QUADRATIC EXPRESSION - I
TEACHING TASK
JEE MAINS LEVEL

1. Given $\frac{x^2-2x-3}{x+1}=0$

Clearly, $x+1\neq 0 \Rightarrow x\neq -1$

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

$\Rightarrow (x-3)(x+1)=0$

$\Rightarrow x-3=0 \quad or \quad x+1=0$

$\Rightarrow x=3 \quad or \quad x=-1$

$\therefore$ The solution set $=\{3\}$

Ans : C

2. Given $\sqrt{5x^2-6x+8}-\sqrt{5x^2-6x-7}=1$

Let $5x^2-6x = t$

$\Rightarrow \sqrt{t+8}-\sqrt{t-7}=1$

$\Rightarrow \sqrt{t+8}-1+\sqrt{t-7}$

squaring on both sides

$\Rightarrow t+8=1+t-7+2\sqrt{t-7}$

$\Rightarrow 2\sqrt{t-7}=14 \qquad since \quad t\neq 0$

$\Rightarrow \sqrt{t-7}=7$

$\Rightarrow t-7=49$

$\Rightarrow 5x^2-6x-7-49=0$

$\Rightarrow 5x^2-6x-56=0$

$\Rightarrow x=4 \quad or \quad x=\frac{-14}{5}$

Ans : B

3. Given a,b amd c are in A.P

$\Rightarrow 2b=a+c \quad ....(i)$

Given $ax^2+bx+c = 0$

$\Rightarrow ax^2+\left(\frac{a+c}{2}\right)x+c=0 \qquad [from\ (i)]$

$\Rightarrow 2ax^2+(a+c)x+2c=0$

Given 2 is one root, let α be the other root.

We have $\alpha.2=\frac{2c}{2a}=\frac{c}{a} \quad ....(ii)$

and $\alpha + 2 = -\left(\frac{a+c}{2a}\right)$

$$= -\left(\frac{1}{2} + \frac{c}{2a}\right)$$

$$= -\left(\frac{1}{2} + \alpha\right) \qquad from\,(ii)$$

$$= -\left(\frac{1}{2} - \alpha\right)$$

$$\Rightarrow \alpha + \alpha \;=\; \frac{-1}{2} - 2$$

$$\Rightarrow 2\alpha \;=\; \frac{-5}{2}$$

$$\Rightarrow \alpha \;=\; \frac{-5}{4}$$

Ans : A

4. We know $30^0 + 15^0 = 45^0$

$$\Rightarrow \tan\left(30^0 + 15^0\right) = \tan 45^0$$

$$\Rightarrow \frac{\tan 30^0 + \tan 15^0}{1 - \tan 30^0 . \tan 15^0} = 1$$

$$\Rightarrow \frac{(-p)}{1-q} = 1$$

$$\Rightarrow 1 - q = -p$$

$$\Rightarrow q - p = 1$$

$$\Rightarrow 2 + q - p = 3$$

Ans : D

5. Given $2x^2-3x-6 = 0$

$$\Rightarrow \alpha + \beta = \frac{3}{2} \;\; and \;\; \alpha.\beta = -3$$

Now, $\left(\alpha^2 + 2\right) + \left(\beta^2 + 2\right) = \alpha^2 + \beta^2 + 4$

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

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

$$= \frac{49}{4}$$

Again, $\left(\alpha^2+2\right)\left(\beta^2+2\right)=\alpha^2\beta^2+2\left(\alpha^2+\beta^2\right)+4$

$=\alpha^2\beta^2+2\left[\left(\alpha+\beta\right)^2-2\alpha\beta\right]+4$

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

$=\frac{59}{2}$

The required equation is

$x^2-\left(\frac{49}{4}\right)x+\frac{59}{2}=0$

$\Rightarrow 4x^2-49x+118=0$

Ans : D

6. Given $ax^2+bx+c=0$

We know, $\alpha+\beta=\frac{-b}{a}$ *and* $\alpha.\beta=\frac{c}{a}$

Now $\frac{1}{\alpha^3}+\frac{1}{\beta^3}=\frac{\alpha^3+\beta^3}{\left(\alpha\beta\right)^3}$

$=\frac{\left(\alpha+\beta\right)^3-3\alpha\beta\left(\alpha+\beta\right)}{\left(\alpha\beta\right)^3}$

$=\frac{\left(\frac{-b}{a}\right)^3-3\left(\frac{c}{a}\right)\left(\frac{-b}{a}\right)}{\left(\frac{c}{a}\right)^3}$

$=\frac{3abc-b^3}{c^3}$

Ans : C

7. Given $x^2-(5m-2)x+(4m^2+10m+25)$ is a perfectsquare

we have, $\Delta=b^2-4ac=0$

$\Rightarrow \left(5m-2\right)^2-4\left(4m^2+10m+25\right)=0$

$\Rightarrow 25m^2-20m+4-16m^2-40m-100=0$

$\Rightarrow 9m^2-60m-96=0$

$\Rightarrow 3m^2-20m-32=0$

$\Rightarrow m = -\frac{4}{3} \quad or \quad 8$

Ans : C

8. Given $\left(a^2+b^2\right)x^2+2\left(bc+ad\right)x+\left(c^2+d^2\right)=0$

$\Rightarrow \left(ax+d\right)^2+\left(bx+c\right)^2 = 0$

$\Rightarrow ax+d = 0 \quad and \quad bx+c=0$

$\Rightarrow \frac{-d}{a} = \frac{-c}{b}$

$\Rightarrow ac = bd$

$\Rightarrow a^2c^2 = \left(bd\right)^2$

$\therefore a^2, bd, c^2$ are in G.P

Ans : B

9. Given $x^{\sqrt{x}} = \left(\sqrt{x}\right)^x$

$\Rightarrow \log x^{\sqrt{x}} = \log\left(\sqrt{x}\right)^x$

$\Rightarrow \sqrt{x}.\log x = \log x^{\frac{x}{2}}$

$\Rightarrow \sqrt{x}.\log x = \frac{x}{2}.\log x$

$\Rightarrow \sqrt{x}.\log x - \frac{x}{2}.\log x = 0$

$\Rightarrow \log x\left(\sqrt{x}-\frac{x}{2}\right) = 0$

$\Rightarrow \log x = 0 \quad or \quad \sqrt{x}-\frac{x}{2} = 0$

$\Rightarrow x = 1 \quad or \quad \sqrt{x} = \frac{x}{2}$

$\Rightarrow x = \frac{x^2}{4}$

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

$\Rightarrow x\left(x-4\right)=0$

$\Rightarrow x = 0 \quad or \quad r=4$

But $x \neq 0$

$\therefore$ The solution set $= \{1,4\}$

Ans : C

10. Given $(a+b+c)x^2-2(a+c)x+(a-b+c)=0$

$$\Delta=4(a+c)^2-4(a+b+c)(a+c-b)$$

$$=4(a+c)^2-4\left[(a+c)^2-b^2\right]$$

$$=4b^2>0$$

The roots are rational

Ans : C

JEE ADVANCED LEVEL

11. Given $x^2+3x-2=0$

$$\Rightarrow \alpha+\beta=-3,\ \alpha\beta=-2$$

Now $\Rightarrow \dfrac{\alpha+1}{\alpha}+\dfrac{\beta+1}{\beta} = 1+\dfrac{1}{\alpha}+1+\dfrac{1}{\beta}$

$$=2+\left(\frac{\alpha+\beta}{\alpha\beta}\right)$$

$$=2+\left(\frac{-3}{-2}\right)$$

$$=\frac{7}{2}$$

$$=\frac{14}{4}$$

Ans : A,C

12. $A.M=\dfrac{\alpha+\beta}{2}=9$

$$\Rightarrow \alpha+\beta=18$$

$G.M=\sqrt{\alpha\beta}=4$

$$\Rightarrow \alpha\beta=16$$

$Q.E\ \ is\ \ x^2-(\alpha+\beta)x+\alpha\beta=0$

$$\Rightarrow x^2-18x+16=0$$

Also $2x^2-36x+32=0$

Ans : B,C

13. **Statement - I**

We have $\alpha+\beta=\frac{-b}{a}$ and $\alpha.\beta=\frac{-c}{a}$

Now, $\left(\frac{\alpha}{\beta}-\frac{\beta}{\alpha}\right)^2 = \left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)^2$

$$\Rightarrow \frac{\left((\alpha+\beta)(\alpha-\beta)\right)^2}{(\alpha\beta)^2}$$

$$\Rightarrow \frac{\left(\frac{-b}{a}\right)^2\left(\frac{\sqrt{b^2-4ac}}{|a|}\right)^2}{\left(\frac{c}{a}\right)^2}$$

$$\Rightarrow \frac{b^2\left(b^2-4ac\right)}{c^2a^2}$$

Hence, Statement-I is TRUE

Statement-II : We hare $\alpha+\beta=\frac{-b}{a}$ and $\alpha.\beta=\frac{c}{a}$

Hence, Statement-II is TRUE.
Also, Statement-II is the correct explanation of statement-I

Ans : A

14. **Statement-I**

$\Delta=\left[2(c-a)\right]^2-4(b-c)(a-b)$

$=4\left(c^2+a^2-2ac\right)-4\left(ab-b^2-ac+bc\right)$

$=4\left(c^2+a^2-2ac-ab+b^2+ac-bc\right)$

$=4\left(a^2+b^2+c^2-ab-bc-ca\right)$

$=2\left((a-b)^2+(b-c)^2+(c-a)^2\right)>0$

$\therefore$ The roots are real and distinct Hence, statement-I is TRUE.

Statement-II

If α,β are the roots of f(x) = 0, then $\frac{\alpha}{k}$ and $\frac{\beta}{k}$ are the roots of f(Kx) = 0

Hence, statement-I is TRUE.
Both statements are TRUE, but statement-II is NOT the correct explanation of statement-I.

Ans : B

15. **<u>Comprehension-I</u>**

We have $\alpha+\beta=15$ and $\alpha.\beta=1$

Now, $\left(\frac{1}{\alpha}-15\right)^{-2}+\left(\frac{1}{\beta}-15\right)^{-2}$

$=(\beta-15)^{-2}+(\alpha-15)^{-2}$

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

$=\frac{1}{\alpha^2}+\frac{1}{\beta^2}$

$=\frac{\alpha^2+\beta^2}{\alpha^2\beta^2}$

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

$=\frac{(15)^2-2(1)}{(1)^2}$

= 223

Ans : A

16. We have $\alpha+\beta=\frac{-q}{p}$, $\alpha\beta=\frac{r}{p}$ .... (i)

Since, p,q,r are in $A.P \Rightarrow 2q=p+r$ .... (ii)

Now, $\frac{1}{\alpha}+\frac{1}{\beta}=4$

$\Rightarrow \frac{\alpha+\beta}{\alpha\beta}=4$

$\Rightarrow \frac{-q}{r}=4$ from (i)

$\Rightarrow q=-4r$

Also, 2q = p+r

$\Rightarrow 2(-4r)=p+r$

$\Rightarrow p=-9r$

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

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

$$= \frac{16r^2}{81r^2} + \frac{4r}{9r}$$

$$= \frac{16}{81} + \frac{4}{9}$$

$$= \frac{52}{81}$$

$$\therefore \alpha - \beta = \frac{2\sqrt{3}}{9}$$

Ans : D

17. One root is $2+\sqrt{3}$

$\therefore$ Other root is $2-\sqrt{3}$

Quadratic equation is

$$x^2 - \left[\left(2+\sqrt{3}\right)+\left(2-\sqrt{3}\right)\right]x + \left(2+\sqrt{3}\right)\left(2-\sqrt{3}\right) = 0$$

$$\Rightarrow x^2 - 4x + 1 = 0$$

Ans : B

18. The quadratic equation is

$$x^2 - \left(-\frac{2}{3}+\frac{3}{7}\right)x + \left(-\frac{2}{3}\right)\left(\frac{3}{7}\right) = 0$$

$$\Rightarrow 21x^2 + 5x - 6 = 0$$

Ans : D

Integer answer types questions

19. We know $22^0 + 23^0 = 45$

$$\Rightarrow \; Tan\left(22^0 + 23^0\right) = \tan 45^0$$

$$\Rightarrow \; \frac{Tan22^0 + Tan23^0}{1 - Tan22^0.Tan23^0} = 1$$

$$\Rightarrow \; \frac{-a}{1-b} = 1$$

$$\Rightarrow \; a - b = -1$$

Ans : -1

20. We have $\alpha + \beta = 6$, $\alpha.\beta = q$

Given $\alpha^2 - \beta^2 = 24$

$$\Rightarrow (\alpha+\beta)(\alpha-\beta) = 24$$

$$\Rightarrow (\alpha+\beta)\sqrt{(\alpha+\beta)^2 - 2\alpha\beta} = 24$$

$\Rightarrow 6\sqrt{36-2q} = 24$

$\Rightarrow \sqrt{36-2q} = 4$

$\Rightarrow 36-2q = 16$

$\Rightarrow 2q = 20$

$\Rightarrow q = 10$

Ans : 10

Learner's Task

CUQ'S

1. $x^2-2x+4 = 0$, $y^2+y-6 = 0$ and $z^2-3=0$ are all quadratic equations

Ans : D

2. Given $(x-2)(8-x) = 0$

$\Rightarrow (x-2)(x-8) = 0$

$\Rightarrow x^2-10x+16 = 0$

Linear term = -10x

Ans : B

3. Given $(x-a)(x-b) = b^2$

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

Now, $\Delta = B^2-4AC$

$= (a+b)^2-4.1(ab-b^2)$

$= (a+b)^2-4ab+4b^2$

$= (a-b)^2+4b^2>0$

The roots are real and distinct

Ans : A

4. Given $x^2+x-1 = 0$

Now, $\Delta = b^2-4ac$

$= 1^2-4.1.(-1)$

= 5, Which is not a perfect square

$\therefore$ The roots are irrational and conjugate

Ans : D

5. Given $x^2-15-m(2x-8) = 0$

$\Rightarrow x^2-2mx+8m-15 = 0$

$\Rightarrow \Delta = 0$

$\Rightarrow (-2m)^2-4(8m-15) = 0$

$\Rightarrow m^2-8m+15 = 0$

$\Rightarrow (m-3)(m-5) = 0$

$\Rightarrow m = 3 \text{ or } 5$

Ans : D

6. Let $f(x) = x^2+11x+3 = 0$
Required equation is $f(x+4) = 0$
$\therefore (x+4)^2+11(x+4)+3 = 0$
$\Rightarrow x^2+19x+73=0$

Ans : B

7. If one root is 3+2i, the other root is 3-2i.

Ans : A

8. The roots of $f\left(\sqrt{x}\right)=0$ are α^2 *and* β^2

Ans : B

9. $\Delta = a^2 - 4bc$

Ans : C

10. Each root is equal to either $\frac{-b}{2a}$ or $\sqrt{\frac{c}{a}}$

Since $\alpha+\beta = \frac{-b}{a}$ *and* $\alpha.\beta = \frac{c}{a}$

$$\Rightarrow \alpha+\alpha = \frac{-b}{a} \text{ and } \alpha.\alpha = \frac{c}{a}$$

$$\Rightarrow 2\alpha = \frac{-b}{a} \text{ and } \alpha^2 = \frac{c}{a}$$

$$\Rightarrow \alpha = \frac{-b}{2a} \text{ and } \alpha = \sqrt{\frac{c}{a}}$$

Ans : D

JEE MAINS LEVEL QUESTIONS

1. Given $\alpha+\beta = S_1$ *and* $\alpha.\beta = S_2$

We have $x^2-(\alpha+\beta)x+\alpha\beta=0$

$$\Rightarrow x^2 - S_1x + S_2 = 0$$

Ans : A

2. Given $(b+c-a)x^2+(c+a-b)x+(a+b-c) = 0$

$\Rightarrow (-a-a)x^2+(-b-b)x+(-c-c)=0$ since $a+b+c = 0$

$\Rightarrow 2ax^2+2bx+2c=0$

$\Rightarrow ax^2+bx+c=0$

Now, $\Delta = b^2-4ac$
$= (-a-c)^2-4ac$
$= (a+c)^2-4ac$
$= (a-c)^2>0$

$\therefore$ The roots are real and distinct

Ans : B

3. Let $\alpha = 3-2i,\ \beta = 3+2i$ quadratic equation is $x^2-(\alpha+\beta)x+\alpha\beta=0$

$\Rightarrow x^2-[(3-2i)+(3+2i)]x+(3-2i)(3+2i) = 0$

$\Rightarrow x^2-6x+13 = 0$

Ans : C

4. We have $\sin\theta+\cos\theta=\frac{-b}{a}$ and $\sin\theta.\cos\theta=\frac{c}{a}$

Now, $(\sin\theta+\cos\theta)^2=\frac{b^2}{a^2}$

$\Rightarrow \sin^2\theta+\cos^2\theta+2\sin\theta.\cos\theta=\frac{b^2}{a^2}$

$\Rightarrow 1+2\left(\frac{c}{a}\right)=\frac{b^2}{a^2}$

$\Rightarrow a^2+2ac=b^2$

$\therefore\ b^2=a^2+2ac$

Ans : A

5. Given $\alpha+\beta=-1$

$\Rightarrow -\left(\frac{2a+3}{a+1}\right)=-1$

$\Rightarrow 2a+3=a+1$

$\Rightarrow a=-2$

Now, product of the roots $=\frac{3a+4}{a+1}$

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

$= 2$

Ans : B

6. Given $\alpha+\beta=\frac{-b}{a}$ and $\alpha.\beta=\frac{c}{a}$

Now, $(\alpha+1).(\beta+1)=1$

$\Rightarrow \alpha\beta+\alpha+\beta+1=1$

$\Rightarrow \frac{-b}{a}+\frac{c}{a}=0$

$\Rightarrow b=c$

Ans : C

7. 4 is root of $x^2+px+12 = 0$

$$\Rightarrow 4^2 + p(4)+12 = 0$$

$$\Rightarrow p = -7$$

Given $x^2+px+q = 0$ has equal roots

i.e $x^2-7x+q = 0$

Now, $\Delta = b^2 - 4ac = 0$

$$\Rightarrow 49 - 4q = 0$$

$$\Rightarrow q = \frac{49}{4}$$

Ans : D

8. Given $x^{\frac{2}{3}} + x^{\frac{1}{3}} - 2 = 0$

Let $x^{\frac{1}{3}} = t$

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

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

$$\Rightarrow t+2 = 0 \quad or \quad t-1 = 0$$

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

$$\Rightarrow x^{\frac{1}{3}} = -2 \quad or \quad x^{\frac{1}{3}} = 1$$

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

$$\Rightarrow x = -8 \quad or \quad x = 1$$

Ans : B

9. $f(x) = 4x^2+7x+2 = 0$

$$f(\sqrt{x}) = 4(\sqrt{x})^2 + 7(\sqrt{x}) + 2 = 0$$

$$\Rightarrow 4x + 7\sqrt{x} + 2 = 0$$

$$\Rightarrow 4x + 2 = -7\sqrt{x}$$

$$\Rightarrow 16x^2 + 16x + 4 = 49x$$

$$\Rightarrow 16x^2 - 33x + 4 = 0$$

Ans : D

10. Given $x^2+4x+3 = 0$

$$\Rightarrow (x+1)(x+3) = 0$$

$$\Rightarrow x = -1 \; or \; -3$$

$\therefore$ Both roots are negative

Ans : B

JEE ADVANCED LEVEL QUESTIONS

11. Given $x^2+3x+1 = 0$

$$\Rightarrow x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$\Rightarrow x = \frac{-3 \pm \sqrt{9-4}}{2}$$

$$\Rightarrow x = \frac{-3 \pm \sqrt{5}}{2}$$

Ans : A,B

12. Given $x^2+x-3 = 0$

Now, $\Delta = b^2-4ac$

$= (1)^2-4.1.(-3)$

$= 13$, which is not a perfect square

$\therefore$ The roots are Irrational and distinct

Ans : C,D

Statement Type:

13. Statement - I:

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

$$\Rightarrow (x-2)^2 = 0$$

$$\Rightarrow x = 2,\ 2$$

$\therefore$ Hence, statement-I is TRUE.

Statement - II :

Given $ax^2+bx+c = 0$

Now, $\alpha + \beta = \frac{-b}{a}$

$$\Rightarrow \alpha + \alpha = \frac{-b}{a}$$

$$\Rightarrow 2\alpha = \frac{-b}{a}$$

$$\Rightarrow \alpha = \frac{-b}{2a}$$

Hence, statement - II is TRUE.

Statement-II is the correct explanation of statement-I

Ans : A

14. Statement-I

Let $f(x) = ax^2+bx+c = 0$

The equation whose roots are the negatives of the roots of $f(x)=0$ is $f(-x) = 0$

i.e $f(-x) = a(-x)^2+b(-x)+c = 0$

$\Rightarrow ax^2 - bx + c = 0$

Hence, statement-I is TRUE.

Statement-II Given x^2-3x+4 = 0

The sum of the roots $= \frac{-b}{a}$

$$= \frac{-(-3)}{1} = 3$$

Hence, statement-II is FALSE

Ans : C

Comprehesion Type Questions:

Comprehension-I

15. Let f(x) = x^2+x+1 = 0

Required equation is f(x-1)=0

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

$\Rightarrow x^2 - x + 1 = 0$

Ans : C

16. Given α, β are roots of $2x^2$-3x-6 = 0

We have $\alpha + \beta = \frac{3}{2}$ and $\alpha.\beta = -3$

Now $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$

$$= \left(\frac{3}{2}\right)^2 - 2(-3)$$

$$= \frac{33}{4}$$

Now $(\alpha^2 + 2) + (\beta^2 + 2) = \alpha^2 + \beta^2 + 4$

$$= \frac{33}{4} + 4$$

$$= \frac{49}{4}$$

Now, $(\alpha^2 + 2)(\beta^2 + 2) = \alpha^2\beta^2 + 2(\alpha^2\beta^2) + 4$

$$= (-3)^2 + 2\left(\frac{33}{4}\right) + 4$$

$$= \frac{59}{2}$$

$\therefore$ The required equation is

$$x^2-\left(\frac{49}{4}\right)x+\frac{59}{2}=0$$

$$\Rightarrow 4x^2-49x+118=0$$

Ans : B

Comprehension-II

17. Given $x^2+x+3 = 0$

Discriminant = $\Delta = b^2-4ac$

= 1^2-4.1.3

= -12<0

$\therefore$ The roots are imaginary

Ans : C

18. a) $9x^2-6x+1=0$

$\Delta = (-6)^2-4.9.1$

= 0

b) $x^2+6x+9=0$

$\Delta = 6^2-4.1.9$

= 0

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

$\Delta = (-4)^2-4.1.4$

= 0

Ans : D

Integer Answer Type :

19. Given $(a^2-5a+3)x^2+(3a-1)x+2=0$

Let $\alpha, 2\alpha$ be the roots

We have, $\alpha+2\alpha = -\left(\frac{3a-1}{a^2-5\alpha+3}\right)$

$$\Rightarrow 3\alpha = \frac{1-3a}{a^2-5a+3}$$

$$\Rightarrow \alpha = \frac{1-3a}{3(a^2-5a+3)} \qquad \text{........... (i)}$$

Also, $\alpha.2\alpha = \frac{2}{a^2-5a+3}$

$$\Rightarrow \alpha^2 = \frac{1}{a^2-5a+3}$$

$$\Rightarrow\left[\frac{1-3a}{3\left(a^2-5a+3\right)}\right]^2=\frac{1}{a^2-5a+3}$$

$$\Rightarrow\left[\frac{1-3a}{9\left(a^2-5a+3\right)^2}\right]^2=\frac{1}{a^2-5a+3}$$

$$\Rightarrow\frac{1-6a+9a^2}{9\left(a^2-5a+3\right)}=1 \qquad \text{since} \quad a^2-5a+3\neq 0$$

$$\Rightarrow 1-6a+9a^2=9a^2-45a+27$$

$$\Rightarrow 39a=26$$

$$\Rightarrow 3a \text{ x } 13=26$$

$$\Rightarrow 3a=2$$

Ans : 2

20. Given x^2-5x+6 = 0

$$\Rightarrow \alpha+\beta=5,\ \alpha.\beta=6$$

We have $\alpha^2+\beta^2=\left(\alpha+\beta\right)^2-2\alpha\beta$

= $(5)^2$-2(6)

= 13

Ans : 13

Matrix Matching Type

21. a) $\alpha^3+\beta^3=\left(\alpha+\beta\right)^3-3\alpha\beta\left(\alpha+\beta\right)$

$$=\left(\frac{-b}{a}\right)^3-3\left(\frac{c}{a}\right)\left(\frac{-b}{a}\right)$$

$$=\frac{-b^3}{a^3}+\frac{3bc}{a^2}$$

$$=\frac{3abc-b^3}{a^3}$$

b) $\alpha^2+\beta^2=\left(\alpha+\beta\right)^2-2\alpha\beta$

$$=\left(\frac{-b}{a}\right)^2-2\left(\frac{c}{a}\right)$$

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

$$=\frac{b^2-2ac}{a^2}$$

c) $|\alpha - \beta| = \sqrt{(\alpha+\beta)^2 - 4\alpha\beta}$

$$= \sqrt{\left(\frac{-b}{a}\right)^2 - \frac{4c}{a}}$$

$$= \sqrt{\frac{b^2}{a^2} - \frac{4c}{a}}$$

$$= \sqrt{\frac{b^2 - 4ac}{a^2}}$$

$$= \frac{\sqrt{b^2 - 4ac}}{|a|}$$

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

Ans: a-t, b-p, c-s, d-q

22. a) The roots of $f\left(\frac{x}{K}\right) = 0$ are $k\alpha, k\beta$

b) The roots of f(kx) = 0 are $\frac{\alpha}{k}$ *and* $\frac{\beta}{k}$

c) The roots of $f\left(\sqrt{x}\right) = 0$ are α^2 *and* β^2

d) The roots of f(x-k) = 0 are $\alpha + k$ and $\beta + k$

Ans : a-s, b-p, c-q, d-r