Quadratic Equations
द्विघात समीकरण

Any equation of the form $p(x) = ax^2+bx+c=0$ where $a \neq 0$ is a quadratic equation. where x is a variable and highest power (degree) of x is 2 and a, b, c are real numbers (constants).

कोई भी समीकरण $p(x) = ax^2+bx+c=0$ की तरह का जहाँ a जीरो न हो द्विघात समीकरण कहलाता है। जहाँ x एक चर संख्या है जिसकी अधिकतम घात 2 है तथा a, b, c अचर वास्तविक संख्यायें हैं।

Derivation of Quadratic Formula to solve x

x का मान ज्ञात करने का सूत्र निकालने की विधि

$$ax^2+bx+c=0 \qquad \text{पूरे समीकरण को a से भाग देने पर}$$

$$\therefore \frac{ax^2}{a}+\frac{b}{a}x+\frac{c}{a}=\frac{0}{a}$$

$$\therefore x^2+\frac{b}{a}x+\frac{c}{a}=0 \qquad \text{पूर्ण वर्ग विधि अपनाने पर}$$

$$\therefore (x)^2+2\left(\frac{b}{2a}\right)x+\left(\frac{b}{2a}\right)^2-\left(\frac{b}{2a}\right)^2+\frac{c}{a}=0$$

$$\therefore \left(x+\frac{b}{2a}\right)^2-\frac{b^2}{4a^2}+\frac{c}{a}=0$$

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

$$\therefore \left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$$

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

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

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

Exercise 4.1

Q(1) (i) check whether the following are quadratic equations

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

$\therefore\ x^2+2x+1 = 2x-6$ [expanding brackets - ब्रैकेट को खोलने पर

$\therefore\ x^2+\cancel{2x}+1-\cancel{2x}+6 = 0$

$\therefore\ x^2+0.x+7 = 0$ [The highest power of x is 2 ∴ it is Quadratic eqⁿ. क्योंकि चर की अधिकतम घात 2 है इसलिये द्विघात समीकरण है।

Yes it is a Quadratic Equation.

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

$\therefore\ x^2-2x = -6+2x$

$\therefore\ x^2-2x+6-2x = 0$ [The highest power of x is 2 ∴ it is a Quadratic Equation.

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

क्योंकि अधिकतम घात 2 है ∴ ये द्विघात समीकरण है।

(iii) $(x-2)(x+1) = (x-1)(x+3)$

$\therefore\ x^2+x-2x-2 = x^2+3x-x-3$

$\therefore\ \cancel{x^2}+x-2x-2-\cancel{x^2}-3x+x+3 = 0$

$\therefore\ -3x+1 = 0$ The highest power of x is 1 ∴ it is not a Quadratic Eqⁿ.

क्योंकि अधिकतम घात एक है ∴ ये द्विघात समीकरण नहीं है

(iv) $(x-3)(2x+1) = x(x+5)$

$\therefore\ 2x^2+x-6x-3 = x^2+5x$

$2x^2-5x-3-x^2-5x = 0$

$x^2-10x-3 = 0$ [The highest power of x is 2 ∴ it is a Quadratic Equation

क्योंकि अधिकतम घात 2 है ∴ ये द्विघात समीकरण है।

(v) $(2x-1)(x-3) = (x+5)(x-1)$

$\therefore\ 2x^2-6x-x+3 = x^2-x+5x-5$

$\therefore\ 2x^2-7x+3-x^2-4x+5 = 0$

$\therefore\ x^2-11x+8 = 0$ [The highest power of x is 2 ∴ it is a quadratic equation

∴ क्योंकि अधिकतम घात 2 है ∴ ये द्विघात समीकरण है।

Exercise 4.1
Class X Maths

Q1 (VI) Check whether the following are quadratic equations

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

$\therefore \cancel{x^2}+3x+1-(\cancel{x^2}-4x+4)=0$

$3x+1+4x-4=0$

$7x-3=0$ [$\because$ The highest power of x is 1 $\therefore$ It is not a quadratic equation]

[क्योंकि चर x की अधिकतम घात 1 है ∴ ये द्विघात समीकरण नहीं है।]

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

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

$\therefore \underline{x^3}+3\times2x^2+3\times4x+8-\underline{2x^3}+2x=0$

$\therefore -x^3+6x^2+14x+8=0$

[$\because$ The highest power of x is 3 $\therefore$ it is not a quadratic equation]
क्योंकि चर x की अधिकतम घात 3 है ∴ द्विघात समीकरण नहीं है]

(VIII) $x^3-4x^2-x+1=(x-2)^3$

$\therefore x^3-4x^2-x+1=(x)^3+3(x)^2(-2)+3(x)(-2)^2+(-2)^3$

$\therefore \cancel{x^3}-4x^2-x+1=\cancel{x^3}-6x^2+12x-8$

$-4x^2-x+1=-6x^2+12x-8$

$-4x^2-x+1+6x^2-12x+8=0$

$2x^2-13x+9=0$

[$\because$ The highest power of the variable x is 2 $\therefore$ It is a quadratic equation. क्योंकि चर x की अधिकतम घात 2 है अत: यह एक द्विघातीय समीकरण है।]

Q2 Represent the following situations in the form of quadratic equations:

(1) The area of a rectangular plot is 528 m^2. The length of the plot (in metres) is one more than twice its breadth. We need to find the length and breadth of the plot.

Date
Page

Q2 (I) Let the breadth be x

$\therefore$ the length is $2x+1$

According to question Area = length $\times$ breadth

$\therefore = (2x+1)(x) = 528\ m^2$

$\therefore 2x^2 + x - 528 = 0$

$\therefore 2x^2 + 33x - 32x - 528 = 0$

$\therefore x(2x+33) - 16(2x+33) = 0$

$\therefore (x-16)(2x+33) = 0$

$\therefore$ either $x-16=0$ or $2x+33=0$

$\therefore x = 16$ or $x = -\frac{33}{2}$

but breadth of a plot cannot be -ve.

$\therefore x = 16$

or breadth of plot = 16 m

$\therefore$ length of field $= (2\times16)+1 = 32+1 = 33$ m

$\therefore \left.\begin{array}{l}\text{length} = 33\ m \\ \text{breadth} = 16\ m\end{array}\right\}$ Ans

Rough Work

x | $2x^2 \times (-528)$
2 | $2x^2 \times (-528)$
x | $x \times (-528)$
2 | -528
2 | -264
2 | -132
2 | -66
3 | -33
11 | -11
-1 | -1
 | 1

$(3\times11\times x) - (2\times2\times2\times2\times2\times x)$

$\therefore 33x - 32x = x$

(II) The product of two consecutive positive integers is 306. We need to find the integers.

Let the integers be x and $x+1$ respectively

$\therefore x(x+1) = 306$

$\therefore x^2 + x - 306 = 0$

$\therefore x^2 + 18x - 17x - 306 = 0$

$\therefore x(x+18) - 17(x+18) = 0$

$\therefore (x+18)(x-17) = 0$

$\therefore$ Either $x+18 = 0$ or $x-17 = 0$

$\therefore x = -18$ or $x = 17$

x | $(x^2)(-306)$
x | $x(-306)$
2 | (-306)
3 | (-153)
3 | (-51)
17 | (-17)
-1 | -1
 | 1

$(2\times3\times3\times x) - 17x$

$18x - 17x = x$

Taking +ve value the first integer is 17 and next integer is 18

$\therefore$ Integers are $(17, 18)$ Ans.

Date_____
Page_____

Q 2 (III) Rohan's mother is 26 years older than him. The product of their ages (in years) 3 years from now will be 360. We would like to find Rohan's present age.

Let Rohan's present age be x $\therefore$ 3 years from now it will be $x+3$

$\therefore$ His mothers age from three year now is $(x+29)$

$\therefore (x+29)(x+3) = 360$

$\therefore x^2+3x+29x+87-360=0$

$\therefore x^2+32x-273=0$

$\therefore x^2+39x-7x-273=0$

$\therefore x(x+39)-7(x+39)=0$

$\therefore (x+39)(x-7)=0$

$\therefore$ Either $x+39=0$ or $x-7=0$

$x=-39$ or $x=7$

but age cannot be negative $\therefore$ leaving -39

Age of Rohan or present age of Rohan $= 7$ yrs

Ans

$$\begin{array}{r|l} x & (x^2)(-273) \\ x & x(-273) \\ 3 & -273 \\ 7 & -91 \\ 13 & -13 \\ -1 & -1 \\ & 1 \end{array}$$

$(13\times3\times x)+[x\times7\times(-1)]$

$39x-7x=32x$

(IV) A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/hrs, Then it would have taken 3 hours more to cover the same distance. We need to find the speed of the train.

Let the speed of the train be x km/hr

$\therefore \frac{480}{x-8} - \frac{480}{x} = 3$ hr $\quad [\because \frac{\text{Distance}}{\text{speed}} = \text{Time}]$

$480\left[\frac{\cancel{x}-\cancel{x}+8}{(x+8)x}\right] = 3$

$\overset{160}{\cancel{480}}[+8] = \cancel{3}(x+8)x$

$+1280 = x^2+8x$

$x^2+8x-1280=0$

$x^2+40x-32x-1280=0$

$x(x+40)-32(x+40)=0$

$(x+40)(x-32)=0$

$\therefore$ Either $x+40=0$ or $x-32=0$

$\therefore x=-40$ or $x=32$

$\therefore$ Ignoring $-$ve value speed of train is: 32 km/hr.

$$\begin{array}{r|l} x & x^2(-1280) \\ x & x(-1280) \\ 2 & -1280 \\ 2 & -640 \\ 2 & -320 \\ 2 & -160 \\ 2 & -80 \\ 2 & -40 \\ 2 & -20 \\ 2 & -10 \\ 5 & -5 \\ -1 & -1 \end{array}$$

$(2\times2\times2\times5)x-(2\times2\times2\times2\times2)x$

$40x-32x=8x$

Exercise 4.2

Suppose α and β are the roots of the equation

$$ax^2+bx+c=0 \quad \text{——— (1)} \quad \text{or} \quad x^2+\frac{b}{a}x+\frac{c}{a}=0 \quad \text{——— (1)}$$

$$\therefore (x-\alpha)(x-\beta)=0$$

$$\therefore x^2-\alpha x-\beta x+\alpha\beta=0$$

$$\therefore x^2-(\alpha+\beta)x+\alpha\beta=0 \quad \text{——— (2)}$$

$\therefore$ equating the coefficients of eq^n (1) and eq^n (2)

coefficients of x are $-(\alpha+\beta)=\frac{b}{a}$

$$\therefore \alpha+\beta=-\frac{b}{a} \quad \text{——— (3)}$$

compairing the constant terms

$$\alpha\beta=\frac{c}{a} \quad \text{——— (4)}$$

$\therefore$ Sum of the roots $(\alpha+\beta)=-\frac{b}{a}$

Product of the roots $\alpha\beta=\frac{c}{a}$

Q1- Find the roots of the following quadratic equations by factorisation:

(1) $x^2-3x-10=0$

as $\alpha+\beta=-\frac{b}{a}$ $\therefore \alpha+\beta=-\left(\frac{-3}{1}\right)=3$ ——— (1)

$\alpha\beta=-\frac{10}{1}$ ——— (2)

$\alpha+\beta=3$ $\therefore \beta=3-\alpha$ putting this value of β into eq^n (2)

$$\alpha(3-\alpha)=-10$$

$$3\alpha-\alpha^2+10=0$$

$$\text{or} \quad \alpha^2-3\alpha-10=0$$

$$\begin{array}{r|l} 2 & -10\alpha^2 \\ 5 & -5\alpha^2 \\ \alpha & -\alpha^2 \\ -\alpha & -\alpha \\ & 1 \end{array}$$

$\therefore -5\alpha+2\alpha=-3\alpha$

$$\therefore \alpha^2-5\alpha+2\alpha-10=0$$

$$\alpha(\alpha-5)+2(\alpha-5)=0$$

$$(\alpha-5)(\alpha+2)=0$$

$\therefore$ either $\alpha-5=0$ or $\alpha+2=0$

$\therefore \alpha=5$ or $\alpha=-2$

if $\alpha=5$ $\quad \beta=3-5=-2$

if $\alpha=-2$ $\quad \beta=3-(-2)=3+2=5$

$\therefore$ roots are 5 and -2 Ans.

we can also find it directly for x

α की जगह हम इसे सीधा x से भी इसी तरह हल कर सकते हैं

आगे के हल हम अब सीधे x से ही करेंगे |

Exercise 4.2

Rough

Q1 (II) $2x^2+x-6=0$

$\therefore\ 2x^2+\underline{4x-3x}-6=0$

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

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

$\therefore$ Either $x=-2$ or $2x=3$

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

$\therefore$ Roots are $\left(-2 \text{ and } \frac{3}{2}\right)$ Ans.

$2 \,|\, (-6)\times(2x^2)$
$2 \,|\, (-3)(2x^2)$
$3 \,|\, (-3)(x^2)$
$x \,|\, (-1)(x^2)$
$-x \,|\, -x$
$2\times 2\times \cancel{x}^{1} - 3\times x = x$
$4x-3x=x$

(III) $\sqrt{2}x^2+7x+5\sqrt{2}=0$

$\therefore\ \sqrt{2}x^2+\underline{2x+5x}+5\sqrt{2}=0$

$\therefore\ \sqrt{2}x(x+\sqrt{2})+5(x+\sqrt{2})=0$

$(x+\sqrt{2})(\sqrt{2}x+5)=0$

$\therefore$ Either $x+\sqrt{2}=0$ or $\sqrt{2}x+5=0$

$\therefore\ x=-\sqrt{2}$ or $\sqrt{2}x=-5$

$\therefore\ x=-\frac{5}{\sqrt{2}}=-\frac{5}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}=-\frac{5\sqrt{2}}{2}$

$\therefore$ Roots are $\left(-\sqrt{2},\ -\frac{5\sqrt{2}}{2}\right)$

$\sqrt{2} \,|\, 5\sqrt{2}\times\sqrt{2}\ x^2$
$\sqrt{2} \,|\, 5\times\sqrt{2}\ x^2$
$5 \,|\, 5x^2$
$x \,|\, x^2$
$x \,|\, x$
$5x+\sqrt{2}\times\sqrt{2}\times x$
$=5x+2x=7x$

(IV) $2x^2-x+\frac{1}{8}=0$

$\therefore\ 2x^2-\frac{1}{2}x-\frac{1}{2}x+\frac{1}{8}=0$

$\therefore\ 2x\left(x-\frac{1}{4}\right)-\frac{1}{2}\left(x-\frac{1}{4}\right)=0$

$\therefore\ \left(x-\frac{1}{4}\right)\left(2x-\frac{1}{2}\right)=0$

$\therefore$ Either $x-\frac{1}{4}=0$ or $2x-\frac{1}{2}=0$

$\therefore\ x=\frac{1}{4}$ or $x=\frac{1}{4}$

$\therefore$ Roots are $\left(\frac{1}{4},\frac{1}{4}\right)$ Ans.

$2 \,|\, 2x^2\times\frac{1}{8}$
$\frac{1}{2} \,|\, x^2\times\frac{1}{8}$
$\frac{1}{2} \,|\, x^2\times\frac{1}{4}$
$\frac{1}{2} \,|\, x^2\times\frac{1}{2}$
$x \,|\, x^2$
$x \,|\, x$
$\cancel{2}\times\frac{1}{2}\times\frac{1}{2}x+\frac{1}{2}x$
$\frac{1}{2}x+\frac{1}{2}x=x$

(V) $100x^2-20x+1=0$

$(10x)^2-2(10x)(1)+(1)^2=0$

$(10x-1)(10x-1)=0$

$\therefore$ Either $10x-1=0$ or $10x-1=0$

$\therefore\ x=\frac{1}{10}$ or $x=\frac{1}{10}$

$\therefore$ Roots are $\left(\frac{1}{10},\frac{1}{10}\right)$ Ans.

Exercise 4.2

Q2- It is same as Example 1 which is solved in the book.

Q3- Find two numbers whose sum is 27 and product is 182.

Let the first number be x $\therefore$ other number $= 27 - x$

$\therefore x(27 - x) = 182$

$\therefore 27x - x^2 = 182$

$\therefore 27x - x^2 - 182 = 0$

or $x^2 - 27x + 182 = 0$

or $x^2 - 13x - 14x + 182 = 0$

or $x(x - 13) - 14(x - 13) = 0$

or $(x - 13)(x - 14) = 0$

$\therefore$ Either $x - 13 = 0$ or $x - 14 = 0$

$\therefore x = 13$ or $x = 14$

$\therefore$ The numbers are $(13, 14)$ Ans.

2	$182x^2$
7	$91x^2$
13	$13x^2$
x	x^2
x	x

$7 \times 2x + 13x = 27x$

Exercise 4.2

Q4- Find two consecutive positive integers, sum of whose squares is 365.

Let the consecutive numbers be (x) and $(x+1)$

$\therefore (x)^2 + (x+1)^2 = 365$

$\therefore x^2 + x^2 + 2x + 1 = 365$

$\therefore 2x^2 + 2x + 1 - 365 = 0$

$\therefore 2x^2 + 2x - 364 = 0$

$\therefore 2[x^2 + x - 182] = 0$

$\therefore x^2 + x - 182 = 0$

$\therefore x^2 + 14x - 13x - 182 = 0$

$\therefore x(x+14) - 13(x+14) = 0$

$\therefore (x+14)(x-13) = 0$

$\therefore$ Either $x+14 = 0$ or $x-13 = 0$

$\therefore x = -14$ or $x = 13$

$\therefore x = 13$ ignoring negative value

$\therefore$ The numbers are $(13, 14)$ Ans.

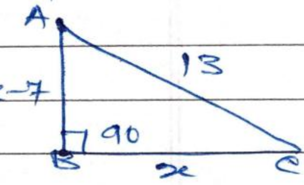
2	$-182x^2$
+7	$-91x^2$
13	$-13x^2$
x	$-x^2$
$-x$	$-x$
	1

$2 \times 7 \times x - 13x$

$14x - 13 = x$

Q5- The altitude of a right triangle is 7 cm less than its base, If the hypotenuse is 13 cm find the other two sides

$AC^2 = AB^2 + BC^2$ by Pythagorus theorem



$\therefore (x-7)^2 + (x)^2 = (13)^2$

$\therefore x^2 - 14x + 49 + x^2 = 169$

$\therefore 2x^2 - 14x + 49 - 169 = 0$

$\therefore 2x^2 - 14x - 120 = 0$

$\therefore 2[x^2 - 7x - 60] = 0$

$\therefore x^2 - 7x - 60 = 0$

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

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

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

$\therefore$ Either $x = 12$ or $x = -5$ Ignoring -ve value.

Base is 12 and altitude is 5

Ans

2	$-60x^2$
2	$-30x^2$
3	$-15x^2$
5	$-5x^2$
x	$-x^2$
$-x$	$-x$
	1

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

$-12x + 5x$

$= -7x$

Exercise 4.2

Date ____
Page ____

Q6 – A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was Rs 90, find the number of articles produced and the cost of each article.

Let the industry produces x articles

$\therefore$ Cost of production of one article is $(2x+3)$

$\therefore$ Cost of production for the day $= x \times (2x+3)$

$\therefore x(2x+3) = 90$

$\therefore 2x^2 + 3x = 90$

$\therefore 2x^2 + 3x - 90 = 0$

$\therefore 2x^2 + 15x - 12x - 90 = 0$

$\therefore x(2x+15) - 6(2x+15) = 0$

$\therefore (2x+15)(x-6) = 0$

$\therefore$ Either $2x+15 = 0$ or $x-6 = 0$

$\therefore 2x = -15$ or $x = 6$

$\therefore x = -\frac{15}{2}$ or $x = 6$

2	$(-90)(2x^2)$
+3	$(-45)(2x^2)$
3	$(-15)(2x^2)$
5	$(-5)(2x^2)$
2	$-2x^2$
x	$-x^2$
$-x$	$-x$
	1

$5 \times 3 \times x - 2 \times 2 \times 3x$

$15x - 12x = 3x$

ignoring $-$ve value $x = 6$

$\therefore$ Industry produces 6 articles per day

$\therefore$ Cost of production of one article $= 2 \times 6 + 3$

$= 12 + 3$

$= 15$ rupees

Ans.

Exercise 4.3

From the desk of Mohd Shakil khan DATE 1/1/2023

Q1- Find the roots of the following quadratic equations, if they exist, by the method of completing the square.

(i) $2x^2 - 7x + 3 = 0$

For real roots $b^2 - 4ac \geq 0$ here $b = -7$, $a = 2$, $c = 3$

$\therefore b^2 - 4ac = (-7)^2 - 4(2)(3) = 49 - 24 = 25$

$\therefore b^2 - 4ac \geq 0$ hence it has real roots

$\therefore 2\left[x^2 - \frac{7}{2}x + \frac{3}{2}\right] = 0$

$\therefore x^2 - \frac{7}{2}x + \frac{3}{2} = 0/2 = 0$

$\therefore$ by completing the square method :-

$$(x)^2 - 2\left(\frac{7}{4}\right)x + \underbrace{\left(\frac{7}{4}\right)^2 - \left(\frac{7}{4}\right)^2}_{\text{Adjustment}} + \frac{3}{2} = 0$$

$\therefore \left(x - \frac{7}{4}\right)^2 - \frac{49}{16} + \frac{3}{2} = 0$

$\therefore \left(x - \frac{7}{4}\right)^2 - \left(\frac{49 - 24}{16}\right) = 0$

$\therefore \left(x - \frac{7}{4}\right)^2 - \left(\frac{25}{16}\right) = 0$

$\therefore \left(x - \frac{7}{4}\right)^2 - \left(\frac{5}{4}\right)^2 = 0$

Now using
$a^2 - b^2 = (a+b)(a-b)$

$\therefore \left(x - \frac{7}{4} + \frac{5}{4}\right)\left(x - \frac{7}{4} - \frac{5}{4}\right) = 0$

$a = x - \frac{7}{4}$
$b = \frac{5}{4}$

$\therefore \left(x - \frac{2}{4}\right)\left(x - \frac{12}{4}\right) = 0$

$\therefore \left(x - \frac{1}{2}\right)(x - 3) = 0$

$\therefore$ Either $x - \frac{1}{2} = 0$ or $x - 3 = 0$

$\therefore x = \frac{1}{2}$ or $x = 3$

$\therefore$ The roots are $\left(\frac{1}{2}, 3\right)$

Ans.

Neelgagan

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 1/1/2023

Q1 (II) $2x^2+x-4=0$

for real roots $D=b^2-4ac \geq 0$ In this case $a=2$
$b=1$, $c=-4$

$\therefore b^2-4ac=(1)^2-4(2)(-4)=1+32=33$

$\therefore$ It has real roots, Now using the completing the square method

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

$\therefore 2\left[x^2+\frac{1}{2}x-2\right]=0$

$\therefore x^2+\frac{1}{2}x-2=\frac{0}{2}=0$

$\therefore (x)^2+2\left(\frac{1}{4}\right)x+\underbrace{\left(\frac{1}{4}\right)^2-\left(\frac{1}{4}\right)^2}_{\text{Adjustment}}-2=0$

$\therefore \left(x+\frac{1}{4}\right)^2-\frac{1}{16}-2=0$

$\therefore \left(x+\frac{1}{4}\right)^2-\left(\frac{1+32}{16}\right)=0$

$\therefore \left(x+\frac{1}{4}\right)^2-\left(\frac{\sqrt{33}}{4}\right)^2=0$ [Now using $a^2-b^2=(a+b)(a-b)$]

$\therefore \left(x+\frac{1}{4}+\frac{\sqrt{33}}{4}\right)\left(x+\frac{1}{4}-\frac{\sqrt{33}}{4}\right)=0$

$\therefore$ Either $x+\frac{1}{4}+\frac{\sqrt{33}}{4}=0$ or $x+\frac{1}{4}-\frac{\sqrt{33}}{4}=0$

$\therefore x=-\frac{1}{4}-\frac{\sqrt{33}}{4}$ or $x=\frac{\sqrt{33}}{4}-\frac{1}{4}$

$\therefore x=\left(\frac{-1-\sqrt{33}}{4}\right)$ or $x=\left(\frac{\sqrt{33}-1}{4}\right)$

$\therefore$ The roots are $\left(\frac{-1-\sqrt{33}}{4}\right)$ and $\left(\frac{\sqrt{33}-1}{4}\right)$

Ans.

Exercise 4.3

From the desk of Mohd Shakeel Khan DATE 1/1/2023

Q1 (III) $4x^2 + 4\sqrt{3}x + 3 = 0$

For real roots $D = b^2 - 4ac \geq 0$ where $a = 4$, $b = 4\sqrt{3}$ and $c = 3$

$\therefore D = (4\sqrt{3})^2 - 4(4)(3)$

$\therefore D = 48 - 48 = 0$ $\therefore$ Real roots exist.

Now using the completing the square method -

$4x^2 + 4\sqrt{3}x + 3 = 0$

$\therefore 4\left[x^2 + \sqrt{3}x + \frac{3}{4}\right] = 0$

$\therefore x^2 + \sqrt{3}x + \frac{3}{4} = \frac{0}{4} = 0$

$\therefore (x)^2 + 2\left(\frac{\sqrt{3}}{2}\right)x + \underbrace{\left(\frac{\sqrt{3}}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2}_{\text{Adjustment}} + \frac{3}{4} = 0$

$\therefore \left(x + \frac{\sqrt{3}}{2}\right)^2 - \cancel{\frac{3}{4}} + \cancel{\frac{3}{4}} = 0$

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

$\therefore \left(x + \frac{\sqrt{3}}{2}\right) = 0$

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

$\therefore$ Both roots are equal $= \left(-\frac{\sqrt{3}}{2}\right)$ and $\left(-\frac{\sqrt{3}}{2}\right)$

Ans.

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 1/1/2023

Q1 (IV) $2x^2+x+4=0$

For real roots $D=b^2-4ac \geq 0$ where $a=2, b=1, c=4$

$\therefore D=(1)^2-4(2)(4) = 1-32 = -31$

As $D<0$ The real roots are not possible

Q2- Find the roots of the quadratic equations given in Q1 by applying the quadratic formula.

The quadratic formula to find roots is-

(I) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ where $a=2, b=-7, c=3$

$= \frac{+7 \pm \sqrt{49-4\times2\times3}}{2\times2}$

$= \frac{7 \pm \sqrt{49-24}}{4} = \frac{7 \pm \sqrt{25}}{4} = \frac{7 \pm 5}{4}$

$\therefore$ The roots are $\frac{7+5}{4}$ and $\frac{7-5}{4} \Rightarrow \left(3 \text{ and } \frac{1}{2}\right)$

(II) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ where $a=2, b=1, c=-4$

$\therefore x = \frac{-1 \pm \sqrt{1-4(2)(-4)}}{2\times2}$

$x = \frac{-1 \pm \sqrt{1+32}}{4} = \frac{-1 \pm \sqrt{33}}{4}$

$\therefore$ Roots are $\left(\frac{-1+\sqrt{33}}{4}\right)$ and $\left(\frac{-1-\sqrt{33}}{4}\right)$

Ans.

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 1/1/2023

Q 2(III) $4x^2+4\sqrt{3}x+3=0$

For real roots value of $D=b^2-4ac\geq 0$ where $a=4$

$b=4\sqrt{3}$, $c=3$

$\therefore D=(4\sqrt{3})^2-4(4)(3)$

$D=48-48=0$

$\therefore x=\dfrac{-4\sqrt{3}\pm\sqrt{D}}{2\times 4}$

$\therefore x=\dfrac{-4\sqrt{3}\pm\sqrt{0}}{8}=\dfrac{-4\sqrt{3}}{8}=\dfrac{-\sqrt{3}}{2}$

$\therefore$ Both real and equal roots are $-\dfrac{\sqrt{3}}{2}$ Ans.

Q-2(IV) $2x^2+x+4=0$

For real roots value of $D=b^2-4ac\geq 0$ where

$a=2$, $b=1$, $c=4$

$D=(1)^2-4(2)(4)=1-32=-31$

As $D<0$ Therefore real roots are not possible.

Q 3- Find the roots of the following equations-

(I) $x-\frac{1}{x}=3$, $x\neq 0$

$\therefore \dfrac{x^2-1}{x}=3$ or $x^2-1=3x$ or $x^2-3x-1=0$

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

$x=\dfrac{3\pm\sqrt{9+4}}{2}=\dfrac{3\pm\sqrt{13}}{2}$

$\therefore$ The roots are $\left(\dfrac{3+\sqrt{13}}{2}\right)$ and $\left(\dfrac{3-\sqrt{13}}{2}\right)$ Ans.

Neelgagan

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 1/1/2023

Q 3(II) $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}, \quad x \neq -4, 7$

$\therefore \frac{(x-7)-(x+4)}{(x+4)(x-7)} = \frac{11}{30}$

$\therefore \frac{\cancel{x}-7-\cancel{x}-4}{x^2-7x+4x-28} = \frac{11}{30}$

$\therefore \frac{-11}{x^2-3x-28} = \frac{11}{30}$

$\therefore (-\cancel{11})(30) = (\cancel{11})(x^2-3x-28)$

$\therefore -30 = x^2-3x-28$

$\therefore x^2-3x-28+30=0$

$\therefore x^2-3x+2=0 \qquad a=1, \ b=-3, \ c=2$

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

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

$\therefore x = \frac{3 \pm \sqrt{9-8}}{2} = \frac{3 \pm \sqrt{1}}{2}$

$\therefore x = \frac{3 \pm 1}{2} \Rightarrow \frac{3+1}{2}$ and $\frac{3-1}{2} \Rightarrow \frac{4}{2}$ and $\frac{2}{2}$

$\therefore$ The roots are 2 and 1

Ans.

Exercise 3.4

From the desk of Mohd Shakil Akbar DATE 1/1/2023

Q.4 – The sum of the reciprocals of Rehman's ages, (in yr) 3 years ago and 5 years from now is $\frac{1}{3}$. Find his present age.

Let Rehman's present age be x years

$\therefore$ Rehman's age 3 years ago was $(x-3)$ years

$\therefore$ Rehman's age 5 years from now will be $(x+5)$ yr

According to question sum of reciprocals of his age is

$$\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$$

$$\therefore \frac{(x+5)+(x-3)}{(x-3)(x+5)} = \frac{1}{3}$$

$$\therefore \frac{x+5+x-3}{x^2+5x-3x-15} = \frac{1}{3}$$ [cross mutiplying it]

$$\therefore 3(2x+2) = 1(x^2+2x-15)$$

$$\therefore 6x+6 = x^2+2x-15$$

$$\therefore x^2+2x-15-6x-6=0$$

$$\therefore x^2-4x-21=0$$ where $a=1$, $b=-4$, $c=-21$

By quadratic Formula

$$\therefore x = \frac{-(-4) \pm \sqrt{(-4)^2-4(1)(-21)}}{2 \times 1}$$

$$\therefore x = \frac{+4 \pm \sqrt{16+84}}{2}$$

$$\therefore x = \frac{+4 \pm \sqrt{100}}{2} = \frac{+4 \pm 10}{2} = 2 \pm 10$$

$\therefore$ Roots are $(2+10)$ and $(2-10)$ i.e. 12 and -8

Ignoring $-$ve value, Rehman's present age is 12 yr

Ans.

Neelgagan

Exercise 4.3

From the desk of Mohd Shakil Iqbar DATE 1/1/2023

Q5- In a class test, sum of Shefali's marks in Mathematics and English is 30. Had she got 2 marks more in Mathematics and 3 Marks less in English, The product of their marks would have been 210. Find her marks in the two subjects.

Let Shefali got x marks in Mathematics

$\therefore$ Shefali got $(30-x)$ marks in English

$\therefore$ According to question $(x+2)(30-x-3)=210$

$\therefore (x+2)(27-x)=210$

$\therefore 27x+54-x^2-2x=210$

$\therefore x^2-25x+210-54=0$

$\therefore x^2-25x+156=0$ $[\therefore a=1,\ b=-25,\ c=156]$

$$\therefore x=\frac{-(-25)\pm\sqrt{(-25)^2-4(1)(156)}}{2\times 1}$$

$$\therefore x=\frac{+25\pm\sqrt{625-624}}{2}$$

$$\therefore x=\frac{+25\pm 1}{2}$$

$$\therefore x=\frac{25+1}{2} \text{ or } \frac{25-1}{2}$$

$\therefore x = 13$ or 12

$\therefore$ If Shefali gets 13 Marks in Mathematics
Then 17 Marks in English

or

If Shefali gets 12 Marks in Mathematics
then 18 Marks in English

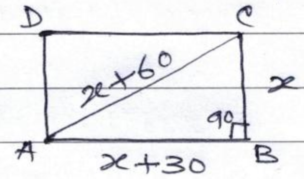
Ans.

Exercise 4.3

From the desk of Mohd Shakil Akbar DATE 2/1/2023

Q6 – The diagonal of a rectangular field is 60 metres more than the shorter side. If the longer side is 30 metres more than the shorter side, find the sides of the fields.

Sol: The question is giving details as I have shown in this picture



Let the smaller side be x

$\therefore$ the other side is $(x+30)$

$\therefore$ the diagonal is $(x+60)$

By Pythagorus Theorem $H^2 = P^2 + B^2$

$\therefore (x+60)^2 = (x+30)^2 + x^2$

$\therefore \cancel{x^2} + 120x + 3600 = \cancel{x^2} + 60x + 900 + x^2$

$\therefore x^2 + 60x + 900 - 120x - 3600 = 0$

$\therefore x^2 - 60x - 2700 = 0$ [$a = 1, b = -60, c = -2700$]

$$\therefore x = \frac{-(-60) \pm \sqrt{(-60)^2 - 4(1)(-2700)}}{2 \times 1}$$

$$\therefore x = \frac{+60 \pm \sqrt{3600 + 10800}}{2}$$

$$\therefore x = \frac{+60 \pm \sqrt{14400}}{2}$$

$$\therefore x = \frac{+60 \pm 120}{2} \Rightarrow \frac{60+120}{2} \text{ or } \frac{60-120}{2}$$

$\therefore x = \frac{180}{2} = 90$ [Ignoring the negative value]

$\therefore$ The shorter side is 90 m

$\therefore$ The longer side is 120 m Ans.

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q7 - The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers.

Let the smaller number be x

$\therefore$ The bigger number is $\frac{x^2}{8}$ Let it be y

$\therefore$ According to the condition of the question

$\therefore \left(\frac{x^2}{8}\right)^2 - (x)^2 = 180$ [As $\frac{x^2}{8} = y \therefore x^2 = 8y$]

$\therefore y^2 - x^2 = 180$ [Now replacing $x^2 = 8y$]

$\therefore y^2 - 8y = 180$

$\therefore y^2 - 8y - 180 = 0$

$\therefore y = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(-180)}}{2 \times 1}$

$\therefore y = \frac{+8 \pm \sqrt{64 + 720}}{2}$

$\therefore y = \frac{+8 \pm \sqrt{784}}{2}$

$\therefore y = \frac{+8 \pm 28}{2} = \frac{+8+28}{2}$ or $\frac{+8-28}{2}$

$\therefore y = \frac{36}{2} = 18$ Ignoring the negative value

$\therefore \frac{x^2}{8} = 18 \quad \therefore x^2 = 18 \times 8 = 144$

$\therefore x = 12$

$\therefore$ The numbers are 12 and 18

Ans.

Neelgagan

Exercise 4.3

From the desk of Mohd Shakil Ikbar DATE 2/1/2023

Q8- A train travels 360 Km at a uniform speed. If the speed had been 5 km/h more, It would have taken 1 hour less for the same journey. Find the speed of the train.

Sol: Let the speed of the train be (x km/hr)

According to the condition of the question

$$\frac{360}{x} - \frac{360}{x+5} = 1 \text{ hr.} \qquad \left[\frac{\text{Distance}}{\text{speed}} = \text{Time}\right]$$

$$\therefore\ 360\left[\frac{1}{x} - \frac{1}{x+5}\right] = 1$$

$$\therefore\ 360\left[\frac{\cancel{x}+5-\cancel{x}}{x(x+5)}\right] = 1$$

$$\therefore\ 360 \times 5 = x^2 + 5x$$

$$\therefore\ x^2 + 5x - 1800 = 0 \qquad [\text{where } a = 1,\ b = 5,\ c = -1800]$$

$$\therefore\ x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(-1800)}}{2 \times 1}$$

$$\therefore\ x = \frac{-5 \pm \sqrt{25 + 7200}}{2}$$

$$\therefore\ x = \frac{-5 \pm \sqrt{7225}}{2}$$

$$\therefore\ x = \frac{-5 \pm 85}{2} \Rightarrow \frac{-5+85}{2} \text{ or } \frac{-5-85}{2}$$

$$\therefore\ x = \frac{80}{2} = 40 \text{ km/hr} \qquad [\text{Ignoring the negative value of } x]$$

$\therefore$ The train was travelling at a speed of 40 km/hr

Ans.

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q9- Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

Sol: Let the smaller tap takes t hours to fill the tank

$\therefore$ In one hour it fills the part of the tank $= \frac{1}{t}$

$\therefore$ The larger tap takes $(t-10)$ hours to fill the tank

$\therefore$ In one hour it fills the part of the tank $= \frac{1}{t-10}$

$\therefore$ Both taps simultaneously will fill the part of the tank $= \frac{1}{t} + \frac{1}{t-10} = \frac{1}{9\frac{3}{8}}$

$$\therefore \quad \frac{1}{t} + \frac{1}{t-10} = \frac{1}{75/8} = \frac{8}{75}$$

$$\therefore \quad \frac{t-10+t}{t(t-10)} = \frac{8}{75}$$

$$\therefore \quad 75[2t-10] = 8[t^2-10t]$$

$$\therefore \quad 150t - 750 = 8t^2 - 80t$$

$$\therefore \quad 8t^2 - 230t + 750 = 0$$ [where $a = 8$, $b = -230$, $c = 750$]

$$\therefore \quad t = \frac{-(-230) \pm \sqrt{(-230)^2 - 4(8)(750)}}{2 \times 8}$$

$$\therefore \quad t = \frac{230 \pm \sqrt{52900 - 24000}}{16}$$

$$\therefore \quad t = \frac{230 \pm \sqrt{28900}}{16} = \frac{230 \pm 170}{16} \Rightarrow \frac{230+170}{16}, \frac{230-170}{16}$$

$$\therefore \quad t \Rightarrow \frac{400}{16}, \frac{60}{16} \Rightarrow 25, 3.75$$

Ignoring 3.75 as $(t-10)$ will be negative.

$\therefore$ Smaller tap will fill the tank in 25 hr.

Larger tap will fill the tank in 15 hr. Ans.

Neelgagan

Excercise 4.3

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q10 – An express train takes 1 hour less than a passenger train to travel 132 km between Myose and Banglore (without taking into consideration the time they stop at intermidiate stations). If the average speed of the express train is 11 km/hr more than that of the passenger train, find the average speed of the two trains.

Sol: Let the average speed of passenger train is x km/hr

$\therefore$ Speed of the express train (average speed) $= (x+11)$ km/h

According to the question :-

$$\frac{132}{x} - \frac{132}{x+11} = 1$$

$$\therefore 132\left[\frac{\cancel{x}+11-\cancel{x}}{x(x+11)}\right] = 1$$

$$\therefore 132 \times 11 = x^2 + 11x$$

$$\therefore x^2 + 11x - 1452 = 0 \qquad [a=1,\ b=11,\ c=-1452]$$

$$\therefore x = \frac{-11 \pm \sqrt{(11)^2 - 4(1)(-1452)}}{2 \times 1}$$

$$\therefore x = \frac{-11 \pm \sqrt{121 + 5808}}{2} = \frac{-11 \pm \sqrt{5929}}{2}$$

$$\therefore x = \frac{-11 \pm 77}{2} = \frac{-11+77}{2} \text{ or } \frac{-11-77}{2}$$

Ignoring – ve value $x = \frac{66}{2} = 33$

$\therefore$ Speed of passenger train is 33 km/hr

$\therefore$ Speed of express train is $(33+11) = 44$ km/hr

Ans.

Exercise 4.3

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q11- Sum of the areas of two squares is 468 m^2. If the difference of their perimeters is 24 m. Find the sides of the two squares.

Sol: Let the side of smaller square be x

Let the side of bigger square be y

$\therefore$ Difference of perimeters $= 4y - 4x = 24$

$\therefore 4(y-x) = 24$

$\therefore y - x = \frac{24}{4} = 6$

$\therefore y = 6 + x$

Applying the first condition of the question

$x^2 + y^2 = 468$

Replacing y with $6+x$

$x^2 + (6+x)^2 = 468$

$x^2 + 36 + 12x + x^2 - 468 = 0$

$2x^2 + 12x - 432 = 0$ $[\therefore a = 2, b = 12, c = -432]$

$\therefore x = \dfrac{-12 \pm \sqrt{(12)^2 - 4(2)(-432)}}{2 \times 2}$

$\therefore x = \dfrac{-12 \pm \sqrt{144 + 3456}}{4} = \dfrac{-12 \pm \sqrt{3600}}{4}$

$\therefore x = \dfrac{-12 \pm 60}{4} = \left(\dfrac{-12+60}{4}\right), \left(\dfrac{-12-60}{4}\right)$

Ignoring the -ve value $x = \frac{48}{4} = 12$

$\therefore$ Side of the small square $= 12$ m

$\therefore$ Side of the bigger square $= 6 + 12 = 18$ m

Ans

Neelgagan

Exercise 4.4

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q2 - Find the values of k for each of the following quadratic equations, so ~~they~~ that they have two equal roots.

(I) $2x^2 + kx + 3 = 0$

Condition for equal roots is $b^2 - 4ac = 0$

$\therefore (k)^2 - 4(2)(3) = 0$

$\therefore k^2 - 24 = 0$

$\therefore k = \pm\sqrt{24} = \pm 2\sqrt{6}$ Ans.

(II) $kx(x-2) + 6 = 0$ or $kx^2 - 2kx + 6 = 0$

$\therefore (-2k)^2 - 4(k)(6) = 0$

$\therefore 4k^2 - 4 \times 6k = 0$

$\therefore 4(k^2 - 6k) = 0$ or $k(k-6) = 0$ as $4 \neq 0$

$\therefore$ Either $k = 0$ or $k - 6 = 0$

$\therefore k = 0$ or $k = 6$ Ans.

Q3 - Is it possible to design a rectangular mango grove whose length is twice its breadth, and the area is $800\,m^2$? If so, find its length and breadth.

Sol: Let breadth is x $\therefore$ length $= 2x$

Area = length × breadth = $800\,m^2$

$$2x \times x = 800$$

$$x^2 = \frac{800}{2} = 400$$

$$\therefore x = \pm\sqrt{400} = \pm 20$$

$\therefore$ breadth of mango grove = 20 m

length of mango grove = $2 \times 20 = 40$ m

Ans.

Exercise 4.4

From the desk of Mohd Shakil Akbar DATE 2/1/2023

Q 3- Is it possible to design a rectangular mango grove whose length is twice its breadth, and the area is $800 m^2$? If so, find its length and breadth.

Sol: Here I am giving second method to solve it

Let the breadth of the mango grove $= x$ m

$\therefore$ the length of the mango grove $= 2x$ m

$\therefore$ The area of the mango grove $= 2x \times x$

$\therefore 2x^2 = 800$

$\therefore 2x^2 - 800 = 0$ $\quad [\because a = 2, b = 0, c = 800]$

$\therefore D = b^2 - 4ac = (0)^2 - 4(2)(-800)$

$\therefore D = 0 + 6400$

$\therefore D > 0$ Hence real and different roots are possibe

$\therefore x = \dfrac{0 \pm \sqrt{6400}}{2 \times 2} = \pm \dfrac{80}{4} = \pm 20$

Ignoring the -ve value as side can't be -ve

x = breadth of mango grove = 20 m

$2x$ = length of mango grove = 40 m

Ans.

Exercise 4.4

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q4 – Is the following situation possible? If so, determine their present ages.
The sum of the ages of two friends is 20 years. Four years ago, the product of their ages in years was 48.

Sol: Let the age of first friend be (x)

$\therefore$ the age of the other friend is $(20-x)$

Four years ago age of first friend was $(x-4)$

$\therefore$ the age of second friend four years ago was

$20-x-4 = (16-x)$

$\therefore (x-4)(16-x) = 48$ according to the given condition

$\therefore 16x - x^2 - 64 + 4x = 48$

$\therefore 16x - x^2 - 64 + 4x - 48 = 0$

$\therefore 20x - x^2 - 112 = 0$

$\therefore x^2 - 20x + 112 = 0$

$\therefore b^2 - 4ac = (-20)^2 - 4(1)(112)$

$\therefore b^2 - 4ac = 400 - 448$

$\therefore b^2 - 4ac = -48$

$\therefore$ No real roots are possible

$\therefore$ This situation is not possible

Ans.

Exercise 4.4

From the desk of Mohd Shakil Khan DATE 2/1/2023

Q5- Is it possible to design a rectangular park of perimeter 80 m and area 400 m^2? If so, find its length and breadth.

Sol: Perimeter $= 2(l+b) = 80$ m

$\therefore\ l + b = \frac{80}{2} = 40$ m

$\therefore\ b = 40 - l$ m

According to the question $l \times b = 400$ m^2

$\therefore\ l(40-l) = 400$

$\therefore\ 40l - l^2 = 400$

$\therefore\ l^2 - 40l + 400 = 0$

$\therefore\ D = b^2 - 4ac = (-40)^2 - 4(1)(400)$

$D = 1600 - 1600 = 0$

$\therefore$ Real and equal roots are possible

$\therefore\ l = \frac{-(-40) \pm \sqrt{(-40)^2 - 4(1)400}}{2 \times 1}$

$\therefore\ l = \frac{+40 \pm 0}{2} = 20$ m

$\therefore\ b = 40 - 20 = 20$ m

$\therefore$ length and breadth both are 20 m

Ans.

Exercise 4.4

From the desk of Mohd Shakil Khan DATE 2/1/2023

Nature of roots depends on the discriminant D

$D = b^2 - 4ac$

(I) If $b^2 - 4ac > 0$ Then the roots are real and different

(II) If $b^2 - 4ac = 0$ Then the roots are real and equal

(III) If $b^2 - 4ac < 0$ Then the root are imaginary or no real roots exist.

Q1- Find the nature of the roots of the following quadratic equations. If the real roots exist, find them:

(I) $2x^2 - 3x + 5 = 0$ $[a = 2,\ b = -3,\ c = 5]$

$D = (-3)^2 - 4(2)(5) = 9 - 40 = -31$

$\therefore$ No real roots exists

(II) $3x^2 - 4\sqrt{3}x + 4 = 0$ $[a = 3,\ b = -4\sqrt{3},\ c = 4]$

$D = (-4\sqrt{3})^2 - 4(3)(4) = 48 - 48 = 0$

$\therefore$ Real and equal roots exists.

$$x = \frac{-(-4\sqrt{3}) \pm \sqrt{0}}{2 \times 3} = \frac{+\cancel{4}^{2}\sqrt{3}}{\cancel{2} \times 3} = \frac{2\sqrt{3}}{3}$$

$\therefore$ Both roots are equal $= \left(\frac{2\sqrt{3}}{3}, \frac{2\sqrt{3}}{3}\right)$

(III) $2x^2 - 6x + 3 = 0$ $[a = 2,\ b = -6,\ c = 3]$

$D = (-6)^2 - 4(2)(3) = 36 - 24 = 12$

$$\therefore x = \frac{-(-6) \pm \sqrt{12}}{2 \times 2} = \frac{6 \pm 2\sqrt{3}}{4} = \frac{3 \pm \sqrt{3}}{2}$$

$\therefore$ Roots are real and unequal

$= \left(\frac{3 + \sqrt{3}}{2}\right)$ and $\left(\frac{3 - \sqrt{3}}{2}\right)$ Ans.

Neelgagan