

Standard Form of a parabola

$$y - k = a(x - h)^2 \quad \text{vertex } (h, k)$$

a — up or down
— slope (narrow)

Example

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

vertex $(3, -2)$

opens down
slope = -4

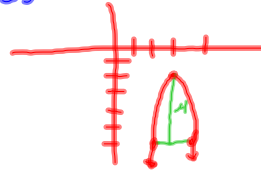
domain $(-\infty, \infty)$

range $(-\infty, -2]$

axis of symm at $x = 3$

Maximum at -2

$$\begin{aligned} y \text{ intercept } & \quad y + 2 = -4(0 - 3)^2 \\ x = 0 & \quad y + 2 = -4 \cdot 9 \\ & \quad y + 2 = -36 \\ & \quad y = -38 \end{aligned}$$



Yesterday

x intercepts

y intercepts = -12

$x = 0$

$y = 0$

$$y = x^2 - 4x - 12$$

$$0 = x^2 - 4x - 12$$

$$0 = (x - 6)(x + 2)$$

$$x = 6 \text{ or } -2$$

x vertex = middle of -2 and 6

$$x = \frac{-2 + 6}{2} = 2$$

$$x_v = 2$$

$$y = 2^2 - 4 \cdot 2 - 12$$

$$4 - 8 - 12$$

$$y = -16$$

vertex $(2, -16)$

$$y - k = a(x - h)^2$$

Using standard form to find
the equation from information

#1 A parabola has a vertex of $(4, -2)$
and the point $(2, 10)$. Find its equation.

$$y - k = a(x - h)^2$$

$$y + 2 = a(x - 4)^2$$

$$10 + 2 = a(2 - 4)^2$$

$$12 = a(2)^2$$

$$12 = a \cdot 4$$

$$\boxed{a = 3}$$

$$\rightarrow \boxed{y + 2 = 3(x - 4)^2}$$

need a
put in x and y
to find a

Exercise 4 - changing an equation

From general to standard.

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

preferred for
graphing

General

$$y = x^2 - 5x - 14$$

Switch from General to Standard
by completing the square

Step 1
isolate
x parts
Step 2
complete
square
($\frac{1}{2}$ middle)²

$$y = x^2 + 8x + 15$$

$$y - 15 = x^2 + 8x$$

$$y - 15 = x^2 + 8x + \underline{16}$$

$$y + 1 = x^2 + 8x + 16$$

$$y + 1 = (x + 4)^2$$

Completing square

$$x^2 + 10x + \underline{25}$$

$$x^2 - 6x + \underline{9}$$

$$x^2 - 7x + \underline{\frac{10 \cdot 25}{4}}$$

$$x^2 - 16x + \underline{64}$$

(half the middle coefficient)²

$$y = x^2 - 10x + 19$$

$$y - 19 = x^2 - 10x + \underline{25}$$

$$y + 6 = (x - 5)^2$$

1) Move number
(isolate x)