Exercise - 4.1 :-

Quadratic Equations

1. Check whether the following equ are quadratic equs.

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

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

$\boxed{x^2+7 = 0}$ —— this is in the form

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

$a=1,\ b=0,\ c=7$

So, it is a quadratic equation.

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

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

$\boxed{x^2-4x+6=0}$ —— this is in the form

$ax^2+bx+c=0$

$a=1,\ b=-4,\ c=6.$

$(a\neq 0)$

So, this is a quadratic equation

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

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

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

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

$\boxed{-3x+1=0}$ comparing this with standard quad. equ $ax^2+bx+c=0$

$a=0,\ b=-3,\ c=1$

As, $a=0$ this is not a quadratic equation.

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

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

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

$\boxed{x^2 - 10x - 3 = 0}$ — This is the compared to $ax^2+bx+c=0$.

$a=1, b=-10, c=-3.$

Here $a \neq 0$.

So, it is a quadratic equation.

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

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

$2x^2 - x^2 - 7x + 5x + x + 3 + 5 = 0.$

$\boxed{x^2 - 11x + 8 = 0}$

If this is compared to $ax^2+bx+c=0$

$a=1, b=-11, c=8$

So, $a \neq 0$.

∴ It is a quadratic equation.

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

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

$x^2 - x^2 + 7x - 3 = 0$

$\boxed{7x - 3 = 0}$ → Here if you compare with $ax^2+bx+c=0$

Here, $a=0, b=7, c=-3.$

So, because $a=0$, it is not a quadratic equation.

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

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

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

↓

This equation is not of the form

$ax^2+bx+c=0$.

So, it is not a quadratic equation.

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

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

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

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

↓

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

where $a=2$, $b=-13$, $c=9$. and $a\neq 0$

$\therefore$ It is quadratic equation.

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Question-2

Represent the following statements 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 length and breadth of the plot.

A) Here, length of the plot is depending on breadth.

So, first assume breadth as $\boxed{x\ m}$

length = 2 x breadth + 1

$l = 2 \times x + 1$

$\boxed{l = 2x + 1}$

Now, Area = length x breadth

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

$= 2x^2 + x$

this is given as $528\ m^2$.

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

$\boxed{2x^2 + x - 528 = 0}$

Hence the length and breadth can be calculated from this equation by finding x.

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

A) Given the integers are consecutive

So, they will be x and $x+1$ respectively

given product of the integers is 306.

$$(x)(x+1) = 306$$

$$x^2 + x = 306$$

$$\boxed{x^2 + x - 306 = 0}$$

This equation satisfies the condition for integer x.

and from this we can find both x and $x+1$

(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.

A) Let Rohan's present age be x yrs

Rohan's mother's present age $= (x+26)$ yrs

Rohan's age 3 years from now $= (x+3)$ yrs.

Rohan mother's age 3 years from now

$$= x + 26 + 3$$

$$= (x+29) \text{ yrs}$$

Given product of their ages 3 years from now $= 360$.

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

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

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

$\Rightarrow x^2 + 32x + 87 - 360 = 0$

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

Rohan's age x will satisfy this quadratic equation.

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.

At first case, $\text{distance}_1 = 480$ km.

Speed, be x km/hr.

(t_1) time taken ① $= d/s = \frac{480}{x}$

Second case, $\text{distance}_2 = 480$ km.

$\text{Speed}_2 = (x-8)$ km/hr

t_2, time taken ② $= d/s = \frac{480}{x-8}$

given $t_2 = t_1 + 3$

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

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

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

$$\Rightarrow \frac{480x - 480x + 3640}{(x-8)(x)} = 3$$

$$\Rightarrow 3640 = 3(x-8)(x)$$

$$\Rightarrow \cancel{3640} = \cancel{3(x^2-8x)}$$

$$\Rightarrow 3640 = 3(x^2-8x)$$

$$\Rightarrow 3640 = 3x^2 - 24x$$

$$\Rightarrow -3x^2 + 24x + 3640 = 0$$

$$\Rightarrow -(3x^2 - 24x - 3640) = 0$$

$$\Rightarrow \boxed{3x^2 - 24x - 3640 = 0}$$

This is the equation that satisfies the speed of the brain.

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