Chapter - 4

Quadratic equation

1) Check whether the following are quadratic equations :-

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

Ans: By using the formula for $(a+b)^2 = a^2+2ab+b^2$

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

$\Rightarrow x^2+7 = 0$

Since the above equation in the form of $ax^2+bx+c=0$

Therefore, the given equation is quadratic equation.

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

Ans: By using the formula for $(a+b)^2 = a^2+2ab+b^2$

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

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

Since the above equation is in the form of $ax^2+bx+c=0$

Therefore, the given equation is quadratic equation.

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

By using the ~~above~~ formula for $(a+b)^2 = a^2+2ab+b^2$

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

$\Rightarrow 3x-1 = 0$

Since the above equation is not in the form of $ax^2+bx+c=0$

Therefore, the given equation is not a quadratic equation

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

By using the formula for $(a+b)^2 = a^2+2ab+b^2$

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

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

Since the above equation is in the form of $ax^2+bx+c=0$

Therefore the given equation is quadratic eqn.

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

By using the formula for $(a+b)^2 = a^2+2ab+b^2$

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

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

Since the above equation is in the form of $ax^2+bx+c=0$

Therefore, the given equation is quadratic equation

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

By using the formula for $(a+b)^2 = a^2+2ab+b^2$

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

$\Rightarrow 7x - 3 = 0$

Since the above equation is not in the form of $ax^2+bx+c=0$

Therefore, the given equation is not a quadratic equation.

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

By using the formula for $(a+b)^3 = a^3+3a^2b+3ab^2+b^3$

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

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

Since the above equation is not a quadratic equation.

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

By using the formula for $(a+b)^3 = a^3+3a^2b+3ab^2+b^3$

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

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

Since the above equation is in the form of $ax^2+bx+c=0$

Therefore, the given equation is quadratic equation.

2) Represent the following situations in the form of quadratic equations.

(i) The area of a rectangular plot is $528\,m^2$. The length of the plot is one more than twice its breadth. We need to find the length and breadth of the plot.

Ans: Let us consider,

Breadth of the rectangular plot $= x$ m

Thus, the length of the plot $= (2x+1)$ m.

As we know,
Area of rectangle = length × breadth
= 528 m²
Putting the value of length and breadth of the plot in the formula, we get,

$$(2x+1) \times x = 528$$
$$\Rightarrow 2x^2 + x = 528$$
$$\Rightarrow 2x^2 + x - 528 = 0$$

Therefore the length and breadth of plot, satisfies the quadratic equation; $2x^2 + x - 528 = 0$ which is the required representation of problem mathematically

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

Ans:- The First integer number = x
Thus the ~~positive~~ next consecutive = $x+1$

Product of two consecutive Integers.

$$\Rightarrow x(x+1) = 306$$
$$\Rightarrow x^2 + x = 306$$
$$\Rightarrow x^2 + x - 306 = 0$$

Therefore the two integer x and $x+1$, satisfies the quadratic equation, $x^2 + x - 306 = 0$, which is the required representation of the problem mathematically

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

Ans: Age of Rohan's = x years

Therefore, as per the given equation,
Rohan's mother's age = $x+26$

After 3 years,
Age of Rohan's = $x+3$
Age of Rohan's mother will be = $x+26+3 = x+29$

The product of their ages after 3 years will be equal to 360,

$$(x+3)(x+29) = 360$$
$$\Rightarrow x^2+29x+3x+87 = 360$$
$$\Rightarrow x^2+32x+87-360 = 0$$
$$\Rightarrow x^2+32x-273 = 0$$

Therefore the age of Rohan and his mother satisfies the quadratic equation $x^2+32x-273=0$ which is the required representation of the problem Mathematically.

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

Ans) The speed of train = x km/h
Time taken to travel 480 km = 480/x km/hr

As per second condition, the speed of train
= (x-8) km/h

Also given the train will take 3 hours
to cover the same distance.

Therefore, time taken to travel 480 km
= 480/(x+3) km/h

As we know,
speed × Time = Distance

Therefore,
$\Rightarrow (x-8)\left(480/(x+3)\right) = 480$

$\Rightarrow 480 + 3x - 3840/x - 24 = 480$

$\Rightarrow 3x - 3840/x = 24$

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

Therefore speed of the train satisfies the quadratic equation solution $3x^2 - 8x - 1280 = 0$ which is the required representation of the problem mathematically.