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$ax^2+bx+c=0$ Factorization 2^2 x^2

Quadratic Equations

- The adjective quadratic comes from the Latin word quadratum which means "square".
- Quadratic equations denotes equation with highest power of two.
- A quadratic equation is an equation of the form $ax^2 + bx + c = 0$, where a, b, c are real numbers but $a \neq 0$.

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Factorization of Quadratic Equations

Roots

Factoring quadratic equations means converting the given quadratic expression into the product of two linear factors.

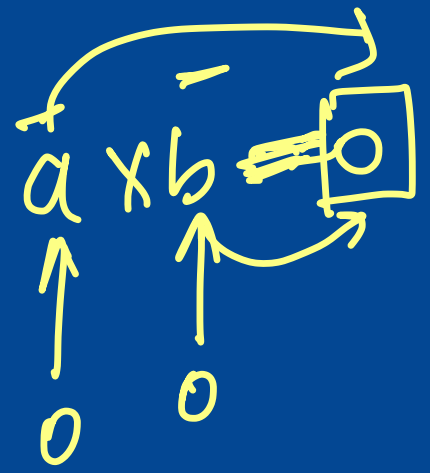
The general quadratic equation $ax^2 + bx + c = 0$ can be factored as $(x + p)(x + q)$.

For example :
Consider the equation $x^2 + 5x + 6 = 0$.
This can be factored as $(x+2)(x+3)=0$.

a · E

$(x+a)(x+b) = x^2 + (a+b)x + ab = 0$

Zero Product Property



To solve quadratic equations by factoring, apply the Zero Product Property

→ which states that, if the product of two real numbers is zero, then one or both of the numbers must be zero.

Thus, if ab = 0, then either a = 0, or b = 0 or both equal 0.

Solving quadratic equations by factoring

$x(x+1)=0$

$(x) \times (x+1) = 0$

$x = 0$ or $x + 1 = 0$

$x = 0$ or $x = -1$

Roots of quadratic eqn

Solving quadratic equations by factoring

$(x-5)(x-1)=0.$

$x-5=0$ or $x-1=0$

$x=0+5$ or $x=0+1$

$x=5$ or $x=1$

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$x^2 - 11x = 0$

$x(x - 11) = 0$

$x = 0$ or $x - 11 = 0$

$\boxed{x = 0 \text{ or } x = 11}$

$10x^2 + 5x = 0$

$5x(2x + 1) = 0$

$5x = 0$ or $2x + 1 = 0$

$x = \frac{0}{5}$ or $2x = -1$

$x = 0$ or $x = -\frac{1}{2}$

$$\frac{1}{3}x^2 + \frac{4}{3}x = 0 \implies \frac{1}{3}x^2 + \frac{1}{3}\times 4x = 0$$

$$\Rightarrow \left(\frac{1}{3}x\right)(x+4) = 0$$

$$\frac{1}{3}x = 0 \quad \text{or} \quad x+4 = 0$$

$$\frac{x}{3} = 0 \quad \text{or} \quad x = -4$$

$$x = 0 \times 3 = 0 \quad \text{or} \quad x = -4$$

$x = 0$

$x = -4$

$3^2 \quad 2^2$

$\downarrow \quad \downarrow$

$9x^2 - 4 = 0$

$a^2 - b^2 = (a+b)(a-b)$

$a^m b^m = (ab)^m$

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

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

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

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

$3x = -2$ or $3x = 2$

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

Factors of a quadratic trinomial ?

An expression of the form $ax^2 + bx + c$ is called a quadratic trinomial.

We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

∴The factors of $x^2 + (a + b)x + ab$ → $(x + a)$ and $(x + b)$

How to find the factors of quadratic trinomial ?

Step 1: Consider the quadratic equation ax^2 + bx + c = 0
Step 2 : Multiply a * c where a is coefficient of x^2 and c is constant term.

Step 3: Now, find two numbers such that their product is equal to ac and sum equals to b.

(number 1)(number 2) = ac

(number 1) + (number 2) = b

To find the factors of $x^2 + 5x + 6$,

$$x^2 + 5x + 6$$

$$x^2 + 2x + 3x + 6$$

$$x(x+2) + 3(x+2)$$

$$(x+2)(x+3) = 0$$

$(x+a)(x+b)$

2 Factors

$6 \times 1 = 7$

$2 \times 3 = 5$ (+)

$+6 \Leftarrow$ multiply

$+5$

$+2 \quad +3$

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Factorise: $2x^2$ - 9x + 9

$2x^2 - 9x + 9$

$2x^2 - 6x - 3x + 9$

$2x(x-3) - 3(x-3)$

$(x-3)(2x-3)$

$2 \times 9 = +18$ ⇐ (X)

(+) ⇒ -9

$-6 \quad -3$

-9×2

-6×3

$-6 - 3 = -9$

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Factorise: 2x^2 + 5x -18

$2x^2 + 5x - 18$

$2x^2 - 4x + 9x - 18$

$2x(x-2) + 9(x-2)$

$(x-2)(2x+9)$

$2X - 18 = -36$

Add = +5

+9	-4

+12X-3

+0 ~~X~~

+9X-4

$f(2) - 3 = +9$

$+9 - 4 = +5$

Factorise: x^2 - 10x + 21

$-3x-7$

-10

21

-3 -7

$x^2 - 10x + 21$

$x^2 - 3x - 7x + 21$

$x(x-3) - 7(x-3)$

$(x-3)(x-7)$

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Find the factors of $2y^2 - 4y - 30$

$2X - 30 = -60$

$-10 \times +6$

$-10 \quad +6$

$2y^2 - 4y - 30$

$2y^2 - 10y + 6y - 30$

$2y(y-5) + 6(y-5)$

$(y-5)(2y+6)$

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