CHAPTER - 4

Quadratic Equations

Level - 1 (01 Marks Question)

Q.1 Check whether the following are quadralic equation or not

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

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

Q.2 Solve by factorisation method

$x^2 - 7x + 12 = 0$

Q.3 Find the discriminant

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

Q.4 Find the nature of root

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

Q.5 Find the value k so that quadratic equation $3x^2 - kx + 27=0$ has equal root

Q.6 Determine whether given value of x is a solution or not

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

Level 2 (02 Marks)

Example 1 Solve the quadratic equation $9x^2 - 3x - 20 = 0$ by factorisation method and find the roots of quadratic equation.

Solution $9x^2 - 3x - 20 = 0$

$9x^2 - 15x + 12x - 20 = 0$

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

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

either $3x - 5 = 0$ or $3x + 4 = 0$

$3x = 5$ $3x = -4$

$x = \frac{5}{3}$ $x = \frac{-4}{3}$

Q.1 Solve by quadratic equation $16x^2 - 24x - 1 = 0$ by using quadratic formula.

Q.2 Determine the values of k for which the quadratic equation $2x^2 + 3x + K = 0$ have both roots real.

Q.3 Find the roots of equation $2x^2 + x - 6 = 0$

Q.4 Find the roots of equation $x - \frac{1}{x} = 3 \quad x \neq 0$

Level 3 (03 Marks)

Q.1 The sum of the squares of two consecutive positive integers is 265. Find the integers.

Q.2 Divide 39 into two parts such that their product is 324.

Q.3 The sum of number and its reciprocal is $\frac{17}{4}$. Find the number.

Q.4 The length of rectangle is 5cm more than its breadth if its area is 150 Sq cm. Find the length and breadth.

Q.5 The altitude of a right triangle is 7cm less than its base. If the hypotnuse is 13 cm. Find the other two sides.

SOLUTION

CHAPTER - 4

Quadratic Equations

Level - 1 (01 Marks Questions)

Q.1 i) $(x-3)(2x+1) = x(x+5)$

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

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

$2x^2+2x - 6x - 3 - x^2 - 5x = 0$

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

Yes, this is a quadratic equation because it is in the form of $ax^2+bx+c=0$

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

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

$x^3 + 8 + 6x(x+2) = 2x^3 - 2x$

$x^3 + 8 + 6x^2 + 12x = 2x^3 - 2x$

$x^3 + 8 + 6x2 + 12x - 2x^3 + 2x = 0$

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

No, it is not a quadratic equation.

Q.2 $x^2 - 7x + 12 = 0$

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

$x(x-4) - 3(x-4) = 0$

$(x-3)(x-4) = 0$

$x-3 = 0$ and $x - 4 = 0$

$x = 3$ $x = 4$

Q.3 $x^2 - 3x - 10 = 0$

Here, $a = 1, b = -3, c = -10$

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

$= (-3)^2 - 4 \times (1) \times (-10)$

$= 9+40 = 49$

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

Here, Discriminant $= b^2 - 4ac = (3)^2 - 4x (2) x (-4)$

$= 9 + 32$

$= 41$

$D=41 > 0$ or roots are real and equal

Q.5 $3x^2 - kx + 27 = 0$

Here, it is given that roots are equal

$D=0$

or $b^2 - 4ac = 0$

$(-K)^2 - 4 \times 3 \times 27 = 0$

$K^2 = 324$

$K^2 = (18)^2$

or $K = 18$

Q.6 $x^2 - 3x - 1 = 0$ and $x = 1$

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

$p(1) = (1)^2 - 3(1) - 1$

$= 1 - 3 - 1$

$= 1 - 4 = -3$

No, x = 1 is not a soultion of p (x)

Level (2) (02 Marks)

Q.1 $16x^2 - 24x - 1 = 0$

$$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-24) \pm \sqrt{(-24)^2 - 4 \times 16 \times (-1)}}{2 \times 16}$$

Here, a = 16, b = -24, c=-1

$$= \frac{24 \pm \sqrt{576 + 64}}{2 \times 16}$$

$$= \frac{24 \pm \sqrt{640}}{32}$$

$$= \frac{24 \pm 8\sqrt{10}}{32}$$

$$= \frac{3}{4} \pm \frac{\sqrt{10}}{4}$$

$$= \frac{3 \pm \sqrt{10}}{4}$$

$x = \frac{3 \pm \sqrt{10}}{4}$ or $\frac{3 - \sqrt{10}}{4}$

Q.2 $2x^2 + 3x + K = 0$

Here, $D = b^2 - 4ac = (3)^2 - 4 \times 2 \times K$

$= 9 - 8K$

It will have real roots, if D=0 or D>0

$\Rightarrow \quad D \geq 0$

or $0 \leq D$

or $0 \leq 9 - 8k$

$k \leq \frac{9}{8}$ or $8k \leq 9$

Q.3 $2x^2 + x - 6$

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

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

$$= \frac{-1 \pm \sqrt{1 + 48}}{4}$$

$$= \frac{-1 \pm \sqrt{49}}{4}$$

$$= \frac{-1 \pm 7}{4}$$

$$x = \frac{-1 \pm 7}{4} = \frac{6}{4} = \frac{3}{2}$$

or $x = \frac{-1-7}{4} = \frac{-8}{4} = -2$

Q.4 $x - \frac{1}{x} = 3,\ x \neq 0$

$\frac{x2-1}{x} = \frac{3}{1}$ or $x^2 - 1 = 3x$

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

$$x = \frac{3 \pm \sqrt{(-3)^2 - 4x1x-1}}{2x1}$$

$x = \frac{3+\sqrt{13}}{2}$, $x = \frac{3-\sqrt{13}}{2}$

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

Level - 3 (03 Mark Questions)

Q.1 Let the first integer = x

$\therefore$ the second interger = x + 1

According to Question

$(x)^2 + (x+1)^2 = 265$

$x^2 + x^2 + 1 + 2x = 265$

$2x^2 + 2x + 1 - 265 = 0$

$2x^2 + 2x - 264 = 0$

$$=\frac{-2\pm\sqrt{4+2112}}{4}$$

$$=\frac{-2\pm\sqrt{2116}}{4}$$

$$=\frac{-2\pm46}{4}$$

$$=\frac{-2\pm46}{4}=\frac{44}{4}=11$$

$$\text{or } x=\frac{-2-46}{4}=\frac{-48}{4}=-12$$

If x = 11, then x+1 = 12

If x = -12, then, x+1 = -11

$$\therefore x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{-2\pm\sqrt{(2)^2-4\times2\times-264}}{2\times2}$$

Q.2 Let one of the number = x

$\therefore$ then the other number will be = 39-x

According to Q

(x) x (39 - x) = 324

$39x - x^2 = 324$

$-x^2 + 39x - 324 = 0$

$$= \frac{-39 \pm \sqrt{(39)^2 - 4x - 1x - 324}}{2x - 1}$$

$$= \frac{-39 \pm \sqrt{1521 - 1296}}{-2}$$

$$= \frac{-39 \pm \sqrt{225}}{-2}$$

$$= \frac{-39 \pm 15}{-2}$$

$$x = \frac{-39 \pm 15}{-2} = \frac{-24}{-2} = +12$$

$$\text{or } x = \frac{-39 - 15}{-2} = \frac{-54}{-2} = +27$$

If x = 27, then 39 - x = 12

If x = 12, then 39 - x = 27

Q.3 Let the number = x

$\therefore$ its Reciprocal = $\frac{1}{x}$

According to Q

$$x + \frac{1}{x} = \frac{17}{4}$$

$$\frac{x^2 + 1}{x} = \frac{17}{4}$$

$4(x^2+1) = 17x$

$4x^2+4-17x = 0$

$4x^2 - 17x + 4 = 0$

$$x = \frac{+17 \pm \sqrt{(-17)^2 - 4 \times 4 \times 4}}{2 \times 4} \qquad = \frac{17 \pm \sqrt{289 - 64}}{8}$$

$$= \frac{17 \pm \sqrt{225}}{8} \qquad = \frac{17 \pm 15}{8}$$

Let $x = \frac{17 + 15}{8} \qquad = \frac{32}{8} = 4$

or $x = \frac{17 - 15}{8} \qquad = \frac{2}{8} = \frac{1}{4}$

If x=4, then $\frac{1}{x} = \frac{1}{4}$

If $x = \frac{1}{4}$, then $\frac{1}{x} = 4$

Q.4 Let Breadth of the rectangle = x

$\therefore$ Length of the rectangle = x + 5

According to Question

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4 \times 1 \times -150}}{2 \times 1}$$

(x) (x+5) = 150

$x^2 + 5x - 150 = 0$

$$= \frac{-5 \pm \sqrt{25 + 600}}{2}$$

$$= \frac{-5 \pm \sqrt{625}}{2}$$

$$= \frac{-5 \pm 25}{2}$$

$$x = \frac{-5+25}{2} = \frac{20}{2} = 10$$

$$x = \frac{-5+25}{2} = \frac{-30}{2} = \frac{-30}{2} = -15$$

The Breadth = 10cm

Length = 15 cm

Q.5 Let the Base of Δ = x cm

the attitude = x - 7 cm

the hypoten use = 13cm

By using Pythagoras Theorem

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

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

or $0 = 2x^2 - 14x - 120$

$\therefore x = \frac{+14 \pm \sqrt{(-14)^2 - 4x2x - 120}}{2x2}$

$$= \frac{+14 \pm \sqrt{196+960}}{4}$$

$$= \frac{+14 \pm \sqrt{1156}}{4}$$

$$= \frac{+14 \pm 34}{4}$$

$$= \frac{+14+34}{4} = \frac{48}{4} = 12$$

$$x = \frac{+14 - 34}{4} = \frac{-20}{4} = -5$$

$\Rightarrow$ The Base of $\Delta = 12$cm

Attitude = x-7 = 12-7 = 5cm