

Exercise 4.1

1. Check whether the following are quadratic equations:

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

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

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

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

$$\Rightarrow x^2 + 7 = 0$$

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

\therefore It is a quadratic equation.

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

Sol. $x^2 - 2x = (-2)(3 - x)$

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

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

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

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

\therefore It is a quadratic equation.

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

Sol. $(x - 2)(x + 1) = (x - 1)(x + 3)$

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

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

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

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

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

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

\therefore It is not a quadratic equation.

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

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

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

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

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

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

\therefore It is a quadratic equation.

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

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

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

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

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

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

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

\therefore It is a quadratic equation.

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

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

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

$$\Rightarrow x^2 + 3x + 1 - x^2 + 4x - 4 = 0$$

$$\Rightarrow 7x - 3 = 0$$

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

\therefore It is not a quadratic equation.

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

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

$$\Rightarrow x^3 + 2^3 + 3 \cdot x \cdot 2(x + 2) = 2x^3 - 2x$$

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

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

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

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

\therefore It is not a quadratic equation.

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

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

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

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

$$\Rightarrow x^3 - 4x^2 - x + 1 - x^3 + 8 + 6x^2 - 12x = 0$$

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

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

\therefore It is a 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 (in metres) is one more than twice its breadth. We need to find the length and breadth of the plot.

Sol. Let the breadth of the rectangular plot = $x \text{ m}$

\therefore the length of the plot = $(2x + 1) \text{ m}$.

Area of rectangular plot = 528 m^2

$\Rightarrow \text{length} \times \text{breadth} = 528 \text{ m}^2$

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

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

$\therefore 2x^2 + x - 528 = 0$ is the required representation of the problem mathematically.

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

Sol. Let the two consecutive positive integers are x and $x + 1$.

A. t. q. $x \times (x + 1) = 306$

$\Rightarrow x^2 + x = 306$

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

$\therefore x^2 + x - 306 = 0$ is the required representation of the problem mathematically.

(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.

Sol. Let the age of Rohan's = x years

\therefore age of his mother = $x + 26$ years

After 3 years,

Age of Rohan = $x + 3$ years

And age of his mother = $x + 26 + 3$

$= x + 29$ years

A. t. q. The product of their ages after 3 years = 360

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

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

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

$\therefore x^2 + 32x - 273 = 0$ 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 8 km/h less, then it would have taken 3 hours more to cover the same distance. We need to find the speed of the train.

Sol. Sol. Let the speed of train = x km/h

Time taken to travel 480 km = $\frac{480}{x}$ km/hr

New speed of train = $(x - 8)$ km/h

\therefore Time taken to travel 480 km = $\frac{480}{x-8}$ km/hr

A. t. q.

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

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

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

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

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

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

$\therefore x^2 - 8x - 1280 = 0$ is the required representation of the problem mathematically.

Exercise 4.2

1. Find the roots of the following quadratic equations by factorization:

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

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

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

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

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

$$\Rightarrow (x-5) = 0 \text{ or } (x+2) = 0$$

$$\Rightarrow x = 5 \text{ or } x = -2$$

\therefore roots of the quadratic equation are $x = 5, -2$ Ans.

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

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

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

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

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

$$\Rightarrow x+2 = 0 \text{ or } 2x-3 = 0$$

$$\Rightarrow x = -2 \text{ or } x = \frac{3}{2}$$

\therefore roots of the quadratic equation are $x = -2, \frac{3}{2}$ Ans.

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

$$\text{Sol. } \sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$$

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

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

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

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

$$\Rightarrow x = \frac{-5}{\sqrt{2}} \text{ or } x = -\sqrt{2}$$

\therefore roots of the quadratic equation are $x = \frac{-5}{\sqrt{2}}, -\sqrt{2}$ Ans.

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

$$\text{Sol. } 2x^2 - x + \frac{1}{8} = 0$$

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

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

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

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

$$\Rightarrow (4x-1) = 0 \text{ or } (4x-1) = 0$$

$$\Rightarrow x = \frac{1}{4} \text{ or } x = \frac{1}{4}$$

\therefore roots of the quadratic equation are $x = \frac{1}{4}, \frac{1}{4}$ Ans.

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

$$\text{Sol. } 100x^2 - 20x + 1 = 0$$

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

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

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

$$\Rightarrow (10x-1) = 0 \text{ or } (10x-1) = 0$$

$$\Rightarrow x = \frac{1}{10} \text{ or } x = \frac{1}{10}$$

\therefore roots of the quadratic equation are $x = \frac{1}{10}, \frac{1}{10}$ Ans.

2. Solve the problems given in Example 1.

(i) John and Jivanti together have 45 marbles. Both of them lost 5 marbles each, and the product of the number of marbles they now have is 124. We would like to find out how many marbles they had to start with.

Sol. Let the number of marbles John have = x .

Therefore, number of marbles Jivanti have = $45 - x$

After losing 5 marbles each,

Number of marbles John have = $x - 5$

Number of marbles Jivanti have = $45 - x - 5$
 $= 40 - x$

A. t. q. now the product of their marbles is 124.

$$\therefore (x - 5)(40 - x) = 124$$

$$\Rightarrow 40x - x^2 - 200 + 5x - 124 = 0$$

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

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

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

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

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

$$\Rightarrow x - 36 = 0 \text{ or } x - 9 = 0$$

$$\Rightarrow x = 36 \text{ or } x = 9$$

Therefore,

If, John's marbles = 36,

Then, Jivanti's marbles = $45 - 36 = 9$

Or, if John's marbles = 9,

Then, Jivanti's marbles = $45 - 9 = 36$ Ans.

(ii) A cottage industry produces a certain number of toys in a day. The cost of production of each toy (in rupees) was found to be 55 minus the number of toys produced in a day. On a particular day, the total cost of production was Rs.750. We would like to find out the number of toys produced on that day.

Sol. Let the number of toys produced in a day = x .

Therefore, cost of production of each toy that day = Rs $(55 - x)$

A. t. q. total cost of production of the toys = Rs 750

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

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

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

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

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

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

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

$$\Rightarrow x - 25 = 0 \text{ or } x - 30 = 0$$

$$\Rightarrow x = 25 \text{ or } x = 30$$

\therefore The number of toys produced in a day, will be either 25 or 30. Ans.

3. Find two numbers whose sum is 27 and product is 182.

Sol. Let the first number = x

\therefore the second number = $27 - x$.

A. t. q. the product of two numbers = 182

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

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

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

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

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

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

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

$$\Rightarrow x - 13 = 0 \text{ or } x - 14 = 0$$

$$\Rightarrow x = 13 \text{ or } x = 14$$

Therefore, if first number = 13, then second number = $27 - 13 = 14$

Or, if first number = 14, then second number = $27 - 14 = 13$

\therefore The numbers are 13 and 14. Ans.

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

Sol. Let the two consecutive positive integers are x and $x + 1$.

A. t. q. sum of squares of the numbers = 365

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

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

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

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

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

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

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

$$\Rightarrow x + 14 = 0 \text{ or } x - 13 = 0,$$

$$\Rightarrow x = -14 \text{ or } x = 13$$

$\therefore x = 13$ [$\because x$ is a positive integer]

\therefore The two consecutive positive integers are 13 and $13 + 1 = 14$. Ans.

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

Sol. Let the base of the right triangle = x cm.

\therefore the altitude of right triangle = $(x - 7)$ cm

In a right triangle, we know

Base² + Altitude² = Hypotenuse² [By Pythagoras theorem]

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

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

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

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

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

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

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

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

$$\Rightarrow x - 12 = 0 \text{ or } x + 5 = 0,$$

$$\Rightarrow x = 12 \text{ or } x = -5$$

$\therefore x = 12$ [\because sides cannot be negative]

\therefore The base = 12cm and the altitude = $12 - 7$ cm = 5 cm. Ans.

6. 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.

Sol. Let the number of articles produced = x .

\therefore the cost of production of each article = Rs $(2x + 3)$

A. t. q. total cost of production = Rs. 90

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

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

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

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

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

$$\Rightarrow 2x + 15 = 0 \text{ or } x - 6 = 0$$

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

$\therefore x = 6$ [\because the number of articles produced can only be a positive integer]

\therefore The number of articles produced = 6

Cost of each article = $2 \times 6 + 3$ = Rs 15. Ans.

Exercise 4.3

1. Find the nature of the roots of the following quadratic equations. If the real roots exist, find them;

(i) $2x^2 - 3x + 5 = 0$

Sol. $2x^2 - 3x + 5 = 0$

Comparing the equation with $ax^2 + bx + c = 0$, we have,

$a = 2$, $b = -3$ and $c = 5$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-3)^2 - 4(2)(5) \\ &= 9 - 40 \\ &= -31 < 0\end{aligned}$$

\therefore equation has not real roots. Ans.

(ii) $3x^2 - 4\sqrt{3}x + 4 = 0$

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

Comparing the equation with $ax^2 + bx + c = 0$, we have,

$a = 3$, $b = -4\sqrt{3}$ and $c = 4$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-4\sqrt{3})^2 - 4(3)(4) \\ &= 48 - 48 \\ &= 0\end{aligned}$$

Roots are real and equal.

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-4\sqrt{3}) \pm \sqrt{0}}{2 \cdot 3} \\ &= \frac{-4\sqrt{3} \pm 0}{6} \\ &= \frac{-4\sqrt{3} + 0}{6} \text{ or } \frac{-4\sqrt{3} - 0}{6} \\ &= \frac{-2\sqrt{3}}{3} \text{ or } \frac{-2\sqrt{3}}{3}\end{aligned}$$

Therefore, the roots are $x = \frac{-2\sqrt{3}}{3}, \frac{-2\sqrt{3}}{3}$ Ans.

(iii) $2x^2 - 6x + 3 = 0$

Sol. $2x^2 - 6x + 3 = 0$

Comparing the equation with $ax^2 + bx + c = 0$, we have

$$a = 2, b = -6, c = 3$$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-6)^2 - 4(2)(3) \\ &= 36 - 24 \\ &= 12 > 0\end{aligned}$$

\therefore Roots are real and distinct.

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

$$= \frac{-(-6) \pm \sqrt{12}}{2 \cdot 2}$$

$$= \frac{6 \pm 2\sqrt{3}}{4}$$

$$= \frac{2(3 \pm \sqrt{3})}{4}$$

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

\therefore the roots for the given equation are $x = \frac{3 + \sqrt{3}}{2}, \frac{3 - \sqrt{3}}{2}$ Ans.

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

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

Sol. $2x^2 + kx + 3 = 0$

Comparing the given equation with $ax^2 + bx + c = 0$, we have,

$a = 2, b = k$ and $c = 3$

Since the roots are real and equal

$$\Rightarrow b^2 - 4ac = 0$$

$$\Rightarrow k^2 - 4 \cdot 2 \cdot 3 = 0$$

$$\Rightarrow k^2 = 24$$

$$\Rightarrow k = \pm\sqrt{24}$$

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

(ii) $kx(x - 2) + 6 = 0$

Sol. $kx(x - 2) + 6 = 0$

or $kx^2 - 2kx + 6 = 0$

Comparing the given equation with $ax^2 + bx + c = 0$, we have,

$a = k, b = -2k$ and $c = 6$

Since the roots are real and equal

$$\begin{aligned}
 &\Rightarrow b^2 - 4ac = 0 \\
 &\Rightarrow (-2k)^2 - 4(k)(6) = 0 \\
 &\Rightarrow 4k^2 - 24k = 0 \\
 &\Rightarrow 4k(k - 6) = 0 \\
 &\Rightarrow 4k = 0 \text{ or } k = 6 = 0 \\
 &\Rightarrow k = 0 \text{ or } k = 6 \\
 &\therefore k = 6 [\because k \neq 0] \\
 &\therefore \text{value of } k \text{ is } 6 \text{ Ans.}
 \end{aligned}$$

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. Let the breadth of mango grove = $x \text{ m}$

\therefore Length of mango grove = $2x \text{ m}$

Area of mango grove = 800 m^2

$\Rightarrow \text{length} \times \text{breadth} = 800 \text{ m}^2$

$$\Rightarrow 2x \times x = 800$$

$$\Rightarrow 2x^2 = 800$$

$$\Rightarrow x^2 = 400$$

$$\Rightarrow x^2 - 400 = 0$$

Comparing the given equation with $ax^2 + bx + c = 0$, we have

$a = 1, b = 0, c = 400$

$$\begin{aligned}
 \therefore \text{Discriminant} &= b^2 - 4ac \\
 &= (0)^2 - 4 \times (1) \times (-400) \\
 &= 1600 > 0
 \end{aligned}$$

\therefore Roots are real and distinct.

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

$$= \frac{-0 \pm \sqrt{1600}}{2 \cdot 1}$$

$$= \frac{-0 \pm 40}{2}$$

$$= \frac{40}{2}, \frac{-40}{2}$$

$$= 20, -20$$

$\therefore x = 20$ [\because length never be negative]

\therefore breadth of mango grove = 20 m

And length of mango grove = $2 \times 20 = 40 \text{ m}$ Ans.

4. 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 one friend = x years.

\therefore the age of the other friend = $(20 - x)$ years.

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

And the age of second friend = $(20 - x - 4) = (16 - x)$ years

A. t. q. the product of their ages = 48 years

$$\Rightarrow (x - 4)(16 - x) = 48$$

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

$$\Rightarrow -x^2 + 20x - 64 - 48 = 0$$

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

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

Comparing the equation with $ax^2 + bx + c = 0$, we have,

$a = 1$, $b = -20$ and $c = 112$

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

$$= (-20)^2 - 4 \times 112$$

$$= 400 - 448$$

$$= -48 < 0$$

\therefore equation has not real roots.

Hence this situation is not possible.

5. 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. Let the length of the park = x m

Perimeter of the rectangular park = 80

$$\Rightarrow 2(\text{length} + \text{breadth}) = 80$$

$$\Rightarrow x + \text{breadth} = \frac{80}{2}$$

$$\Rightarrow \text{breadth} = 40 - x$$

Area of rectangular park 400 m^2

$$\Rightarrow \text{length} \times \text{breadth} = 400 \text{ m}^2$$

$$\Rightarrow x \times (40 - x) = 400$$

$$\Rightarrow 40x - x^2 - 400 = 0$$

$$\Rightarrow x^2 - 40x + 400 = 0$$

Comparing the given equation with $ax^2 + bx + c = 0$, we have

$a = 1$, $b = -40$, $c = 400$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-40)^2 - 4 \times (1) \times (400) \\ &= 1600 - 1600 \\ &= 0\end{aligned}$$

\therefore equation has real and equal roots.

Hence, the situation is possible.

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-40) \pm \sqrt{0}}{2 \cdot 1} \\ &= \frac{40 \pm 0}{2} \\ &= \frac{40}{2}, \frac{40}{2} \\ &= 20, 20\end{aligned}$$

\therefore length of rectangular park = 20 m

And breadth of the park, $b = 40 - 20 = 20$ m Ans.