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

$$= a^2 + ab + ab + b^2$$

$$= a^2 + 2ab + b^2$$

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

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

$$= a^2 - ab - ab + b^2$$

$$= a^2 - 2ab + b^2$$

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

$$* (a \pm b)^2 = a^2 \pm 2ab + b^2$$

$p^2 + 10p + 25$

$= (p)^2 + 2(5)(p) + (5)^2$

$(p + 5)^2$

$m^2 - 12m + 36$

$= (m)^2 - 2(6)(m) + (6)^2$

$= (m - 6)^2$

$16a^2 - 40a + 25$

$(4a)^2 - 2(5)(4a) + (5)^2$

$(4a - 5)^2$

$9b^2 + 42b + 49$

$(3b)^2 + 2(7)(3b) + (7)^2$

$(3b + 7)^2$

Zero Product Property

$0 \cdot b = 0$

$a \cdot 0 = 0$

$0 \cdot 0 = 0$

- If $ab = 0$, then $a = 0$ or $b = 0$

* a and b can both equal 0 also.

e.g. $3x = 0$

* Note: do not divide by 3 for this

$3(0) = 0$

$\rightarrow x = 0$

$3 = 0$ or $x = 0$

$3 \neq 0$

contradiction

$3(x - 2) = 0$

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

$3 \neq 0$ $\quad +2 \quad +2$

$x = 2$

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

$x + 4 = 0$ or $x - \sqrt{3} = 0$

$-4 \quad -4$ $\quad +\sqrt{3} \quad +\sqrt{3}$

$x = -4$ $\quad x = \sqrt{3}$

$x = -4, \sqrt{3}$

$x \in \{-4, \sqrt{3}\}$

↑ is any one of the set

28 $x(x+4)(x-\sqrt{3})=0$

* Observe: We are multiplying 3 factors

3 solutions.

$x=0$

$x+4=0$

$x=-4$

$x-\sqrt{3}=0$

$x=\sqrt{3}$

Quadratic Equation in One Variable

$ax^2+bx^1+c=0$

largest power = 2

$a,b,c \in \mathbb{R}$

$a \neq 0$

a,b,c are real numbers

$a \neq 0$

* $a=1$

$b=6 = 5+1$

$c=5 = 5 \cdot 1$

$x^2+6x+5=0$

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

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

$-1 \quad -1 \qquad -5 \quad -5$

$x=-1$ $\qquad$ $x=-5$

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

$x \in \{-1,-5\}$

$x^2 - 8x = -16$

$+16 \quad +16$

$x^2 - 8x + 16 = 0$

$(x-4)(x-4) = 0$

$x-4=0$ or $x-4=0$

repeat

$+4 \quad +4$

$\boxed{x = 4}$

* Yes it is a quadratic equation

x^2

but not in standard form

$ax^2 + bx + c = 0$

* $a = 1$

$b = -8 = -4 + -4$

$c = 16 = -4 \cdot -4$

* $(x)^2 - 2(4)(x) + (4)^2$

$(x-4)^2$

$\frac{2x^3+9x^2}{x} = \frac{5x}{x}$ ← do not divide by x.

$2x^2+9x = 5$

$2x^2+9x-5=0$

$2x^2+(10-1)x-5=0$

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

$(2x^2+10x)+(-x-5)=0$

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

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

$a=2$
$b=9$
$c=-5$

$ac=-10=-1\cdot 10$

$b=9=-1+10$

$2x-1=0$
$+1\ +1$

$2x=1$

$\frac{2x}{2}=\frac{1}{2}$

$\boxed{x=\frac{1}{2}}$

or $x+5=0$

$-5\ -5$

$\boxed{x=-5}$

$$2x^3 + 9x^2 = 5x$$

$$2x^3 + 9x^2 - 5x = 0$$

$$x(2x^2 + 9x - 5) = 0$$

work done earlier

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

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

$x = \frac{1}{2}$ $\quad$ $x = -5$

$x(5x+2)=3$

*Trap (Do not do this)

$x=3$ $\qquad$ $5x+2=3$

$5x^2+2x=3$

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

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

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

$x(5x-3)+1(5x-3)=0$

$(x+1)(5x-3)=0$

$x+1=0$ or $5x-3=0$

$-1\ -1$ $\qquad$ $+3\ +3$

$x=-1$ $\qquad$ $5x=3$

$x=\frac{3}{5}$

$a=5$

$b=2$

$c=-3$

$ac=-15=-3\cdot 5$

$b=2=-3+5$

$x\in\{-1,\frac{3}{5}\}$

$$x^4 - 9x^3 + 16x^2 - 144x = 0$$

$$x(x^3 - 9x^2 + 16x - 144) = 0$$

$x = 0$

$$x^3 - 9x^2 + 16x - 144 = 0$$

$$(x^3 - 9x^2) + (16x - 144) = 0$$

$$x^2(x-9) + 16(x-9) = 0$$

$$(x^2+16)(x-9) = 0$$

$x^2 + 16 = 0$ or $x - 9 = 0$

$x = 9$

Not Factorable Yet

$x^2 \neq -16$