Chapter - 4

Quadratic Equations

Exercise - 4.1

Quadratic Equation

$ax^2 + bx + c$ - general eqt. , where a, b & c are real & $a \neq 0$

1 → (i) $(x+1)^2 = 2(x-3)$

$\Rightarrow x^2 + 1 + 2x = 2x - 6$

$\Rightarrow x^2 + 1 = -6$

$\Rightarrow x^2 + 1 + 6 = 0$

$\Rightarrow \boxed{x^2 + 7 = 0}$ Yes this equation is quadratic

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

$\Rightarrow x^3 - 4x^2 - x + 1 = x^3 - 8 - 3 \times x \times 2(x-2)$

$\Rightarrow x^3 - 4x^2 - x + 1 = x^3 - 8 - 6x^2 + 12x$

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

$\Rightarrow \boxed{2x^2 - 13x + 9 = 0}$ Yes this equation is quadratic

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

Sol → $x^2 - 2x = -6 + 2x$

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

$\Rightarrow x^2 - 4x + 6 = 0$ Yes this equation is quadratic

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

Sol → $x^2 + x - 2x - 1 = x^2 + 3x - x - 3$

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

$\Rightarrow -3x - 4 = 0$ No this equation is not quadratic

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

sol: $\Rightarrow 2x^2 + x - 6x - 3 = x^2 + 5x$

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

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

$\rightarrow x^2 - 10x - 3 = 0$ Yes this equation is quadratic.

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

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

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

$\Rightarrow 8 - 11x = 0$

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

$\Rightarrow x^2 - 11x - 2 = 0$

Yes this equation is quadratic

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

sol: $x^2 + 3x + 1 = x^2 + 4 - 2x \times -2$

$\Rightarrow x^2 + 3x + 1 = x^2 + 4 + 4x$

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

$\Rightarrow -x - 3 = 0$

No, this equation is not quadratic

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

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

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

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

$\Rightarrow x^3 + 4x^2 + 14x + 8 = 0$

No this equation is not quadratic

2→ (i) Let rectangular plot breadth be x

so, rectangular plot length $= 2x+1$

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

$\Rightarrow 2x^2 + x = 528$

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

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

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

$\Rightarrow (x-16)(2x+33)$

$\Rightarrow x - 16 = 0$ | $2x = -33$

$x = 16$ | $x = \frac{-33}{2}$

we know that the dimension of any shape can not be zero

so, rectangular plot breadth $= x = \boxed{16\ m}$

and, length $= 2x+1$

$\Rightarrow 2(16)+1$

$\Rightarrow 32+1$

$\Rightarrow \boxed{33\ m}$

(ii) Let the first integer be x

so, second integer be $x+1$

A.T.Q, $x(x+1) = 306$

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

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

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

$\Rightarrow (x+18)(x-17)$

$x = -18$ / $x = 17$

we need to find positive integer
so first integer is 17
So, second integer is 17 + 1 ⇒ 18

(iii) Let Rohan's age be x
so, Rohan's mother age is $26+x$
After 3 years
Rohan's age ⇒ $(x+3)$
Rohan's mother age ⇒ $26+x+3 \Rightarrow (29+x)$
$\Rightarrow (x+3)(29+x) = 360$
$\Rightarrow x^2 + 29x + 3x + 87 = 360$
$\Rightarrow x^2 + 32x + 87 - 360 = 0$
$\Rightarrow x^2 + 32x - 273 = 0$
$\Rightarrow x(x+39) - 7(x+39) = 0$
$\Rightarrow (x+39)(x-7)$
$\Rightarrow x = -39 \mid x = 7$

Ages cannot be negative so Rohan's present age is 7 years old and his mother's age is 33 years

(iv) Let original speed be x km/h
Distance ⇒ 480 km
Time(T_1) = $\frac{D}{S} \Rightarrow \frac{480}{x}$
Average speed = $(x-8)$ km
Distance = 480 km
Time(T_2) = $\frac{480}{x-8}$

Now, $T_1 + 3 = T_2$
$\Rightarrow \frac{480}{x} + 3 = \frac{480}{x-8}$

$\Rightarrow 3 = \frac{480}{x-8} - \frac{480}{x}$

$\Rightarrow 3 = \frac{480x - 480(x-8)}{x(x-8)}$

$\Rightarrow 3x(x-8) = 480x - 480x + 3840$

$\Rightarrow 3x^2 - 24x - 3840 = 0$

$\Rightarrow 3(x^2 - 8x - 1280) = 0$

$\Rightarrow x^2 - 8x - 1280 = 0$

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

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

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

$\Rightarrow x + 32 = 0 \quad | \quad x - 40 = 0$

$\Rightarrow x = -32 \quad | \quad x = 40$

we know that speed could not be negative so original speed is 40 Km/h

Exercise → 4.2

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

$\Rightarrow x^2 - 5x + 2x - 10 = 0$

$\Rightarrow x(x-5) + 2(x-5) = 0$

$\Rightarrow (x-5)(x+2) = 0$

$\Rightarrow x = 5 \quad | \quad x = -2$

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

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

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

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

$\Rightarrow x = \frac{-5}{\sqrt{2}} \quad | \quad x = -\sqrt{2}$

(iii) $2x^2 + x - 6 = 0$

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

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

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

$\Rightarrow x = -3 \mid x = 2$

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

$\frac{1}{8}(16x^2 - 8x + 1) = 0$

$\Rightarrow 16x^2 - 8x + 1 = 0$

$\Rightarrow 16x^2 - 4x - 4x + 1 = 0$

$\Rightarrow 4x(4x - 1) - 1(4x - 1) = 0$

$\Rightarrow (4x - 1)(4x - 1) = 0$

$\Rightarrow x = \frac{1}{4} \mid x = \frac{1}{4}$

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

$\Rightarrow 100x^2 - 10x - 10x + 1 = 0$

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

$\Rightarrow (10x - 1)(10x - 1)$

$\Rightarrow x = \frac{1}{10} \mid x = \frac{1}{10}$

Q-2 ⇒ Let John hab be x marbles

so, Jivanti marble hab $= 45 - x$

After loss, John's marbles $= (x - 5)$

Jivanti's marbles $= (45 - x - 5) \Rightarrow (40 - x)$

Now, $(x-5) \times (40-x) = 124$

$\Rightarrow 40x - x^2 - 200 + 5x = 124$

$\Rightarrow -x^2 + 45x - 200 = 124$

$\Rightarrow -x^2 + 45x - 200 - 124 = 0$

$\Rightarrow -x^2 + 45x - 324 = 0$

$\Rightarrow x^2 - 45x + 324 = 0$

$\Rightarrow x^2 - 36x - 9x + 324 = 0$

$\Rightarrow x(x - 36) - 9(x - 36) = 0$

$\Rightarrow (x - 36)(x - 9) = 0$

2-(ii) Let the no. of toys produced in a particular day be x

The total cost of production = ₹750

$\Rightarrow x(x-55) = 750$

$\Rightarrow x^2 - 55x - 750 = 0$

$\Rightarrow x^2 - 30x - 25x - 750 = 0$

$\Rightarrow x(x-30) - 25(x-30) = 0$

$\Rightarrow (x-30)(x-25) = 0$

$\Rightarrow x = 30 \mid x = 25$

4→ Let first no. be x

Consecutive no. of $x = (x+1)$

A.T.Q., $x^2 + (x+1)^2 = 365$

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

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

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

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

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

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

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

$\Rightarrow x = -14 \mid x = 13$

So positive first no. = 13

So, second no. = $13 + 1 \Rightarrow 14$

Q3 → Sum of two no. ⇒ 27

Let two no. be α and β

so, $\alpha + \beta = 27$

product of two no. ⇒ 182

so, $\alpha \cdot \beta = 182$

Let general equation → $ax^2 - bx + c = 0$

$\Rightarrow ax^2 - (\alpha + \beta) + (\alpha \cdot \beta) = 0$

$\Rightarrow x^2 - 27x + 182 = 0$

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

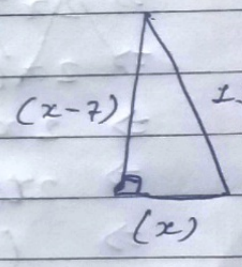
$\Rightarrow x(x - 14) - 13(x - 14) = 0$

$\Rightarrow (x - 14)(x - 13) = 0$

$\Rightarrow x = 14 \mid x = 13$

Q5 → Let base be x

so, Altitude = $(x - 7)$



⇒ by hypotaneous formula

$\Rightarrow (h)^2 + (alt.)^2 + (b)^2$

$\Rightarrow (13)^2 + (x-7)^2 + x^2$

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

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

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

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

$\Rightarrow 2(x^2 - 7x - 60) = 0$

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

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

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

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

$\Rightarrow x = +12 \mid x = -5$

The length cannot be negative so base is 12 cm

Altitude = $x - 7 \Rightarrow 12 - 7$

$\Rightarrow 5$ cm

6→ Let the no. of articles produced on that day be x

one article cost = $3 + 2x$

total cost of production on that day ⇒ ₹90

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

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

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

$\Rightarrow 2x^2 + 15x - 9x - 90 = 0$

$\Rightarrow 2x(x+9) - 9(x+9) = 0$

$\Rightarrow 2x^2 + 18x - 12x - 90 = 0$

$\Rightarrow 2x(x+18) - 12(x+18) = 0$

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

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

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

$\Rightarrow x = 6 \quad / \quad x = \frac{-15}{2}$

Production cannot be negative so production of articles is 6

one article cost = $3 + 2x \Rightarrow 3 + 2(6)$

$\Rightarrow 15$