

opens up



AS

Vertex Max



AS

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

هنا 2 حالتين

L → 1

$$\text{Vertex} = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right) \right)$$

$$\underline{\underline{AS}} \Rightarrow x = -\frac{b}{2a}$$

Exp $y = (x-1)^2 + 2$

① write the general form of this quadratic Eq.

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

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

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

② Does this parabola open up/Down?

$$a = 1 > 0 \Rightarrow \text{opens up}$$



③ Does vertex Max or Min?

Min since it opens up

Min since it opens up

④ Find AS

$$x = -\frac{b}{2a}$$

$$= -\frac{-2}{2(1)}$$

$$= 1$$

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

$$a = 1$$
$$b = -2$$



خط عمودي
V. line
AS

⑤ Find Vertex

$$\text{Vertex} = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right) = (1, f(1)) = (1, 2)$$

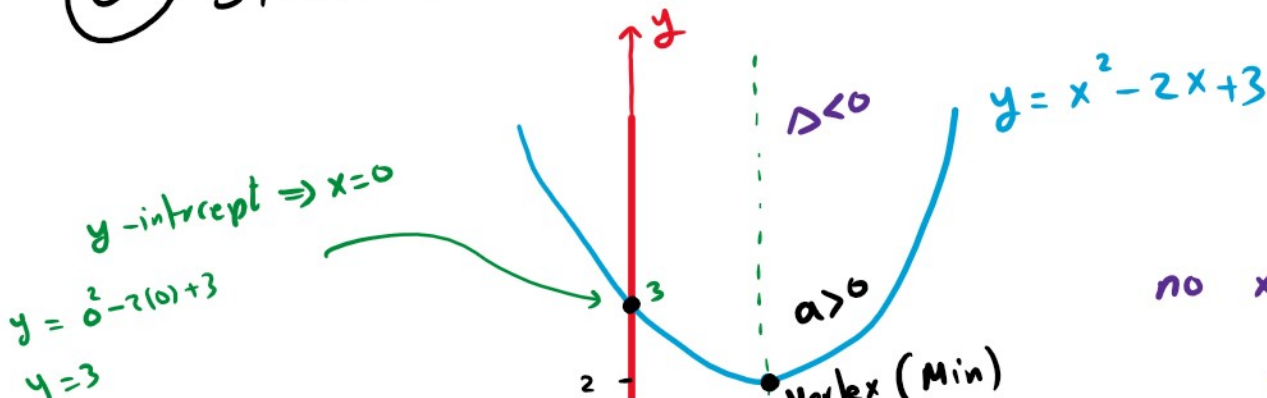
$$y = f(x) = x^2 - 2x + 3$$

$$f(1) = (1)^2 - 2(1) + 3$$

$$= 1 - 2 + 3$$

$$= 2$$

⑥ sketch this parabola

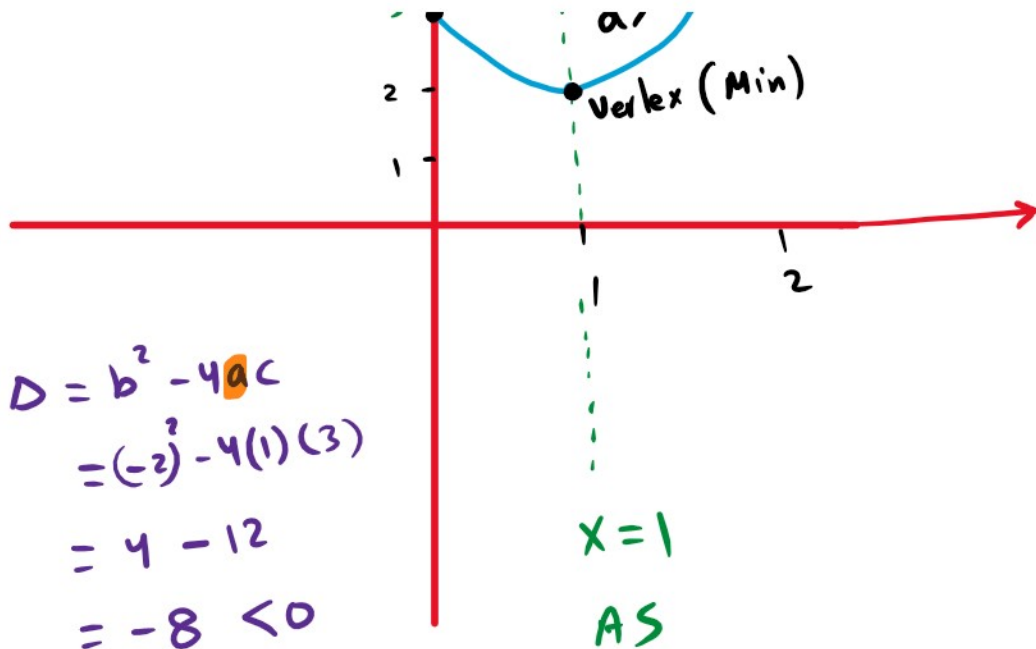


$$y = 0^2 - 2(0) + 3$$
$$y = 3$$

no x-intercept
 $\Rightarrow$
 $y = 0 \Rightarrow$

$$y = 0 \dots$$

$$y = 3$$



$$D = b^2 - 4ac$$

$$= (-2)^2 - 4(1)(3)$$

$$= 4 - 12$$

$$= -8 < 0$$

لا يوجد حل حقيقي

$$y = 0 \Rightarrow$$

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

لا يوجد حل x

لأن المميز سالب

$D < 0$

Discriminate

Δ

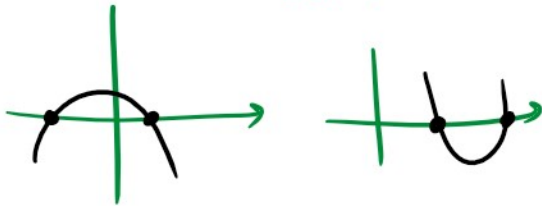
Discriminant

$$\Delta > 0$$

حين

2 x-intercepts

يتقاطع محور x



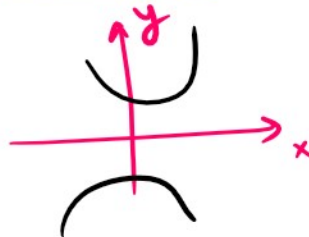
$$\Delta < 0$$

لا يوجد

حل حقيقي

no x-intercept

لا يتقاطع



$$\Delta = 0$$

حل واحد فقط

يسس ولا يتقاطع



Exp

$$f(x) = 4x - 2x^2 - 4$$

re-arrange $f(x)$

$$f(x) = -2x^2 + 4x - 4$$

① sketch $f(x)$

- opens up, **Down**

- vertex = $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$
 $= \left(-\frac{4}{2(-2)}, f\left(\frac{-4}{2(-2)}\right)\right)$
 $= (1, f(1))$
 $= (1, -2)$

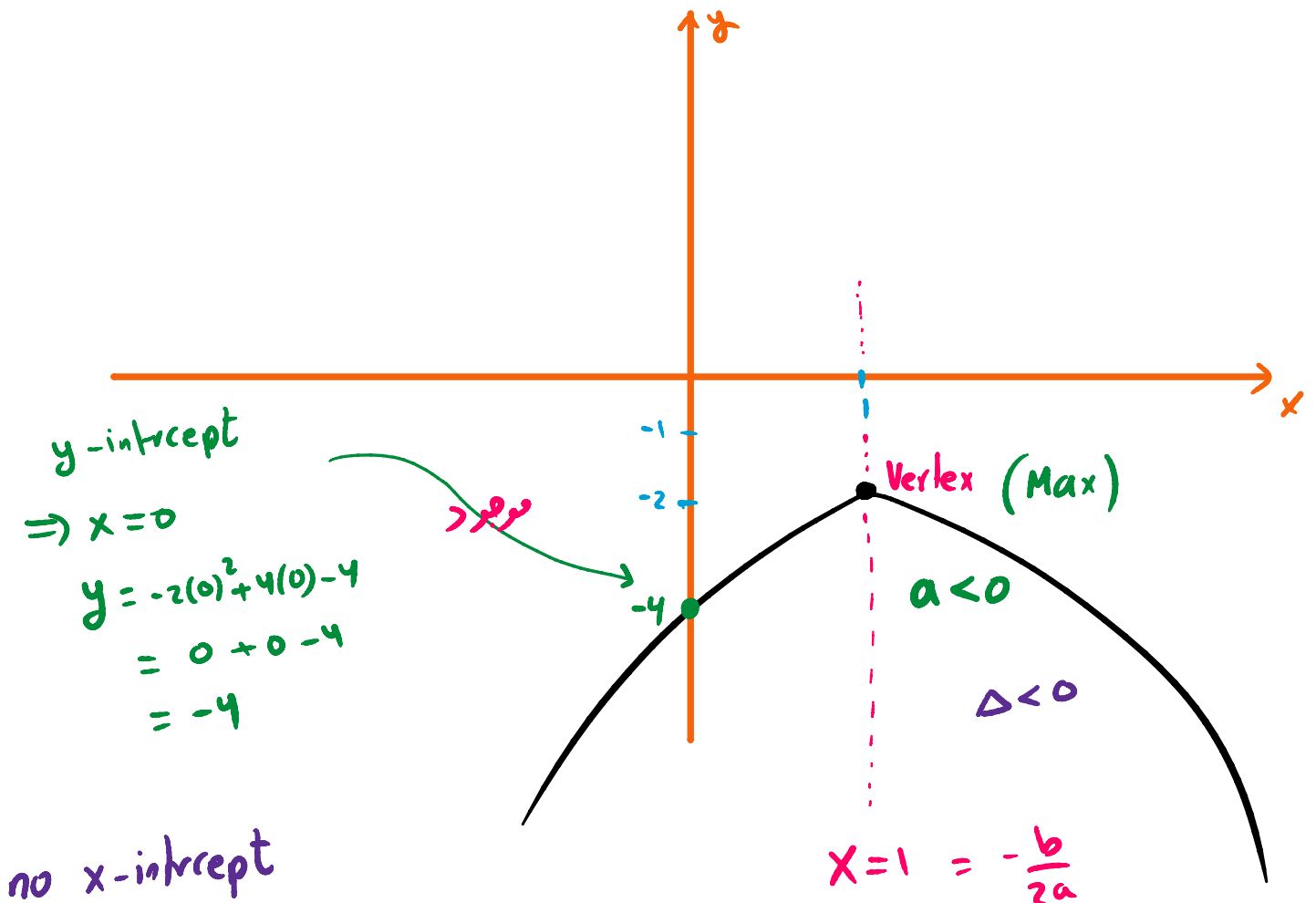
$$f(x) = -2x^2 + 4x - 4$$

$$a = -2$$

opens down

$$b = 4, c = -4$$

$$\begin{aligned} f(1) &= -2(1)^2 + 4(1) - 4 \\ &= -2(1) + 4 - 4 \\ &= -2 + 0 \\ &= -2 \end{aligned}$$



no x-intercept
since $D < 0$

$$x = 1 = -\frac{b}{2a}$$

AS

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

$$D = b^2 - 4ac$$

$$= (4)^2 - 4(-2)(-4)$$

$$= 16 - 32$$

$$= -16 < 0$$

سالب
لا يوجد حل حقيقي

Exp

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

quadratic
Equation

① Find Discriminant

التمييز

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

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

$$a = -1, b = 2, c = 8$$

$$\begin{aligned} D &= b^2 - 4ac = (2)^2 - 4(-1)(8) \\ &= 4 + 32 \\ &= 36 \end{aligned}$$

موجب + إشارة
موجب + إشارة

② Find x-intercept

$$\rightarrow y = 0$$

$$\Rightarrow y = -x^2 + 2x + 8$$

$$\hookrightarrow y=0 \Rightarrow y = -x^2 + 2x + 8$$

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

$a = -1 \quad b = 2 \quad c = 8$

$$\hookrightarrow \Delta = 36 > 0$$

یوجد حلین (2 x-intercept)

$$x = \frac{-b \pm \sqrt{\Delta}}{2a} = \frac{-(2) \pm \sqrt{36}}{2(-1)}$$

$$= \frac{-2 \pm 6}{-2}$$

$$x_1 = \frac{-2 + 6}{-2} = \frac{4}{-2} = -2$$

$$x_2 = \frac{-2 - 6}{-2} = \frac{-8}{-2} = +4$$

(3) Find y-intercept

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

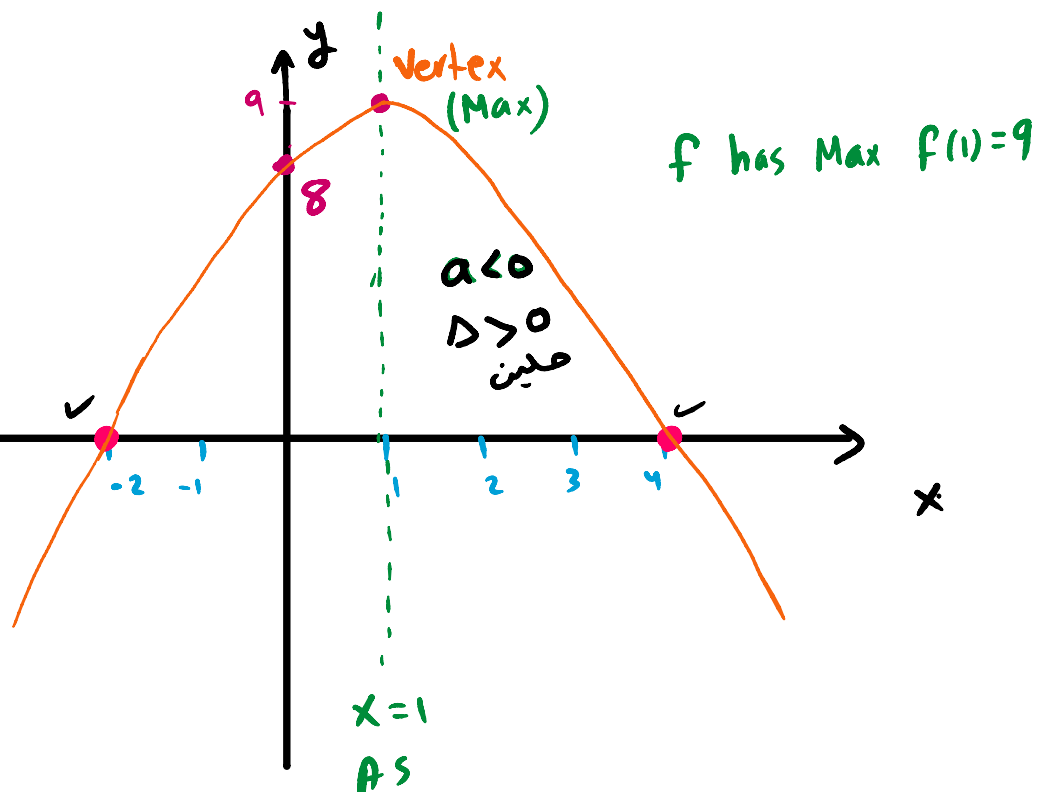
$$x=0 \Rightarrow y=8$$

(4)

open
Up/Down

$$a = -1 < 0$$

Down



⑤ Vertex / As

$$x = \frac{-b}{2a} = \frac{-2}{2(-1)} = \frac{-2}{-2} = 1$$

$$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right) \right) = (1, f(1)) = (1, 9)$$

$$f(x) = -x^2 + 2x + 8$$

$$f(1) = -(1)^2 + 2(1) + 8$$

$$= -1 + 2 + 8$$

$$= 9$$

Exp Find Eq. of line whose slope -2 ساب
and x-intercept 3

$$y - y_0 = m(x - x_0)$$

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

$$y = -2x + 6$$

