

Standard → Factored


add mult
 $x^2 + 8x + 15$
 5+3 5.3
 15, 1.15
 $\frac{15}{5x} \frac{1.15}{3x}$
 $\frac{3x}{8x}$
 $(x+5)(x+3)$
 ← should match each other

When $a > 1$ then Find factors of a for x -values
 $18: 1, 18$
 $12: 1, 12$
 $3: 1, 3$
 $2: 1, 2$
 $2x^2 - 11x + 18$
 $(x-9)(x-2)$
 $(-9x) (-2x)$
 $-11x$
 $2x^2 - 5x - 3$
 $(2x+1)(x-3)$

Standard → Vertex

Ex: $x^2 + 16x + 64 = (\frac{b}{2})^2 = 8^2 = 64$
 $(x^2 + 16x + 64) + 6 - 64$
 $(x^2 + 16x + 64) - 58$
 $(x+8)^2 - 58$
 Vertex: $(-8, -58)$
 $AoS: x = -8$
 y -int: $(0, 6)$
 stretch: $a = 1$
 Factor first
 $2(x^2 - 6x + 9) - 1$
 $2(x-3)^2 - 1$
 Vertex: $(3, -1)$
 $AoS: x = 3$
 stretch: 2

Factored → Standard

Ex: $(x+1)(x+3)$ changesign x -int: $(-1, 0)$
 $(x+3)+1(x+3)$
 $x^2 + 3x + x + 3$
 $x^2 + 4x + 3$
 Ex: $(x-3)(x+4)$ changesign x -int: $(3, 0)$
 $(x+4)+3(x+4)$
 $x^2 + 4x - 3x - 12$
 $x^2 + x - 12$ y -int: $(0, -12)$

 Count all tiles
 Trinomial: $x^2 + 6x + 9$
 area of side length (dimension)
 Binomial: $(x+3)(x+3)$ or $(x+3)^2$

How to Graph

$a(x-h)^2 + k$
 • k shifts up or down $\uparrow \downarrow$
 • h shifts left or right $\leftarrow \rightarrow$ (think opposites)
 • If no # in front $()$ then $a = 1$
 • If stretch is 1 then pattern is $\uparrow 1, \uparrow 3, \uparrow 5, \dots$
 • If stretch is not 1, then mult. # to pattern $1, 3, 5, \dots$
 Ex: $a = 2$ Pattern $\uparrow 2, \uparrow 6, \uparrow 10, \dots$
 Graph $(x-2)^2 - 3$

Vertex Form

$y = a(x-h)^2 + k$
 h, k : Vertex: (h, k)
 $AoS: x = h$
 a: stretch, direction
 $a > 1$ narrow
 $0 < a < 1$ wider
 If a is neg $\rightarrow \curvearrowright$ max
 a is pos $\rightarrow \curvearrowleft$ min
 Ex: $4(x-3)^2 - 10$
 vertex: $(3, -10)$
 $AoS: x = 3$
 stretch: $a = 4$

Standard Form

$y = ax^2 + bx + c$
 direction stretch $\downarrow \uparrow$
 y -intercept

Factored Form

Use to find x -int.
 $y = (x+w)(x+v)$
 * if $w = v$ (same) then rewrite $(x+w)^2$
 x -int: Opposite sign of
 Ex: $(x+2)(x-3)$
 $x+2 = 0 \rightarrow x = -2$
 $x-3 = 0 \rightarrow x = 3$
 x -int: $(-2, 0)$ $(3, 0)$

Completing the Square

Trinomial $ax^2 + bx + c$
 Binomial $(x \pm d)^2$
 Ex: Find c
 $x^2 + 10x + 25$
 $(\frac{b}{2})^2 = c$
 $(\frac{10}{2})^2 = 5^2 = 25$
 $x^2 - x + c$ Ex: Find b
 $x^2 + 14x + 49$
 $(\frac{b}{2})^2 = 49$
 $\frac{b}{2} = 7$
 $b = 14$