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Class - 10

Mathematics

Chapter - 4

Quadratic Equation

Part - 1

Harsh Goyal

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QUADRATIC EQUATION

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QUADRATIC EQUATION

$ax^2 + bx + c \quad a \neq 0$

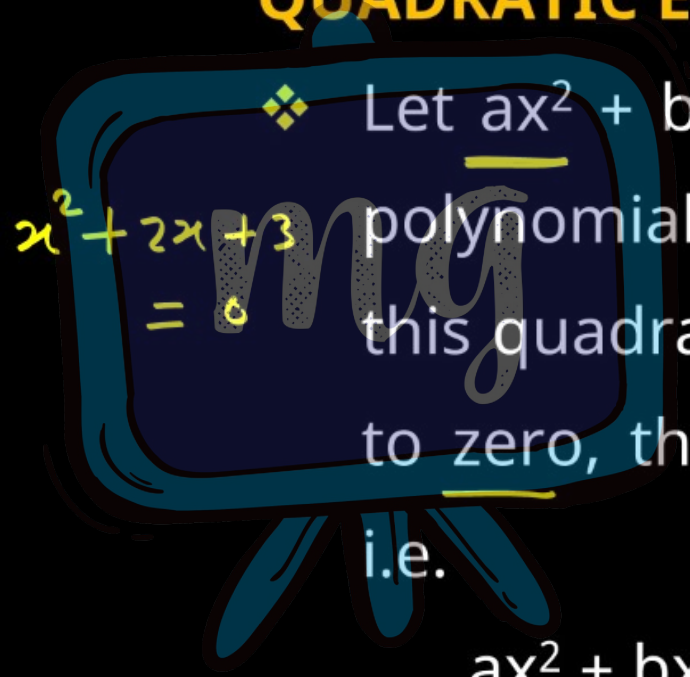
$ax^2 + bx + c = 0$

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QUADRATIC EQUATION



- Let $ax^2 + bx + c$ be a quadratic polynomial. Then by keeping this quadratic polynomial equal to zero, the equation obtained i.e.

$$ax^2 + bx + c = 0, a \neq 0$$

is called a quadratic equation.

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EXAMPLE 1 :

Represent the following situations mathematically :

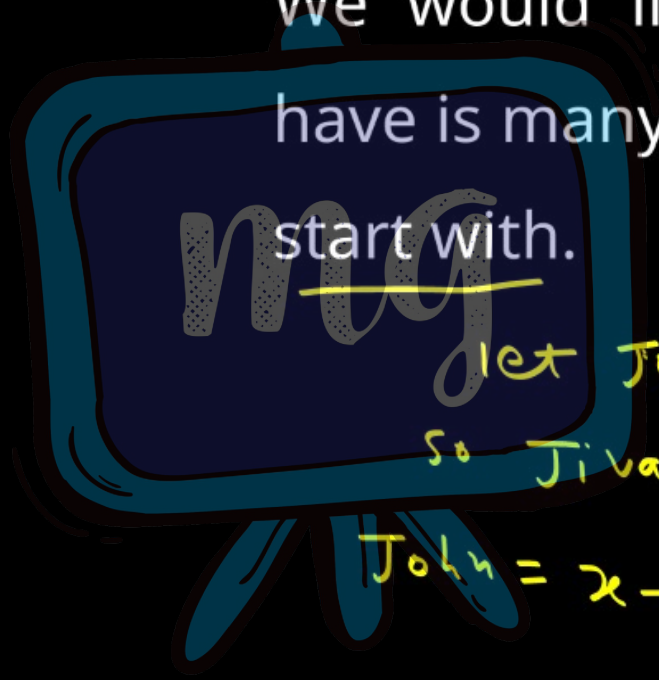
(i) John and Jivanti together have 45 marbles. Both of them lost 5 marbles each, and the product of the number of marbles they now have is 124.

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We would like to find out how have is many marbles they had to start with.



let John has x marbles.

So Jivanti has = 45−x

John = x−5 , Jivanti

= 45−x−5

= 40−x

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

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

$-x^2 + 45x = 324$

$x^2 - 45x = -324$

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



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(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 ₹ 750.

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We would like to find out the number of toys produced on that day.

let x toys be produced in a day.

$(55-x)$

$x(55-x) = 750$

$55x - x^2 = 750$

$x^2 - 55x = -750$

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

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EXAMPLE 2 :

Check whether the following are quadratic equations :

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

ax^2+bx+c

$a \neq 0$

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

$x^2-4x+5=2x-3$

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

Yes

$ax^2+bx+c=0$

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(ii) $x(x + 1) + 8 = (x + 2)(x - 2)$

Yes or No

$x^2 + x + 8 = x^2 + 2x - 2x - 4$

$x^2 + x + 8 = x^2 - 4$

$x + 8 = -4$

$x = -4 - 8$

$x = -12$

$ax^2 + bx + c$

$a \neq 0$

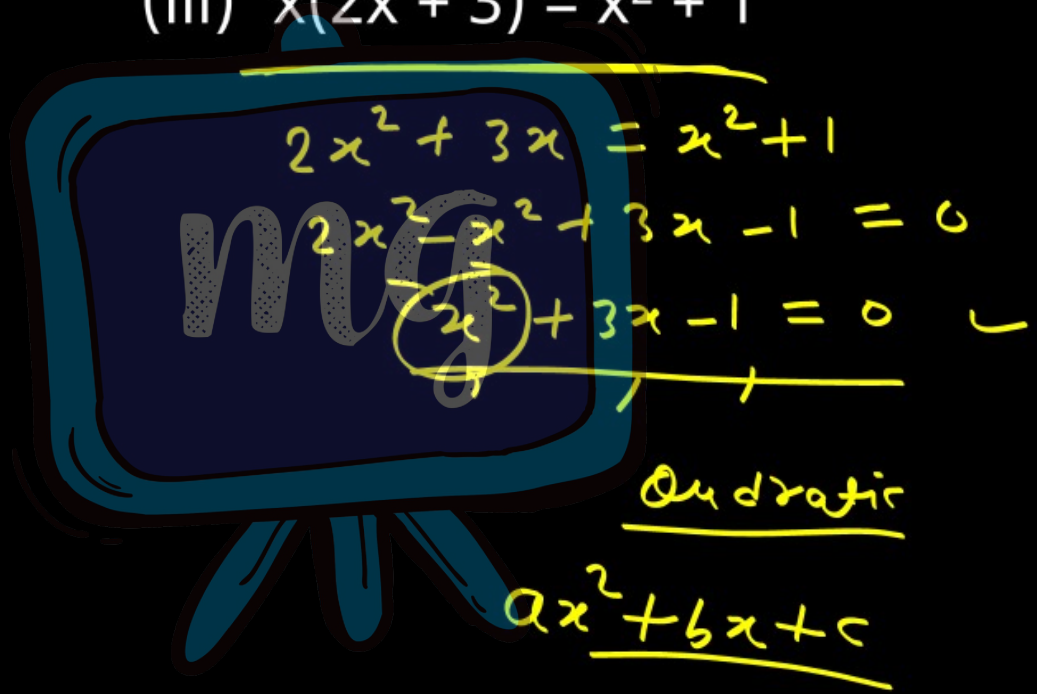
$0 \cdot x^2 + x + 12 = 0$ ✗ No

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



$2x^2 + 3x = x^2 + 1$

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

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

Quadratic

$ax^2 + bx + c$

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(iv) $(x + 2)^3 = x^3 - 4$

Yes / No

$x^3 + 3x^2(2) + 3x(2)^2 + 8 = x^3 - 4$

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

$6x^2 + 12x + 12 = 0$

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EXERCISE 4.1

1. Check whether the following are quadratic equations :

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

x^2

$x^2 + 1$

$x^2 - 2x$

x^2

x

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

$x^2 + 7 = 0$

Yes

$ax^2 + bx + c$

$a \neq 0$

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

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

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

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

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

$x^2 - x - 2 = 2x - 3$

$3x - 1 = 0$

(iii) yes / no

Not Quadratic

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

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

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

$x^2 - 10x - 3 = 0$ ✓

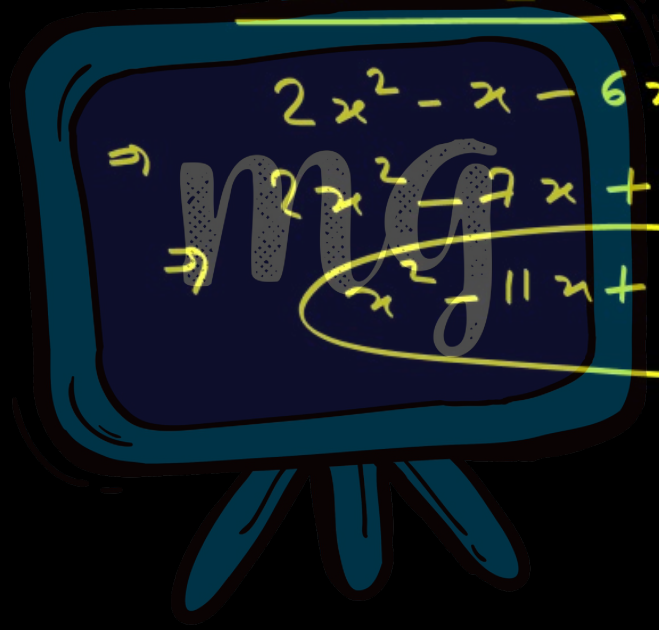
Yes

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



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

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

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

Yes

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



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

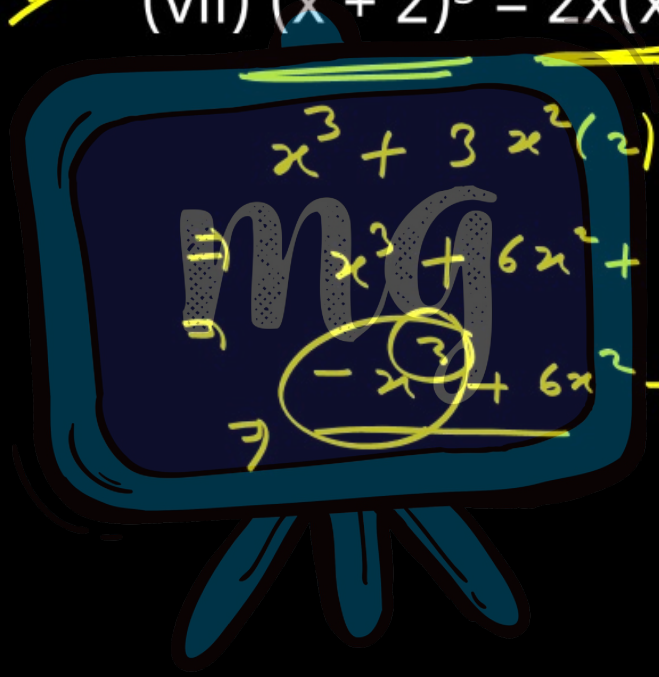
not quadratic eqn

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



$x^3 + 3x^2(2) + 3x(2)^2 + 8$

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

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

not

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

$x^3 - 4x^2 - x + 1$

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

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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.

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let breath = x metre

length = y metre

area of rectangular = l × b

$528 = xy$

$xy = 528$

$2x + 1 = y$

$y = 2x + 1$

$x(2x+1) = 528$

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

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

18×17

$12\ 6$

$18\ \times$

$3\ 0\ 6$

let x be the first positive Integer

x, $(x+1)$

$x(x+1) = 306$

$x^2 + x = 306$

$x^2 + x - 306 = 0$

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

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

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

$x = -18$, $x = 17$

$17, 18$

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(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.

let Rohan present age = x years
" mother age = x + 26

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three years later

Rohan's age = $x+3$

Mother's age = $x+26+3$

$= x+29$

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

$x^2+3x+29x+87 = 360$

$x^2+32x = 273$

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

2

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$D = 480\,km$

let speed $= x$

$t_1 = \frac{D}{S}$

$t_1 = \frac{480}{x}$

(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.

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

$x =$

$ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{29}$$

Speed $= (x - 8)$

$t_2 = t_1 + 3$

$t_2 - t_1 = 3$

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

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

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

$$3840 = 3(x^2 - 8x)$$

$$3840 = 3x^2 - 24x$$

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

$t_2 = \frac{D}{S}$, $t_2 = \frac{480}{x-8}$

$$\frac{480 \times 8}{3840}$$ 6