

X-Quadratic Equations
Exercise Solutions
Exercise -1

LEVEL -1

1.

$$\begin{aligned} \text{SOR} &= \text{POR} \\ \Rightarrow \frac{-(m+1)}{(m+2)} &= \frac{m}{(m+2)} \\ -m-1 &= m \\ 2m &= -1 \quad m = -1/2 \end{aligned}$$

2. 1.

$$D = 16 + 4 \times 3 \times 5 > 0$$

2.

$$\begin{aligned} 2x^2 - 6x - 9 &= 0 \\ 36 - 4 \times 2 \times -9 &> 0 \end{aligned}$$

3.

$$\begin{aligned} x^2 + 97 - 79 &= 0 \\ x^2 + 28 &= 0 \quad D < 0 \end{aligned}$$

4.

$$\begin{aligned} 31x^2 - 62x + 31 &= 0 \\ D &= (62)^2 - 4 \times 31 \times 31 > 0 \end{aligned}$$

3. 1.

$$\begin{aligned} 9x^2 - 5x - 4 &= 0 \\ 9x^2 - 9x + 4x - 4 &= 0 \\ 9x(x-1) + 4(x-1) &= 0 \\ x = -4/9 \quad x = 1 \end{aligned}$$

2.

$$\begin{aligned} 2x^2 + 3x - 4 &= 0 \\ x &= \frac{-3 \pm \sqrt{9 + 4 \times 2 \times 4}}{4} = \frac{-3 \pm \sqrt{41}}{4} \end{aligned}$$

3.

$$\begin{aligned} x^2 - 2x &= 0 \\ x = 0 \quad x &= 2 \end{aligned}$$

4.

$$\begin{aligned} x^2 - 2 &= 0 \\ x &= \pm\sqrt{2} \end{aligned}$$

4.

$$2x(-5)^2 - 5p - 15 = 0$$

$$50 - 15 = 5p$$

$$p = 7$$

$$p(x^2) + px + k = 0$$

$$D = 0$$

$$p^2 - 4pk = 0$$

$$p - 4k = 0$$

$$7 = 4k \quad k = 7/4$$

5.

$$x^2 - (50R)x + pOR = 0$$

$$x^2 - (0)x - 36 = 0$$

6.

1.

$$\begin{aligned} \alpha^2 + \beta^2 &= (\alpha + \beta)^2 - 2\alpha\beta \\ &= (-1)^2 - 2 \times 1 \\ &= 1 - 2 = -1 \end{aligned}$$

2.

$$\begin{aligned} \alpha^3 + \beta^3 &= (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta) \\ &= (-1)^3 - 3 \times 1 \times -1 \\ &= -1 + 3 = 2 \end{aligned}$$

3.

$$\begin{aligned} \alpha^4 + \beta^4 &= (\alpha^2 + \beta^2)^2 - 2\alpha^2\beta^2 \\ &= \left((\alpha + \beta)^2 - 2\alpha\beta \right)^2 - 2\alpha^2\beta^2 \\ &= \left((-1)^2 - 2 \times 1 \right)^2 - 2 \times 1 \\ &= 1 - 2 = -1 \end{aligned}$$

7.

$$D=0$$

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

$$m^2 + 4 + 4m - 4m^2 + 16m - 16 = 0$$

$$-3m^2 + 20m - 12 = 0$$

$$3m^2 - 20m + 12 = 0$$

$$3m^2 - 18m - 2m + 12 = 0$$

$$3m(m-6) - 2(m-6) = 0 \quad m = 2/3 \quad m = 6$$

8.

$$\alpha + \beta = -3 \quad \alpha\beta = 7$$

$$x \quad \left(\frac{\alpha + \beta}{\alpha\beta} \right) \times \frac{\alpha\beta}{\alpha\beta} = -3$$

9.

$$x^{2/3} + x^{1/3} - 2 = 0$$

$$\text{Let } x^{1/3} = t$$

$$t^2 + t - 2 = 0$$

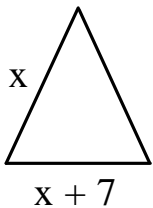
$$t^2 + 2t - t - 2 = 0$$

$$t(t+2) - 1(t+2) = 0$$

$$t = 1 \quad t = -2$$

$$x = 1 \quad x = (-2)^3$$

10.



$$\frac{1}{2}(x)(x+7) = 30$$

$$x^2 + 7x - 60 = 0$$

$$x^2 + 12x - 5x - 60 = 0$$

$$(x+12)(x-5) = 0$$

$$x = 5$$

11.

$$x \rightarrow x-5$$

$$3(x-5)^2 + 4(x-5) + 5 = 0$$

$$3(x^2 + 25 - 10x) + 4x - 20 + 5 = 0$$

$$3x^2 + 75 - 30x + 4x - 15 = 0$$

$$3x^2 - 26x + 60 = 0$$

12.

$$\alpha - \beta = 1$$

$$\alpha^2 + \beta^2 + 2\alpha\beta - 4\alpha\beta = 1$$

$$(\alpha + \beta)^2 - 4\alpha\beta = 1$$

$$\boxed{p^2 - 4q = 1}$$

$$\alpha + \beta = -p$$

$$\alpha\beta = q$$

13.

$$\frac{x}{x+1} + \frac{x+1}{x} = \frac{34}{15}$$

$$\Rightarrow \frac{x^2 + (x+1)^2}{x(x+1)} = \frac{34}{15}$$

$$\frac{x^2 + 2x^2 + 1 + 2x}{x^2 + x} = \frac{34}{15}$$

$$30x^2 + 15 + 30x = 34x^2 + 34x$$

$$4x^2 + 4x - 15 = 0$$

$$x = \frac{-4 \pm \sqrt{4^2 + 4 \times 4 \times 15}}{8}$$

$$x = \frac{9}{2}, -\frac{5}{2}$$

14.

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

$$\frac{(x+3)x + (x+1)(x+2)}{x(x+2)} = \frac{10}{3}$$

$$(x^2 + 3x + x^2 + 3x + 3)3 = 10x^2 + 20x$$

$$6x^2 + 18x + 9 = 10x^2 + 20x$$

$$4x^2 + 2x - 9 = 0$$

$$x = \frac{-2 \pm \sqrt{4 + 4 \times 4 \times 9}}{8}$$

$$x = \frac{-2 \pm \sqrt{148}}{8}$$

15.

$$\frac{1}{a+b+x} - \frac{1}{x} = \frac{1}{a} + \frac{1}{b}$$

$$\frac{x - a - b - x}{(a+b+x)x} = \frac{a+b}{ab}$$

$$-ab = ax + bx + x^2$$

$$x^2 + x(a+b) + ab = 0$$

$$x(x+a) + b(x+a) = 0$$

$$x = -b \quad x = -a$$

16.

$$\text{Let } x^2 + 3x = t$$

$$(t+2)^2 - 8x - t$$

$$(x+2)^2 - 8x - 4 = 0$$

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

$$x^2 - 4x = 0 \quad t = 0$$

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

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

$$t = 4$$

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

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

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

$$x = -4$$

$$x = 1$$

17.

Δa	Second
x	$4+x$

$$\Rightarrow \frac{1}{x} - \frac{1}{x+4} = \frac{4}{21}$$

$$\frac{x+4-x}{x(x+4)} = \frac{4}{21}$$

$$\Rightarrow x^2 + 4x - 21 = 0$$

$$(x-3)(x+7) = 0$$

$$x = 3$$

$$N = 3, 7$$

18.

$$\begin{aligned} x(x-11) &= 30 \\ x(x-11) - 30 &= x^2 - 11x - 30 \\ x^2 - 11x + 30 &= 0 \\ x^2 - 5x - 6x + 30 &= 0 \\ x(x-5) - 6(x-5) &= 0 \\ x=6 \quad x=5 \end{aligned}$$

19.

let α, α^2 be roots -

$$\begin{aligned} \alpha + \alpha^2 &= -1 & \alpha^3 &= -k \\ \alpha^2 + \alpha + 1 &= 0 & & \\ \alpha^3 - 1 &= 0 & & \\ \alpha^3 &= 1 & & \boxed{k = -1} \end{aligned}$$

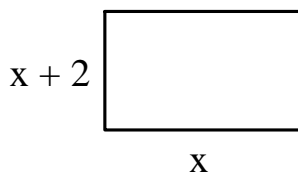
LEVEL-2

1. Conceptual

2.

$$\begin{aligned} x &+ 8 - x \\ x(x-8) &= 15 \\ 8x - x^2 - 15 &= 0 & x^2 - 8x + 15 &= 0 \\ x^2 - 3x - 5x + 15 &= 0 & x^2 - 3x - 5x - 15 &= 0 \\ x(x-3) - 5(x-3) &= 0 & x(x-3) - 5(x-3) &= 0 \\ x=3, x=5 \end{aligned}$$

3.



$$\begin{aligned} x(x+2) &= 24 \\ x &= 4 \\ x+2 &= 6 \\ x &= 1 \end{aligned}$$

4.

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

$$x, 4-x$$

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

$$x^2 + x^2 + 16 - 8x = 8$$

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

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

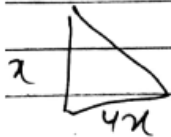
$$\boxed{x=2}$$

6.

$$x(x+1) = 20$$

7.

$$x = 4$$



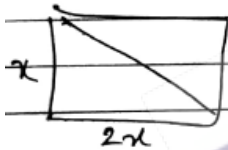
$$\frac{1}{2} \times x \times 4x = 32$$

$$x^2 = 16$$

$$x = 4$$

$$4x = 16$$

8.



$$\sqrt{4x^2 + x^2} = 5$$

$$5x^2 = 25$$

$$x = \sqrt{5}$$

9.

$$(x-2) < 0$$

10.

$$x^2 - 3x - 4 \leq 0$$

$$x^2 - 4x + x - 4 \leq 0$$

$$(x-4)(x+1) \leq 0$$

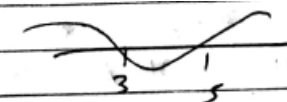


$$x \in [-1, 4]$$

11.

$$x^2 - 8x + 15 > 0$$

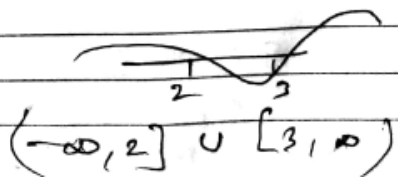
$$(x-3)(x-5) > 0$$



$$x \in (-\infty, 3) \cup (5, \infty)$$

12.

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

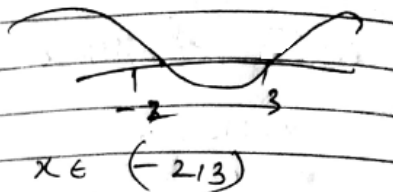
$$(x-3)(x-2) > 0$$


$$(-\infty, 2] \cup [3, \infty)$$

13.

$$x^2 - x - 6 < 0$$

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

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


$$x \in (-2, 3)$$

14.

$$y = \sqrt{kxy}$$

$$y^2 = ky = 0$$

$$y = 0 \quad y = k$$

15.

$$D = 0$$

$$(2m+5)^2 - 4(m+1)(m+3) = 0$$

$$4m^2 + 25 - 20m - 4m^2 - 16m - 12 = 0$$

$$-36m + 13 = 0$$

$$m = 13/36$$

16.

$$F = \frac{x}{x+3}$$

$$\frac{x}{x+3} + \frac{x+3}{x} = 29/28$$

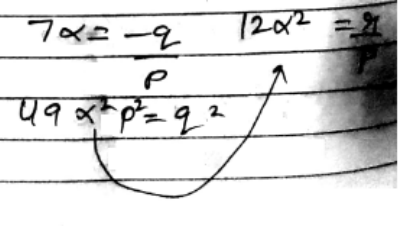
Solve for x

17.

$$3x, 4x \quad 7x = -9 \quad 12x^2 = 2x$$

$$12x \frac{9^2}{49p^2} = \frac{x}{p}$$

$$49p^2 = 12 \times 81 \times p$$

$$p^2 = 81 \times 12 / 49$$


18.

$$\begin{aligned}
 x^2 - 3x - 5 &> x - 5 \\
 x^2 - 4x - 4 &> 0 \\
 x^2 - 9x + 5x - 4 &> 0 \\
 (x-9)(x+5) &> 0 \\
 x \in (-\infty, -5) \cup (9, \infty)
 \end{aligned}$$

19.

$$\begin{aligned}
 x^4 - 17x^2 + 16 &= 0 \\
 x^2 &= t \\
 t^2 - 16t + 16 &= 0 \\
 (t-16)(t-1) &= 0 \\
 t &= 1 \quad t = 16 \\
 x &= \pm 1 \quad x = \pm 4 \\
 \text{SOR} &= 0
 \end{aligned}$$

21.

$$\begin{aligned}
 \frac{1}{4x+4} - \frac{2}{4x-2} &> 0 \\
 \frac{(2x-1) - (x+1)}{4(x+1)(2x-1)} &> 0 \\
 \frac{x-2}{4(x+1)(2x-1)} &> 0 \\
 x \in (-1, \frac{1}{2}) \cup (2, \infty)
 \end{aligned}$$

23.

$$\begin{aligned}
 (x+4)(x+1) &> 0 \\
 -x^2 - 7x + 6x + 4 &> 0 \\
 -x(x+1) + 6(x+7) &> 0 \\
 (x-6)(x+7) &< 0 \\
 x \in (-7, -4) \cup (1, 6)
 \end{aligned}$$

24.

$$x=1 \text{ is the root}$$

$$\text{or } f(1) = 0 \quad \text{Roots are } 1, 1$$

$$\alpha \times \beta = \frac{c-a}{a-b} = 1$$

$$c-a = a-b$$

$$a = \frac{b+c}{2}$$

25.

$$\alpha, 2\alpha$$

$$3\alpha = -b/a \quad 2\alpha^2 = c/a$$

$$\alpha = \frac{-b}{3a}$$

$$2 \times \frac{b^2}{9a^2} = \frac{c}{a}$$

$$2b^2 = 9ac$$

27.

$$x \rightarrow 480 \quad B = \frac{480}{x}$$

$$x-8 \quad \frac{480}{x-8} \quad B' = \frac{480}{x-8}$$

$$\frac{480}{x-8} + \frac{480}{x} = 10$$

$$48(x+x-8) = x(x-8)$$

$$x^2 - 8x = 48 \times 2x - 48 \times 8$$

$$x^2 - 104x + 384 = 0$$

28.

$$\text{Total camel} = x$$

$$\Rightarrow \frac{1}{4}x + 2\sqrt{x} + 15 = x$$

$$= \frac{20\sqrt{x}}{4} = \sqrt{x} \quad \sqrt{x} = t$$

$$\frac{t^2}{4} + 2t + 15 - t^2 = 0$$

$$-3t^2 + 2t + 15 = 0$$

$$-3t^2 + 8t^2 + 60 = 0$$

29.

$$x - 20 = 69x \quad |$$

$$\frac{x}{x}$$

$$x^2 - 20x - 69 = 0$$

$$x^2 - 23x + 3x - 69 = 0$$

$$(x - 23)(x + 3) = 0$$

$$x = 23, -3$$

30.

Ru 35 let xM

$$Im = \frac{35}{x}$$

$$x \rightarrow x+4 \quad C = \frac{35}{x+4}$$

$$\frac{35}{x} - \frac{35}{x+4} = 1$$

$$35(x+4) - 35x = x^2 + 4x$$

$$x^2 + 4x + 35x - 35x - 35 \times 4 = 0$$

31.

$$x \rightarrow 12/x$$

$$\frac{10 \times 12}{x} + x = \frac{120}{x} + x$$

On reversing $\frac{10x+12}{x}$

$$\frac{10x+12}{x} = \frac{120}{x} + x + 36$$

$$x = \frac{12}{x} + 4$$

$$x^2 = 12 + 4x \Rightarrow (x+2)(x-6) = 0$$

$$x = -2$$

$$x = 6$$

$$N = 26$$

32.

(A) M

$$x \quad x^2$$

$$x^2 + 5 = 3(x + 3) \quad A = 4$$

$$x^2 - 3x - 4 = 0 \quad M = 16$$

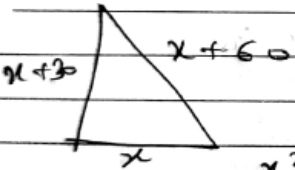
$$x^2 - 4x + x - 4 = 0 \quad (x-4)(x+1) = 0$$

$$x = 4$$

33.

$$\begin{aligned}
 \text{Mother} &= x \\
 E &= 30 - x \\
 \text{By the quest } (x+2)(30-x-3) &= 210 \\
 x(27-x) + 2(27-x) &= 210 \\
 \Rightarrow x^2 - 25x + 156 &= 0 \\
 (x-13)(x-12) &= 0 \\
 x &= 13, 12 \\
 m=13 \quad m=12 \\
 E=17 \quad E=18
 \end{aligned}$$

34.



Using P.T

$$\begin{aligned}
 (x+60)^2 &= x^2 + (x+30)^2 \\
 x^2 + 60^2 + 120x &= x^2 + x^2 + 30^2 + 60x \\
 \Rightarrow x^2 - 60x - 2700 &= 0 \\
 (x+30)(x-90) &= 0 \\
 \boxed{x=90}
 \end{aligned}$$

35.

let the side be x & y

$$\begin{aligned}
 4(x-y) &= 24 \quad \boxed{x-y=6} \\
 x^2 + y^2 &= 468 \\
 (x+6)^2 + x^2 &= 468 \\
 x^2 + 6x - 216 &= 0 \quad (x-12)(x+18) = 0 \\
 x &= 12, -18 \\
 \text{first side is } &12 \\
 \text{second} &= 18
 \end{aligned}$$

36.

$$\begin{aligned}
 p+q &= 15 & \frac{1}{p} + \frac{1}{q} &= \frac{3}{10} \\
 \frac{p+q}{pq} &= \frac{3}{10} \\
 \frac{15}{pq} &= \frac{3}{10} & pq &= 50 \\
 p + \frac{50}{p} &= 15
 \end{aligned}$$

$$p^2 - 15p + 50 = 0 \quad p = 5p - 10p + 50 = 0$$

$$(p-5)(p-10) = 0$$

$$p = 5, p = 10$$

$$q = 10 \quad q = 5$$

37.

Let speed = x

$$T_1 = \frac{600}{x} \quad T_2 = \frac{600}{x-10}$$

$$T_2 - T_1 = 2$$

$$\frac{600}{x-10} - \frac{600}{x} = 2$$

$$600(x - x + 10) = 2(x)(x-10)$$

$$2(x)(x-10) = 3000$$

$$x = 60$$

38.

Let first pipe take x min
second $(x+3)$ min.

$$\frac{1}{x} + \frac{1}{x+3} = \frac{3}{10}$$

$$(x+3+x)10 = 3(x)(x+3)$$

$$(2x+3)10 = 3x^2 + 9x$$

$$\Rightarrow 3x^2 + 9x - 30 - 20x = 0$$

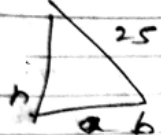
$$3x^2 - 11x - 30 = 0$$

$$x = \frac{11 \pm \sqrt{11^2 + 4 \times 3 \times 20}}{6}$$

$$x = \frac{11 \pm 19}{6}$$

$$x = \frac{30}{6} = 5 \text{ m}$$

39.



Using P-T

$$b+h=35$$

$$(b+h)^2=35^2 \quad \text{①}$$

$$b^2+h^2=25^2 \quad \text{②}$$

$$\text{①} - \text{②}$$

$$2bh=600$$

$$bh=300$$

$$\frac{1}{2}bh=150$$

40.

let stream = x km/h

$$T_u + T_d = \frac{4+1}{2}$$

$$\frac{30}{15+x} + \frac{16}{15-x} = \frac{9}{2}$$

$$30(15+x) + 16(15-x) = \frac{9}{2}(15+x)(15-x)$$

$$30 \times 30 \times 2 = -9x^2 + 15^2$$

$$9x^2 = 225$$

$$x=5$$

Exercise -2

LEVEL-1

1.

$$\frac{\alpha+1}{\alpha} = \frac{-13}{5} \quad \left\{ \begin{array}{l} \alpha \times L = k \\ \alpha \quad \quad 5 \\ k=5 \end{array} \right.$$

2.

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

$$D = 1 - 4 \times 3 \times -1$$

$$D > 0$$

IR Rational

3.

$$\alpha - \beta = 5 \quad \alpha^2 - \beta^2 = 65$$

$$\alpha = \beta + 5$$

$$(\beta + 5)^2 - \beta^2 = 65$$

$$\beta^2 + 25 + 10\beta - \beta^2 = 65$$

$$\beta = 4 \quad \alpha = 9$$

5.

$$\text{One Root} = 2 + \sqrt{3}$$

$$\text{Other One is } 2 - \sqrt{3}$$

$$\text{eqn } x^2 - (2 + \sqrt{3} + 2 - \sqrt{3})x -$$

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

$$= x^2 - 4x - 1$$

6. (c)

7. (d)

8.

$$D = 0 \quad b^2 - 4 \times 9 \times 81 = 0$$

$$b = \pm 2 \times 3 \times 9$$

$$b = 54$$

9. (d)

10.

$$7x \frac{4}{9} + \frac{2}{3}x - 3 = 0$$

$$\frac{2x}{3} = \frac{-1}{-93} \quad x = \frac{1}{6}$$

11.

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

$$x(x - 3) = 0 \quad x = 0, x = 3$$

12. $D > 0$

13.

$$D = 0 \quad q^2 - 4pr = 0$$

$$r = \frac{q^2}{4p}$$

14.

$$D=0 \quad (6p)^2 - 4 \times 9 \times 4 = 0$$

$$36p^2 = 36 \times 4$$

$$p = \pm 2$$

15.

$$ax^2 + 2xa + 3 = 0$$

$$11a + 3 = 0$$

$$a = -3/11$$

16.

$$D \Rightarrow 4 - 4 \times 3 \times 3$$

$$D < 0$$

Imaginary

17.

$$\alpha + \beta = -b/a = \frac{-27}{\sqrt{3}} = -9\sqrt{3}$$

$$\alpha\beta = c/a = \frac{5\sqrt{3}}{\sqrt{3}} = 5$$

18.

$$\alpha + \beta = 12 \quad \alpha\beta = 32$$

$$\frac{\alpha^2 + \beta^2}{\alpha + \beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha + \beta}$$

$$\Rightarrow \frac{12^2 - 2 \times 32}{12} = \frac{80}{12}$$

19.

$$\text{Max} = \infty$$

$$\text{min} = \frac{-D}{4a} = -\frac{(9-20)}{4}$$

$$= 11/4$$

20.

$$\sqrt{3x+7} - \sqrt{2x+3} = 1$$

Checking options will be easier.

21.

$$\begin{aligned} \text{One Root is } \sqrt{7}-4 \\ \text{Other} &= -\sqrt{7}-4 \\ \text{eq} \quad x^2 &= \frac{(-\sqrt{7}-4 + \sqrt{7}-4)x}{+9} \end{aligned}$$

22.

$$\begin{aligned} x &\rightarrow -x \\ ax^2 - bx + c &= 0 \end{aligned}$$

23.

$$\begin{aligned} \alpha + \beta &= -\frac{b}{a} = -\left(\frac{-25}{3}\right) = \frac{25}{3} \\ \alpha \times \beta &= \frac{c}{a} = -25 \end{aligned}$$

24.

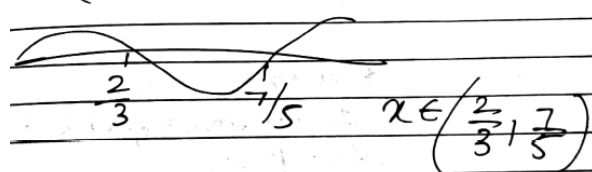
$$\begin{aligned} \alpha \mid 2\alpha & \left. \begin{array}{l} 2\alpha^2 = k \\ 9 \end{array} \right\} \\ 3\alpha & \left. \begin{array}{l} 2 \times 4 = k \\ 9 = 9 \end{array} \right\} \\ 3\alpha = 2 & \\ \alpha = 2/3 & \quad k = 8 \end{aligned}$$

25. Conceptual

26.

$$\begin{aligned} D &= 4 - 4 \times 4 \times 7 \\ &= 20 \quad D > 0 \quad \textcircled{B} \end{aligned}$$

27.

$$\begin{aligned} 15x^2 - 31x + 14 &< 0 \\ 15x^2 - 10x - 21x + 14 &< 0 \\ 5x(3x-2) - 7(3x-2) &< 0 \\ -7(3x-2) &< 0 \\ (5x-7)(3x-2) &< 0 \end{aligned}$$


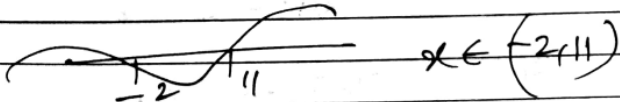
$$x \in \left(\frac{2}{3}, \frac{7}{5}\right)$$

28.

$$x^2 - 7x + 3 - 2x - 25 < 0$$

$$x^2 - 9x - 22 < 0$$

$$x^2 - 11x + 2x - 22 < 0$$

$$(x-11)(x+2) < 0$$


29.

$$\alpha + \beta = 12 \quad \alpha\beta = 27$$

$$\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$$

$$= 12^3 - 3 \times 27 \times 12$$

$$= 756$$

30.

$$a + b + c = 0$$

1 is one of the roots

$$\alpha = \beta = 1$$

$$\alpha\alpha\beta = 1 = \frac{c}{a}$$

$$1 = \frac{c^2 - a^2}{a^2 - b^2}$$

$$2a^2 = c^2 - b^2$$

31.

$$x + \frac{1}{x} = \frac{10}{3}$$

$$\frac{x^2 + 1}{x} = \frac{10}{3}$$

$$3x^2 - 10x + 3 = 0$$

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

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

$$x = 3 \quad x = \frac{1}{3}$$

$$\sqrt{5x-6} = 3 \quad \sqrt{5x-6} = \frac{1}{3}$$

$$5x-6 = 9 \quad 5x-6 = \frac{1}{9}$$

$$\boxed{x = 3} \quad 5x = \frac{55}{9}$$

$$x = \frac{11}{9}$$

LEVEL-2

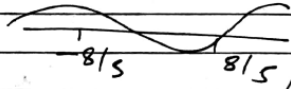
1.

$$x^2 + 5px + 16 = 0$$

$$D < 0$$

$$(5p)^2 - 4 \times 16 < 0$$

$$(5p - 8)(5p + 8) < 0$$



$$p \in \left(-\frac{8}{5}, \frac{8}{5}\right)$$

2.

$$D > 0$$

$$16 - 4 \times 2p > 0$$

$$2 - p > 0$$

$$p < 2$$

3.

For R-R check $D > 0$

4.

$$x^2 - px + q = 0$$

$$p = 1 \quad q = -2$$

$$D = p^2 - 4q$$

$$D = 1 - 4 \times -2 \quad D > 0$$

6.

$$D < 0$$

$$K^2 - 4 < 0$$

$$(K - 2)(K + 2)$$

$$K \in (-2, 2)$$

7.

$$\alpha \quad \alpha + 4$$

$$\alpha \times (\alpha + 4) = 192$$

$$\alpha = 12$$

8.

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

$$D > 0$$

$$16 - 4k > 0$$

$$4 - k > 0$$

$$\boxed{k < 4}$$

9.

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

$$16 - 4p - 4 = 0$$

$$12 = 4p$$

$$\boxed{p = 3}$$

$$x^2 + px + k = 0 \quad D = 0$$

$$p^2 - 4k = 0$$

$$3^2 - 4k = 0$$

$$\frac{9}{4} = k$$

10.

$$10x + y = 4(x + y)$$

$$6x - 3y = 0$$

$$\boxed{2x = y}$$

Also $\rightarrow 10x + y = 3 \times 2y$

$$10x + 2x = 6x$$

11.

$$x^2 = 2x$$

$$x = 0 \quad x = 2$$

$$\boxed{y = 4}$$

$$N = 24$$

12.

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

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

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

$$x = \frac{1}{2} \quad x = 2$$

New roots $x' = \frac{1}{2} \quad x'' = 4$

$$\text{eqn} = x^2 - 5x + 4$$

13.

$$2(l+b) = 82$$

$$l+b = 41$$

$$l \times b = 400$$

$l = 25$	$b = 25$
$b = 16$	$l = 16$

14.

$$x = \frac{1}{\sqrt{2}}$$

$$x + x$$

$$2x^2 = 1$$

$$x = \pm \frac{1}{\sqrt{2}}$$

15.

$$\frac{x-1}{x-2} + \frac{x-3}{x-4} = \frac{10}{3}$$

$$\frac{(x-1)(x-4) + (x-3)(x-2)}{(x-2)(x-4)} = \frac{10}{3}$$

$$\frac{2x^2 - 10x + 10}{x^2 - 6x + 8} = \frac{10}{3}$$

$$2x^2 - 15x + 25 = 0$$

$$x = 5 \quad \text{or} \quad x = 5/2$$

16.

$$D < 0$$

17.

$$x = 7 + 4\sqrt{3}$$

$$\frac{1}{x} = 7 - 4\sqrt{3}$$

$$x + \frac{1}{x} = 14$$

18.

$$x = \sqrt{1+x}$$

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

$$x = \frac{1 \pm \sqrt{5}}{2}$$

$$x \neq \frac{1 - \sqrt{5}}{2} \quad \text{or} \quad x = \frac{1 + \sqrt{5}}{2}$$

19.

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

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

$$x = \frac{-1 \pm \sqrt{5}}{2}$$

20.

$$\frac{\alpha}{a\beta+b} + \frac{\beta}{a\alpha+b}$$

$$= \frac{\alpha(a\alpha+b) + \beta(a\beta+b)}{(a\beta+b)(a\alpha+b)}$$

$$\Rightarrow \frac{a\alpha^2 + \alpha b + a\beta^2 + \beta b}{a^2\alpha\beta + ab(\alpha+\beta) + b^2}$$

$$= \frac{a(\alpha^2 + \beta^2) + b(\alpha + \beta)}{a^2\alpha\beta + ab(\alpha + \beta) + b^2}$$

$$\Rightarrow \frac{a((\alpha + \beta)^2 - 2\alpha\beta) + b(\alpha + \beta)}{a^2\alpha\beta + ab(\alpha + \beta) + b^2}$$

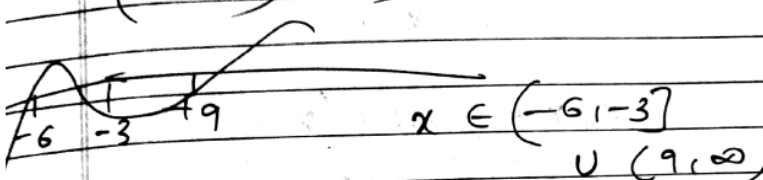
put $\alpha + \beta = -b/a$

$\alpha\beta = c/a$

21.

$$\frac{(x+3)}{(x+6)(x+9)} \geq 0$$

$x^2 - 9x + 54 < 0$
 $(x-9)(x+6)$



$x \in (-6, -3] \cup (9, \infty)$

23.


$$x^2 + x - 12 < 0$$

$$x^2 - 3x + 2$$

$$x^2 + 4x - 3x - 12 < 0$$

$$x^2 - 2x - x + 2$$


$$x(x+4)(x+4)(x-3) < 0$$

$$(x-2)(x-1)$$


$$(-4, 1) \cup (2, 3)$$

24.

$x^2 - 4x + 3 > 0$	$x^2 - 4x - 2x + 8 < 0$
$(x-3)(x-1) > 0$	$(x-4)(x-2) < 0$



$$x \in (3, 4)$$

25.

$$a \times b = c / a = -16$$

26.

$$f(x) \text{ is max}$$

$$\text{for } x = -b/2a$$

$$= -(-5)$$

$$+ 2x - 3$$

$$= \frac{5}{-6}$$

27.

$$D > 0$$

$$(2k)^2 - 4 \times (2k^2 - 4) > 0$$

$$4k^2 - 8k^2 + 16 > 0$$

$$-4k^2 + 16 > 0$$

$$-k^2 + 4 > 0$$

$$(k-2)(k+2) \leq 0$$

28.

$$x = \sqrt{30+x}$$

$$x^2 - x - 30 = 0$$

$$(x-6)(x+5)$$

$$x = 6$$

29.

$$y^2 + 6y - 3m = 0 \quad y^2 - 3y + m = 0$$

let common root be c

$$c^2 + 6c - 3m = 0 \quad c^2 - 3c + m = 0$$

$$3m = c^2 + 6c \quad m = 3c - c^2$$

$$3\sqrt{3c - c^2} = c^2 + 6c$$

$$4c^2 - 3c = 0$$

$$c = 0 \text{ or } c = 3/4$$

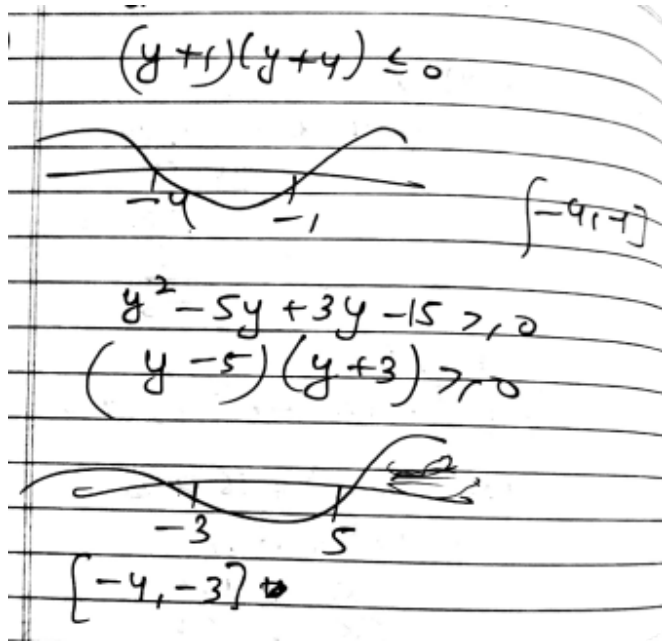
$$c = 0 \quad c = 3/4$$

$$m = 0$$

$$m = \frac{27}{16}$$

$$m = \frac{27}{16}$$

30.



31.

