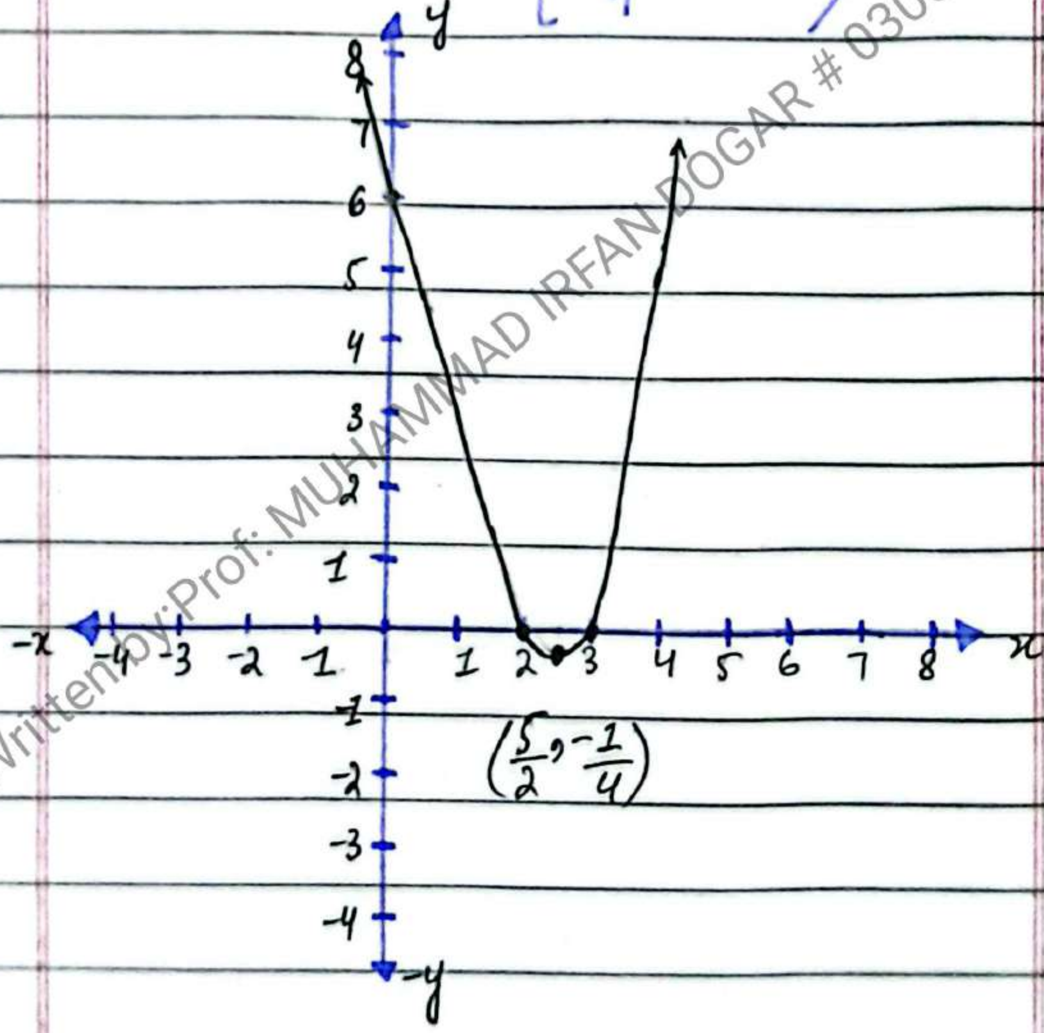
$K = -\frac{1}{4}$

$\boxed{K = -0.25}$

vertex = $(2.5, -0.25)$

Domain of $f(x) = (-\infty, +\infty)$

Range of $f(x) = \left[-\frac{1}{4}, +\infty\right)$.



(iii) $f(x) = -x^2 + 2x - 8$

Sol: let, $y = -x^2 + 2x + 8$

Taking x & y intercept.

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y-intercept

put $x=0$

$y = -(0)^2 + 2(0) - 8$

$= -0+0-8$

$\boxed{y=-8}$

$(0,-8)$

x-intercept.

put $y=0$

$0 = -x^2+2x-8$

Not possible

To find additional point, we

let $x=2$.

$y = -(2)^2 + 2(2) - 8$

$y = -4+4-8$

$\boxed{y=-8}$ $(2,-8)$.

Finding vertex:

$h = \frac{-b}{2a} = \frac{-\cancel{2}}{\cancel{2}(-1)} = 1$

$k = \frac{4ac-b^2}{4a} = \frac{4(-1)(-8)-(2)^2}{4(-1)}$

$k = \frac{32-4}{-4} = \frac{\cancel{28}}{\cancel{-4}}$

$\boxed{k=-7}$

vertex $= (1,-7)$

Domain of $f(x) = (-\infty, +\infty)$

Range of $f(x) = (-\infty, -7]$.

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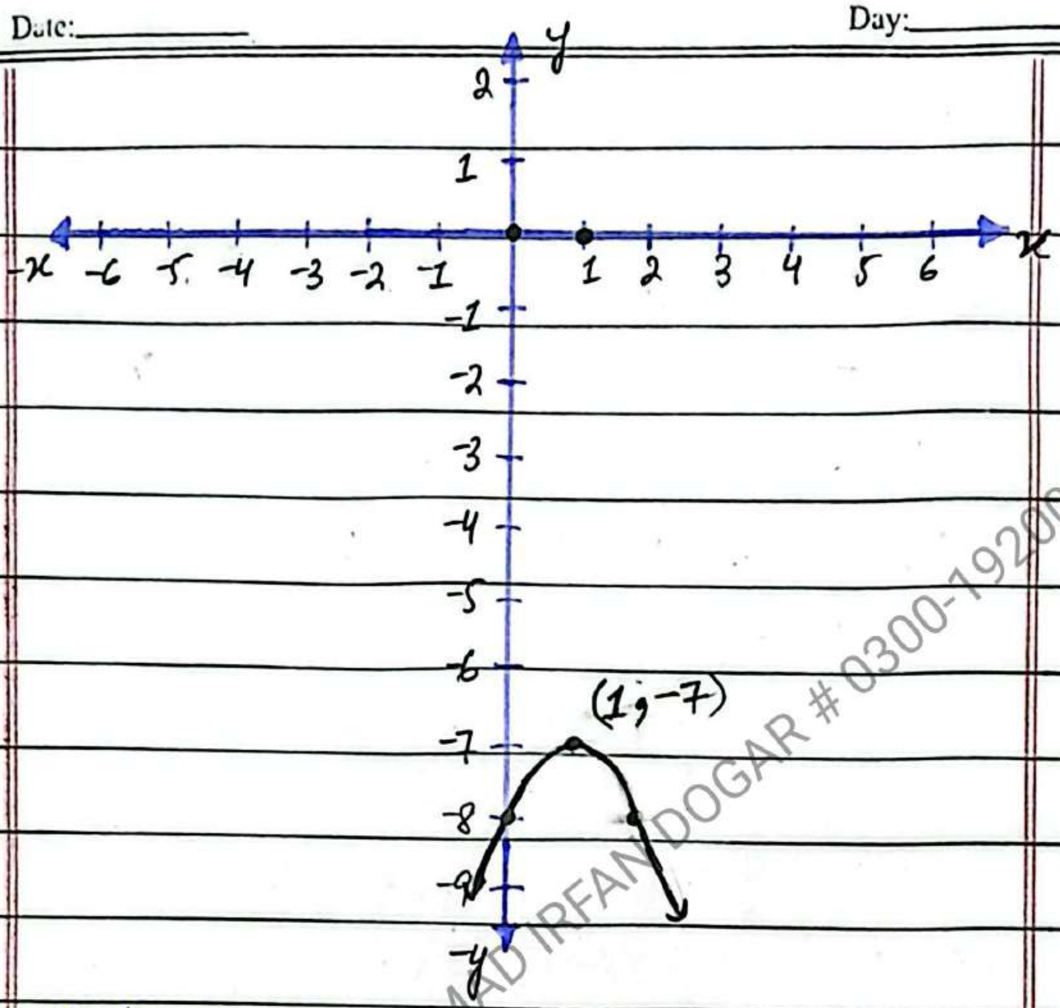

(iv) $f(x) = x^2 - 4x + 4$

Sol: let, $y = x^2 - 4x + 4$

y-intercept

put $x = 0$

$y = (0)^2 - 4(0) + 4$

$y = 0 - 0 + 4$

$\boxed{y = 4}$

$(0, 4)$

x-intercept.

put $y = 0$

$0 = x^2 - 4x + 4$

$\sqrt{0} = \sqrt{(x-2)^2}$

$x - 2 = 0$

$\boxed{x = 2}$ $(2, 0)$.

To find additional point, we let $x = 3$.

$y = (3)^2 - 4(3) + 4$

$y = 9 - 12 + 4$ $\boxed{y = 1}$ $(3, 1)$.

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$$\text{vertex} = h = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = \frac{\cancel{4}}{\cancel{2}}$$

$$\boxed{h=2}$$

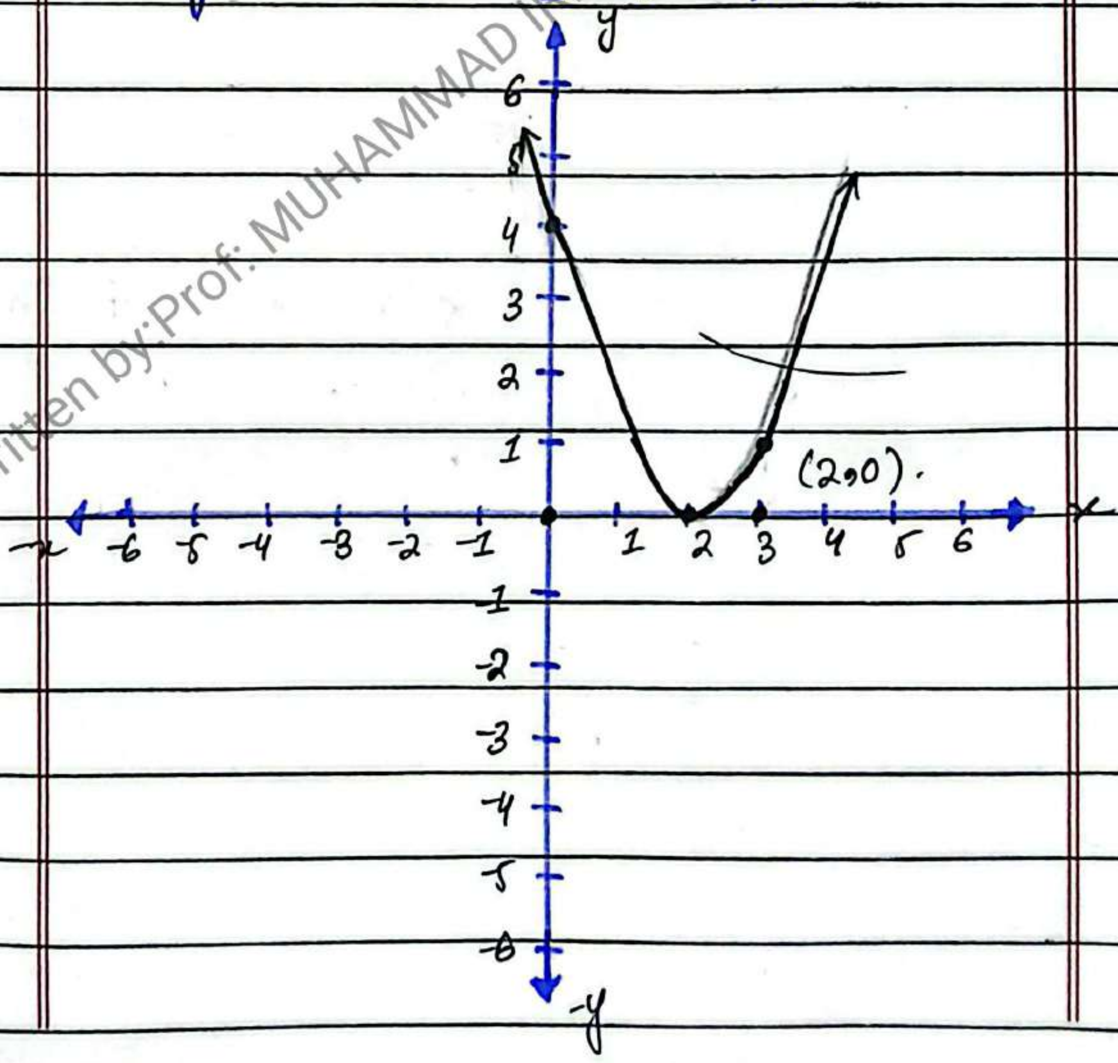
$$k = \frac{4(1)(4) - (-4)^2}{4}$$

$$= \frac{16-16}{4} = \frac{0}{4}$$

$\boxed{k=0}$ vertex $= (2, 0)$.

Domain of $f(x) = (-\infty, +\infty)$

Range of $f(x) = [0, \infty)$.



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(v) $f(x) = x^2 + 2x - 8.3$

sol: Let, $y = x^2 + 2x - 8.3$

y-intercept

put $x = 0$

$y = (0)^2 + 2(0) - 8.3$

$y = 0 + 0 - 8.3$

$\boxed{y = -8.3}$

$(0, -8.3)$

x-intercept.

put $y = 0$

$0 = x^2 + 2x - 8.3$

$x = \dfrac{-2 \pm \sqrt{(2)^2 - 4(1)(-8.3)}}{2(1)}$

$x = \dfrac{-2 \pm \sqrt{4 + 33.2}}{2}$

$x = \dfrac{-2 \pm \sqrt{37.2}}{2}$

$x = \dfrac{-2 + \sqrt{37.2}}{2}$, $x = \dfrac{-2 - \sqrt{37.2}}{2}$

$x = +2.05$, $x = -4.05$

$(2.05, 0)$, $(-4.05, 0)$

vertex: $h = \dfrac{-2}{2(1)}$

$\boxed{h = -1}$

$k = \dfrac{4(1)(-8.3) - (2)^2}{4}$

$= \dfrac{-33.2 - 4}{4} = \boxed{-9.3 = k}$

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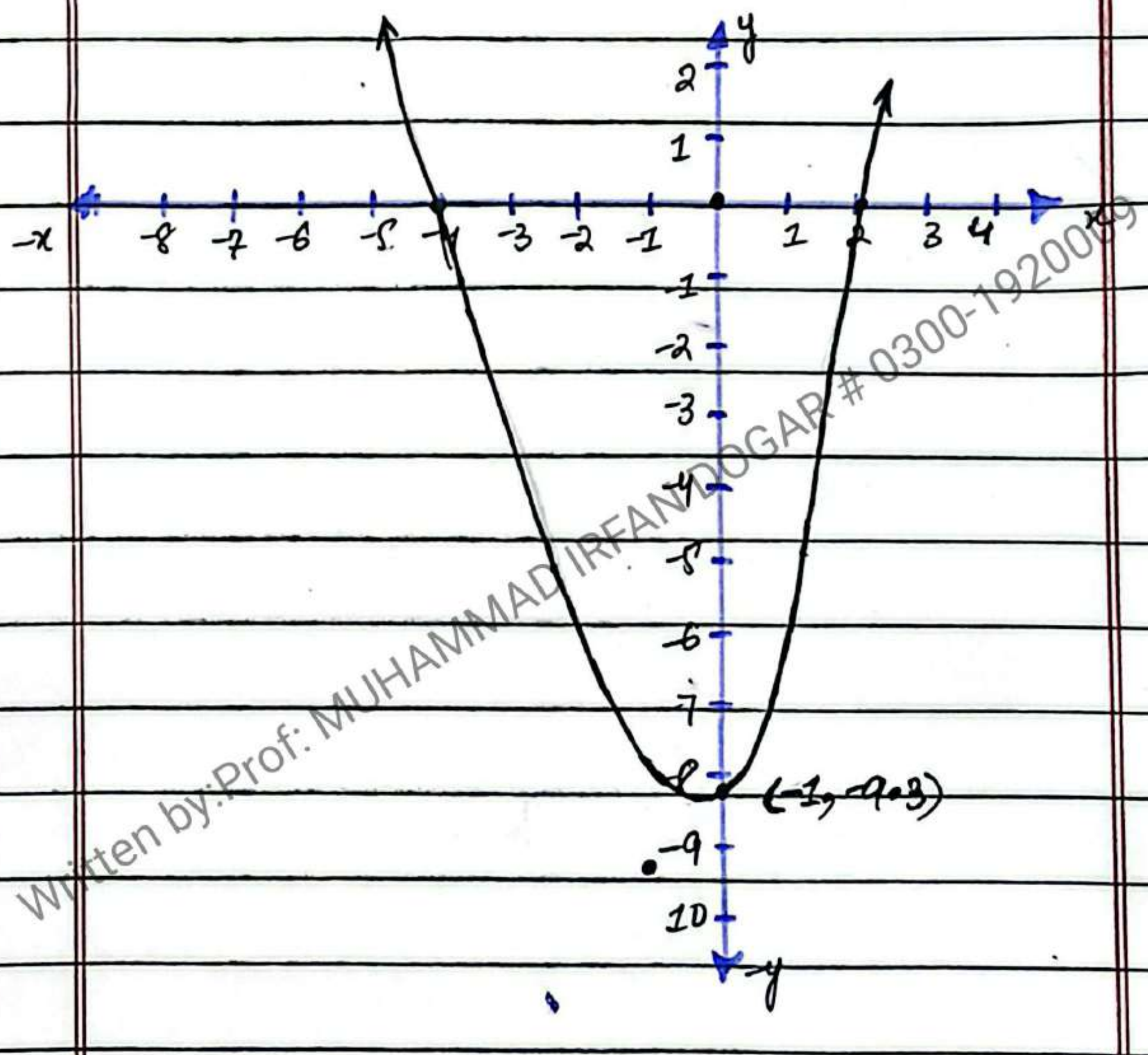
vertex $= (-1, -9.3)$

Domain of $f(x) = (-\infty, \infty)$

Range of $f(x) = [-9.3, +\infty)$.



(vi) $f(x) = 6 - x - x^2$

sol: Let, $y = 6 - x - x^2$

$y = -x^2 - x - 6$

y-intercept
put $x = 0$.

x-intercept
put $y = 0$.

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$y = -(0)^2 - (0) + 6$

$\boxed{y = 6}$

$(0, 6)$

$-x^2 - x + 6 = 0$

$x^2 + x - 6 = 0$

$x^2 + 3x - 2x - 6 = 0$

$x(x+3) - 2(x+3) = 0$

$x + 3 = 0, \; x - 2 = 0$

$\boxed{x = -3}, \; \boxed{x = 2}$

$(-3, 0), \; (2, 0)$

vertex $= h = \dfrac{-(-1)}{2(-1)} = \dfrac{1}{-2} = \boxed{-0.5}$

$k = \dfrac{4(-1)(6) - (-1)^2}{4(-1)}$

$= \dfrac{-24 - 1}{-4}$

$= \dfrac{+25}{+4} \quad \boxed{k = 6.25}$

vertex $= (-0.5, 6.25)$

Domain of $f(x) = (-\infty, +\infty)$

Range of $f(x) = \left(-\infty, \dfrac{25}{4}\right]$.

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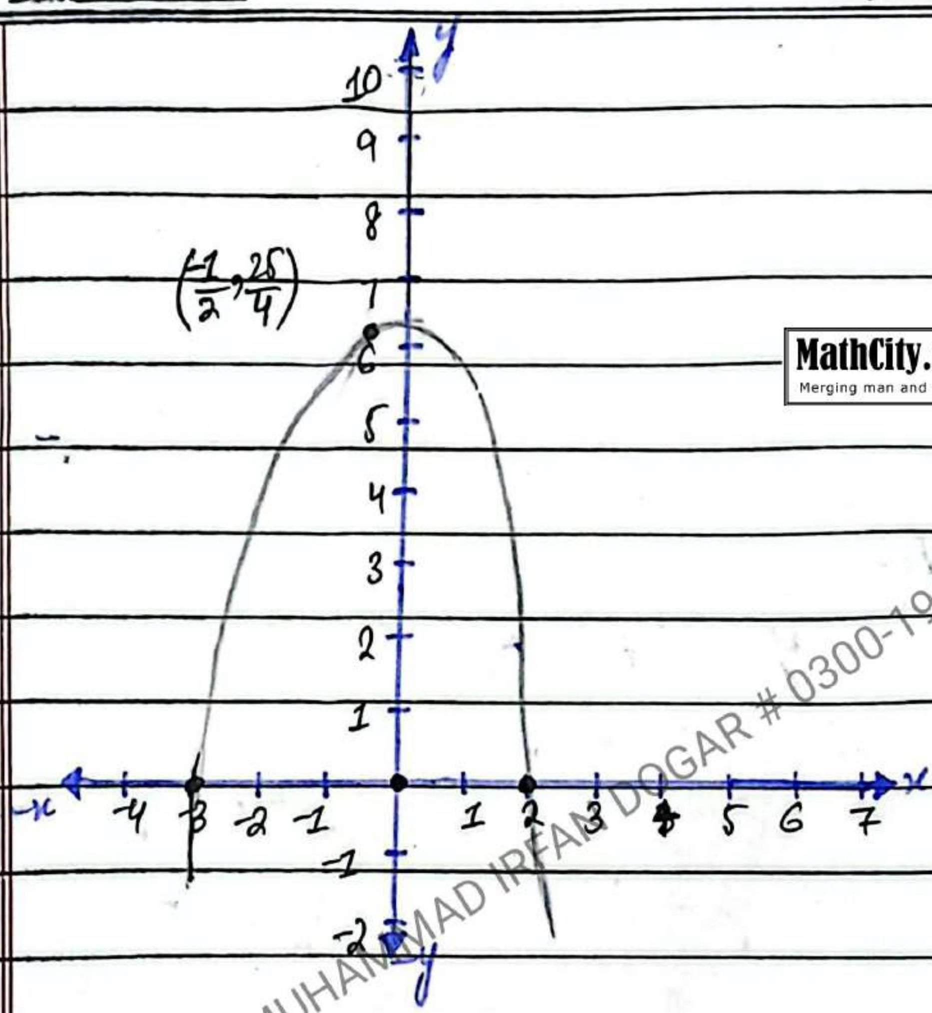

Q38-(i) $f(x) = x^2 - 3,\ x \le 0$

Sol: $f(x) = x^2 - 3$

$y = x^2 - 3$

$y + 3 = x^2$

$\sqrt{x^2} = \sqrt{y+3}$

$x = \pm\sqrt{y+3}$

Now, replace 'y' by 'x'

Inverse $f^{-1}(x) = \pm\sqrt{x+3}$

$f^{-1}(x) = -\sqrt{x+3}$

Domain $f(x) = (-\infty, 0]$

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Range of $f(x) = a = 1 > 0$

$f(x) \geq -3$ when $x \leq 0$

Range $f(x) = [-3, +\infty)$.

Domain of $f^{-1} = [-3, +\infty)$

Range of $f^{-1} = (-\infty, 0]$. Ans.

(iii) $f(x) = x^2+6x+4$, $x < -3$

Sol:- $f(x) = y$

$y = x^2+6x+4$

Replace x and y

$x = y^2+6y+4 \qquad y^2+6y+4-x = 0$

$$y = \frac{-6 \pm \sqrt{6^2-4(1)(4-x)}}{2(1)}$$

$$= \frac{-6 \pm \sqrt{36-16+4x}}{2}$$

$$= \frac{-6 \pm \sqrt{20+4x}}{2}$$

$$= \frac{-6 \pm \sqrt{4(5+x)}}{2}$$

$$= \frac{-6 \pm 2\sqrt{5+x}}{2}$$

$$= \frac{\cancel{2}(-3 \pm \sqrt{5+x})}{\cancel{2}}$$

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$y = -3 \pm \sqrt{5+x}$

Replace y by $f^{-1}(x)$

$f^{-1}(x) = -3 \pm \sqrt{5+x}$

$f^{-1}(x) = -3 - \sqrt{5+x}$

Dom $f(x) = x < -3$

Domain $= (-\infty, -3)$

Range of $f(x) = x^2+6x+4$

$= x^2+6x+3^2-3^2+4$

$= (x+3)^2 - 9+4$

Range $= (x+3)^2-5$

Min value is -5 so

range is $= (-5, \infty)$.

Domain of $f^{-1}(x) = (-5, \infty)$

Range of $f^{-1}(x) = (-3, -\infty)$ Ans

(iii) $f(x) = 2x^2-8x+11$, $x \geq 2$

Sol:- $y = 2x^2-8x+11$

$y = 2(x^2-4x)+11$

$= 2(x^2-4x+2^2-2^2)+11$

$= 2[(x-2)^2-4]+11$

$= 2(x-2)^2-8+11$

$= 2(x-2)^2+3$

$y-3 = 2(x-2)^2$

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$$\frac{y-3}{2} = (x-2)^2$$

$$\sqrt{\frac{y-3}{2}} = \sqrt{(x-2)^2}$$

$$x-2 = \pm\sqrt{\frac{y-3}{2}}$$

$$x = 2 \pm \sqrt{\frac{y-3}{2}}$$

$$f^{-1}(y) = 2 \pm \sqrt{\frac{y-3}{2}}$$

Replace 'x' and 'y'

$$f^{-1}(x) = 2 + \sqrt{\frac{x-3}{2}}$$

Domain of $f(x) = [2, \infty)$

Range of $f(x) = [3, \infty)$

Domain of $f^{-1}(y) = [3, \infty)$

Range of $f^{-1} = [2, \infty)$. Ans.

(iv) $f(x) = 3x^2 - 2x + 6$, $x \geq 5$

Sol. $y = 3x^2 - 2x + 6$

Replace 'x' and 'y'

$$x = 3y^2 - 2y + 6$$

$$3y^2 - 2y + 6 - x = 0$$

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$$y = \frac{+2 \pm \sqrt{-2^2 - 4(3)(6-x)}}{2(3)}$$

$$= \frac{2 \pm \sqrt{4 - 12(6-x)}}{6}$$

$$= \frac{2 \pm \sqrt{4 - 72 + 12x}}{6}$$

$$= \frac{2 \pm \sqrt{12x - 68}}{6}$$

$$= \frac{2 \pm \sqrt{4(3x-17)}}{6}$$

$$= \frac{2(1 \pm \sqrt{3x-17} \cdot 4}{6}$$

$$= \frac{2(1 \pm \sqrt{3x-17})}{6}$$

$$y = \frac{1 \pm \sqrt{3x-17}}{3}$$

$$f^{-1}(x) = \frac{1 \pm \sqrt{3x-17}}{3}$$

Domain of $f(x) = [5, \infty)$

$$\text{Range} = \frac{4(3)(6) - (-2)^2}{4(3)}$$

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$= \frac{72-4}{12}$

$= \frac{\cancel{68}^{34^{17}}}{\cancel{12}_{\cancel{6}_3}}$

Range $= \frac{17}{3}$ we cannot take $17/3$ as minimum point.

By condition $x \geq 5$, here $5 > \frac{17}{3}$

so put $x = 5$ in $f(x)$.

$f(5) = 3(5)^2 - 2(5) + 6$

$= 75 - 10 + 6$

$f(5) = 71$

Range of $f(x) = [71, \infty)$

Domain $f^{-1} = [71, \infty)$

Range $f^{-1} = [5, \infty)$ Ans.

(v) $f(x) = 2(x-3)^2 + 1$, $x \geq 3$

Sol:- $y = 2(x-3)^2 + 1$

$y - 1 = 2(x-3)^2$

$\frac{y-1}{2} = (x-3)^2$

$\sqrt{\frac{y-1}{2}} = \sqrt{(x-3)^2}$

$x - 3 = \pm\sqrt{\frac{y-1}{2}}$

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$x - 3 = \sqrt{\frac{y-1}{2}}$ since, $x \geq 3$

$x - 3 > 0,$

$x = 3 + \sqrt{\frac{y-1}{2}}$

$f^{-1}(y) = 3 + \sqrt{\frac{y-1}{2}}$

$f^{-1}(x) = 3 + \sqrt{\frac{y-1}{2}}$

Domain of $f(x) = [3, \infty)$

Range of $f(x) \Rightarrow a = 2 > 0$

$f(x) \geq 1 \quad x \geq 3$

$\therefore$ Range $= [1, \infty)$

Domain $f^{-1} = [1, \infty)$

Range $f^{-1} = [3, \infty)$. Ans.

(vi) $f(x) = -3(x+4)^2 - 5, \quad x < -4$

Sol: $y = -3(x+4)^2 - 5$

$y + 5 = -3(x+4)^2$

$\frac{y+5}{-3} = (x+4)^2$

$-\frac{y+5}{3} = (x+4)^2$

$\sqrt{(x+4)^2} = \sqrt{-\frac{(y+5)}{3}}$

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$$x+4 = \pm\sqrt{\frac{-(y+5)}{3}}$$

$$x+4 = -\sqrt{\frac{-(y+5)}{3}}$$

$$x = -4-\sqrt{\frac{-(y+5)}{3}}$$

$$f^{-1}(y) = -4-\sqrt{\frac{-(y+5)}{3}}$$

$$f^{-1}(x) = -4-\sqrt{\frac{-(y+5)}{3}}$$

Domain of $f(x) = (-\infty, -4)$

Range of $f(x) = (-\infty, -5)$

Domain of $f^{-1} = (-\infty, -5)$

Range of $f^{-1} = (-\infty, -4)$ Ans.

Q48 (i) $|x^2+1| = 5$

Sol: $x^2+1 = \pm 5$

$x^2+1 = 5$ | $x^2+1 = -5$

$x^2 = 5-1$ | $x^2 = -5-1$

$\sqrt{x^2} = \sqrt{4}$ | $\sqrt{x^2} = \sqrt{-6}$

$\boxed{x = \pm 2}$ | $\boxed{x = \pm\sqrt{-6}}$

Imaginary.

$S.S = \{\pm 2\}$ Ans.

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(ii) $|x^2+5x+4|=0$

Sol:- $x^2+5x+4=0$

$x^2+4x+x+4=0$

$x(x+4)+1(x+4)=0$

$(x+4)(x+1)=0$

$x+4=0,\ x+1=0$

$\boxed{x=-4},\ \boxed{x=-1}$

S.S $=\{-4, -1\}$ Ans.

(iii) $|x^2-6x+8|=4$

Sol:- $x^2-6x+8=\pm 4$

$x^2-6x+8=4$

$x^2-6x+8-4=0$

$x^2-6x+4=0$

$$x=\frac{-(-6)\pm\sqrt{-6^2-4(1)(4)}}{2}$$

$$=\frac{6\pm\sqrt{36-16}}{2}$$

$$=\frac{6\pm\sqrt{20}}{2}$$

$$=\frac{6\pm 2\sqrt{5}}{2}$$

$$=\frac{\cancel{2}(3\pm\sqrt{5})}{\cancel{2}}\quad \boxed{x=3\pm\sqrt{5}}$$

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$$x^2-6x+8=-4$$

$$x^2-6x+8+4=0$$

$$x^2-6x+12=0$$

$$x=\frac{-(-6)\pm\sqrt{-6^2-4(1)(12)}}{2}$$

$$=\frac{6\pm\sqrt{36-48}}{2}$$

$$=\frac{6\pm\sqrt{-12}}{2}$$

$$=\frac{6\pm2\sqrt{-3}}{2}$$

$$=\frac{\cancel{2}(3\pm\sqrt{-3})}{\cancel{2}}$$

$$\boxed{x=3\pm\sqrt{-3}}\ \text{(Imaginary)}$$

$S.S=\{3\pm\sqrt{5}\}$ Ans

(iv) $|3x^2-7x+2|=x^2-x+1$

sol: $3x^2-7x+2=\pm(x^2-x+1)$

$$3x^2-7x+2=x^2-x+1$$

$$3x^2-x^2-7x+x+2-1=0$$

$$2x^2-6x+1=0$$

$$x=\frac{6\pm\sqrt{36-4(2)(1)}}{4}$$

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$$= \frac{6 \pm \sqrt{36-8}}{4}$$

$$= \frac{6 \pm \sqrt{28}}{4}$$

$$= \frac{6 \pm 2\sqrt{7}}{4}$$

$$= \frac{\cancel{2}(3 \pm \sqrt{7})}{\cancel{4}\,2}$$

$$\boxed{x = \frac{3 \pm \sqrt{7}}{2}}$$

$$3x^2 - 7x + 2 = -(x^2 - x + 1)$$

$$3x^2 - 7x + 2 = -x^2 + x - 1$$

$$3x^2 + x^2 - 7x - x + 2 + 1 = 0$$

$$4x^2 - 8x + 3 = 0$$

$$4x^2 - 6x - 2x + 3 = 0$$

$$2x(2x - 3) - 1(2x - 3) = 0$$

$$(2x - 3)(2x - 1) = 0$$

$$2x - 3 = 0 \quad , \quad 2x = +1$$

$$2x = +3 \qquad \boxed{x = \frac{1}{2}}$$

$$\boxed{x = \frac{+3}{2}}$$

$$S.S = \left\{ \frac{3 \pm \sqrt{7}}{2}, \frac{3}{2}, \frac{1}{2} \right\} \text{ Ans.}$$

(v) $|x^2-4|<5$

Sol: $-5<x^2-4<5$

$-5<x^2-4$, $x^2-4<5$

$-5+4<x^2$, $x^2<5+4$

$-1<x^2$ —(i) $x^2<9$ —(ii)

Inequality (i)

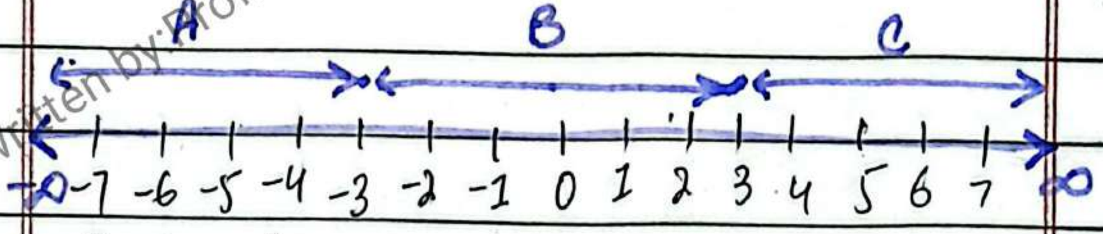
$x^2>1$ so, S.S of (i) is

$R=(-\infty,\infty)$

Inequality (ii)

$x^2<9$

$x^2=9 \Rightarrow x=\pm 3$



Region A:

$x=-4$

$(-4)^2<9$

$16<9$ (False)

Region B:-

$x=0$

$(0)^2<9$ $0<9$ (True)

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Region C_3:

$x = 4$

$(4)^2 < 9$

$16 < 9$ (False)

S.S of (ii) is $(-3, 3)$

$= (-\infty, \infty) \cap (-3, 3) = \boxed{(-3, 3)}$ Ans.

(vi) $|x^2 - 3x + 2| > 4$

Sol:- $-4 > x^2 - 3x + 2 > 4$

$-4 > x^2 - 3x + 2$ $\quad$ $x^2 - 3x + 2 > 4$

$x^2 - 3x + 2 + 4 < 0$ $\quad$ $x^2 - 3x + 2 - 4 > 0$

$x^2 - 3x + 6 < 0$ —(i) $\quad$ $x^2 - 3x - 2 > 0$ —(ii)

$x = \dfrac{-(-3) \pm \sqrt{-3^2 - 4(1)(6)}}{2}$ $\quad$ $x = \dfrac{-(-3) \pm \sqrt{-3^2 - 4(1)(-2)}}{2}$

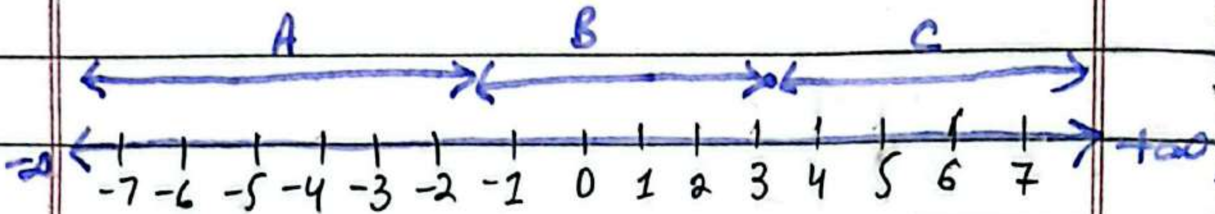
$= \dfrac{3 \pm \sqrt{9 - 24}}{2}$ $\quad$ $x = \dfrac{3 \pm \sqrt{9 + 8}}{2}$

$x = \dfrac{3 \pm \sqrt{-15}}{2}$ $\quad$ $x = \dfrac{3 \pm \sqrt{17}}{2}$

(Imaginary). $\quad$ $x = \dfrac{3 + \sqrt{17}}{2}$, $x = \dfrac{x - \sqrt{17}}{2}$

$\boxed{x = 3.56}$, $\boxed{x = -0.56}$

Date: ______ Day: ______



Region: A

$x = -1$ in (ii)

$(-1)^2 - 3(-1) - 2 > 0$

$+1 - 4 - 2 > 0$

$2 > 0$ (True)

Region B:-

$x = 0$ in (ii)

$(0)^2 - 3(0) - 2 > 0$

$0 - 0 - 2 > 0$

$-2 > 0$ (False)

Region C:-

$x = 4$ in (ii)

$(4)^2 - 3(4) - 2 > 0$

$16 - 12 - 2 > 0$

$2 > 0$ (True)

S.S of (ii) is:-

$$\left(-\infty, \frac{3-\sqrt{17}}{2}\right) \cup \left(\frac{3+\sqrt{17}}{2}, \infty\right)$$ Ans.

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(viii) $|x^2-5x+6| \le x+2$

Sol: $-(x+2) \le x^2-5x+6 \le x+2$

$-(x+2) \le x^2-5x+6$, $x^2-5x+6 \le x+2$

$-x-2 \le x^2-5x+6$, $x^2-5x+6-x-2 \le 0$

$0 \le x^2-5x+6+x+2$ $x^2-6x+4 \le 0$ — (ii)

$x^2-4x+8 \ge 0$ — (i)

$x = \dfrac{-(-4) \pm \sqrt{-4^2-4(1)(8)}}{2(1)}$, $x = \dfrac{6 \pm \sqrt{6^2-4(1)(4)}}{2}$

$= \dfrac{4 \pm \sqrt{16-32}}{2}$ $x = \dfrac{6 \pm \sqrt{36-16}}{2}$

$x = \dfrac{4 \pm \sqrt{-16}}{2}$ $x = \dfrac{6 \pm \sqrt{20}}{2}$

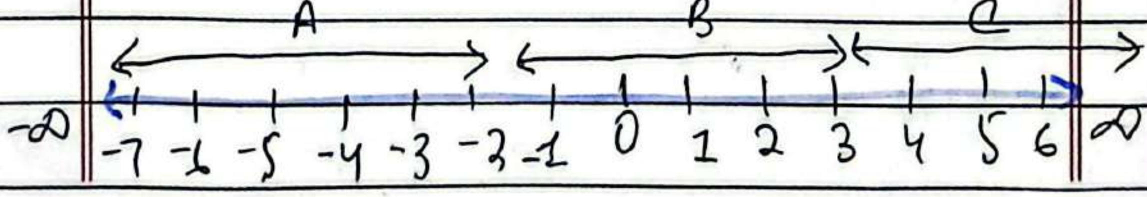
(Imaginary) $x = \dfrac{6 \pm 2\sqrt{5}}{2}$

$x = \dfrac{\cancel{2}(3 \pm \sqrt{5})}{\cancel{2}}$

$x = 3 \pm \sqrt{5}$

$x = 3+\sqrt{5}$, $x = 3-\sqrt{5}$

$\boxed{x = 5.23}$, $\boxed{x = 0.76}$



Date:________ Day:________

Region A:-

$x=0$ in (ii)

$(0)^2-6(0)+4\le 0$

$0-0+4\le 0$

$4\le 0$ (False).

Region B:-

$x=1$ in (ii)

$(1)^2-6(1)+4\le 0$

$1-6+4\le 0$

$-1\le 0$ (True).

Region C:-

$x=6$ in (ii)

$(6)^2-6(6)+4\le 0$

$36-36+4\le 0$

$4\le 0$ (False)

S.S of (ii) is $[3-\sqrt{5}, 3+\sqrt{5}]$

or

S.S $= [-\sqrt{5}+3, \sqrt{5}+3]$ Ans.

(viii) $|2x^2-3x-5|<4$ —— (i)

Sol:- $-4<2x^2-3x-5<4$

$-4<2x^2-3x-5$, $2x^2-3x-5<4$

(i) —— $0<2x^2-3x-1$, $2x^2-3x-9<0$ —— (ii)

$$x = \frac{3 \pm \sqrt{-3^2 - 4(2)(-1)}}{4}$$

$$x = \frac{3 \pm \sqrt{9+8}}{4}$$

$$x = \frac{3 \pm \sqrt{17}}{4}$$

$$x = \frac{3+\sqrt{17}}{4}, \quad x = \frac{3-\sqrt{17}}{4}$$

$$\boxed{x = 1.78}, \quad \boxed{x = -0.28}$$

$$2x^2 - 6x + 3x - 9 = 0$$

$$2x(x-3) + 3(x-3) = 0$$

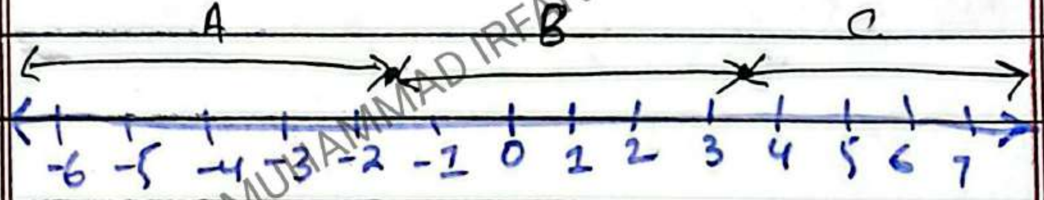
$$(2x+3)(x-3) = 0$$

$$x - 3 = 0, \quad 2x + 3 = 0$$

$$\boxed{x = 3}, \quad 2x = -3$$

$$x = -\frac{3}{2}$$

$$\boxed{x = -1.5}$$



Region A:-

$$x = -1 \text{ in (i)}$$

$$2(-1)^2 - 3(-1) - 1 > 0$$

$$2 + 3 - 1 > 0$$

$$4 > 0 \quad \text{(True.)}$$

Region B:-

$$x = 0 \text{ in (i)}$$

$$2(0)^2 - 3(0) - 1 > 0$$

$$0 - 0 - 1 > 0$$

$$-1 > 0 \quad \text{(False)}$$

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Region C:-

$x=2$ in (i)

$2(2)^2-3(2)-2>0$

$2(4)-6-2>0$

$8-6-2>0$

$2>0$ (True).

S.S of (i) $=\left(-\infty, \frac{3-\sqrt{17}}{4}\right) \cup \left(\frac{3+\sqrt{17}}{4}, \infty\right)$

Now inequality (ii)

Region A:-

$x=-2$ in (ii)

$2(-2)^2-3(-2)-9<0$

$8+6-9<0$

$5<0$ (False)

Region B:-

$x=0$ in (ii)

$2(0)^2-3(0)-9<0$

$0-0-9<0$

$-9<0$ (True).

Region C:-

put $x=4$ in (ii)

$2(4)^2-3(4)-9<0$

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$$2(16) - 12 - 9 < 0$$

$$32 - 12 - 9 < 0$$

$$11 < 0 \quad \text{(False)}.$$

$$S.S \text{ of (ii)} = \left(\frac{-3}{2}, 3\right).$$

$$\text{Overall } S.S = \left(\frac{-3}{2}, \frac{3-\sqrt{17}}{4}\right) \cup \left(\frac{3+\sqrt{17}}{4}, 3\right) \text{ Ans}$$

$$\boxed{\text{Ex } 3.2}$$

Q13-(ii) $\dfrac{1}{3x} + \dfrac{4x}{6} = 1, \quad x \neq 0$

Sol: $\dfrac{1}{3x} + \dfrac{4}{6}x = 1$

$$\frac{1}{3x} + \frac{2x}{3} = 1$$

$$\frac{1 + 2x^2}{3x} = 1$$

$$1 + 2x^2 = 3x$$

$$2x^2 - 3x + 1 = 0$$

$$a = 2, \; b = -3, \; c = 1.$$

Using Quadratic formula