Exercise 4.1

1) Check whether the following are quadratic equations :-

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

Sol^n :- $(x+1)^2 = 2(x-3)$

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

$\Rightarrow x^2 + 7 = 0$

It is not in the form $ax^2 + bx + c = 0$

$\therefore$ the given eq^n is not a quadratic equation.

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

Sol^n:- $x^2 - 2x = (-2)(3 - x)$

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

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

It is of the form $ax^2 + bx + c = 0$

∴ It is a quadratic eq^n.

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

Sol^n:- $x^2 + x - 2x - 2 = x^2 + 3x - x - 3$

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

$\Rightarrow -3x + 1 = 0$

$\Rightarrow 3x - 1 = 0$

It is not in the form $ax^2 + bx + c = 0$

∴ It is not a quadratic eq^n.

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

Sol^n:- $2x^2 + x - 6x - 3 = x^2 + 5x$

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

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

It is of the form $ax^2 + bx + c = 0$

∴ It is a quadratic eq^n.

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

Sol^n:- $2x^2 - 6x - x + 3 = x^2 - x + 5x - 5$

$\Rightarrow x^2 - 5x - x - 5x + 8 = 0$

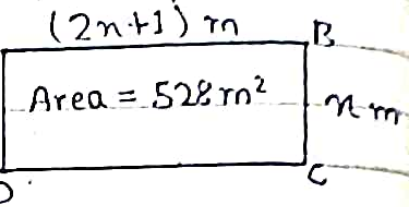
$\Rightarrow x^2 - 11x + 8 = 0$

It is of the form $ax^2 + bx + c = 0$

∴ It is a quadratic eq^n.

2) Represent the following situations in the form of quadratic eq^n:-

(i) 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.



Sol^n:- Let the breadth of the plot be (n) m.
The length of the plot = (2n+1) m.
According to question,

$n(2n+1) = 528$

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

$\Rightarrow 2n^2 + n - 528 = 0$ This is the required representation

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

Sol^n:- Let the 1st consecutive positive integer be n
The 2nd consecutive positive integer be (n+1)
According to question,

$n(n+1) = 306$

$\Rightarrow n^2 + n - 306 = 0$ This is the required representation.

(iii) Roham's mother is 26 yrs older than him. The product of their ages (in yrs) 3yrs from now will be 360. We would like to find Roham's present age.

Sol^n:- Let's Roham's present age be n yrs.
Roham's mother's present age = (n+26) yrs
After 3yrs,
Roham's age = (n+3) yrs
His mother's age = n+26+3 = (n+29) yrs
According to question,

~~$(n+26)(n+29) = 360$~~ $(n+3)(n+29) = 360$

~~$\Rightarrow n^2 + 29n + 26n + 754 = 360$~~ $\Rightarrow n^2 + 29n + 3n + 273 = 360$

~~$\Rightarrow n^2 +$~~ $\Rightarrow n^2 + 32n + 273 = 0$

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

Sol^n:- Let the speed of the train be x km/hr

Time taken to travel 480 km $= \frac{480}{x}$ hrs $\left[\because T = \frac{D}{S}\right]$.

In 2nd condition,

Let the speed of train $= (x-8)$ km/hr

It is also given that the train will take 3 hrs more to cover the same distance.

$\therefore$ Time taken to travel 480 km $= \left(\frac{480}{x} + 3\right)$ hrs

Speed x Time = Distance

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

$\Rightarrow 480 + 3x - \frac{3840}{x} - 24 = 480$

$\Rightarrow 3x - \frac{3840}{x} - 24 = 0$

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

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

Dividing the whole eq^n by 3.

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

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

Example 3 :- Find the roots of the equation $2x^2-5x+3=0$, by factorization.

Sol^n :- $2x^2-5x+3=0$

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

$\Rightarrow 2x(x-3)-1(x-3)=0$

$\Rightarrow (x-3)(2x-1)=0$

Sol^n :- $2x^2-5x+3=0$

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

$\Rightarrow 2x(x-1)-3(x-1)=0$

$\Rightarrow (x-1)(2x-3)=0$

If $x-1=0$ $\quad$ If $2x-3=0$

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

$\therefore$ 1 and $\frac{3}{2}$ are the roots of the eq^n $2x^2-5x+3=0$.

Example 4 :- Find the roots of the quadratic eq^n $6x^2-x-2=0$

Sol^n :- $6x^2-x-2=0$

$\Rightarrow 6x^2-4x+3x-2=0$

$\Rightarrow 2x(3x-2)+1(3x-2)=0$

$\Rightarrow (2x+1)(3x-2)=0$

If $2x+1=0$ $\quad$ If $3x-2=0$

$2x=-1$ $\quad$ $3x=2$

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

$\therefore$ $-\frac{1}{2}$ and $\frac{2}{3}$ are the roots of the equation $6x^2-x-2=0$.

Example 5 :- Find the roots of the quadratic eq^n $3x^2 - 2\sqrt{6}x + 2 = 0$

Sol^n :- $3x^2 - 2\sqrt{6}x + 2 = 0$

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

$\Rightarrow \sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2}) = 0$

$\Rightarrow (\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$

If $\sqrt{3}x - \sqrt{2} = 0$

$\sqrt{3}x = \sqrt{2}$

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

$\therefore$ The roots of $3x^2 - 2\sqrt{6}x + 2 = 0$ are $\sqrt{\frac{2}{3}}$ and $\sqrt{\frac{2}{3}}$