8.4 Vertex Form

Graph the following. $y = a(x-h)^2 + K$ Vertex: (h, k)

a   opp.   same

1) $y = 2(x-2)^2 - 6$

Vertex: $(2,-6)$ A.O.S: $X=2$ y-int: $(0, 2)$

$2(0-2)^2 - 6 = 8-6 = 2$

$\uparrow$
x

Domain: $\{x \mid x \in R\}$ Range: $\{y \mid y \geq -6\}$

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

Vertex: $(-4, 3)$ A.O.S: $X=-4$ y-int: $(0,-13)$

$-(0+4)^2 + 3 = -16 + 3 = -13$

Domain: $\{x \mid x \in R\}$ Range: $\{y \mid y \leq 3\}$
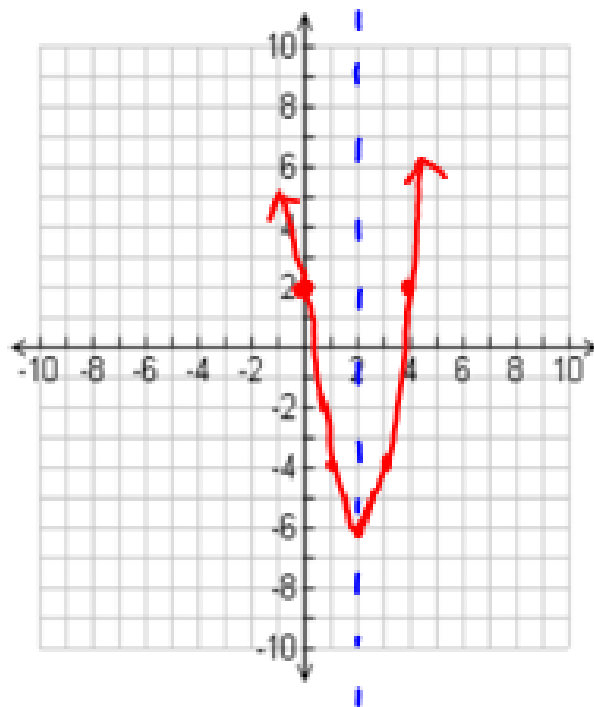
Table

x	y
3	$2(3-2)^2 - 6 = -4$
4	$2(4-2)^2 - 6 = 2$
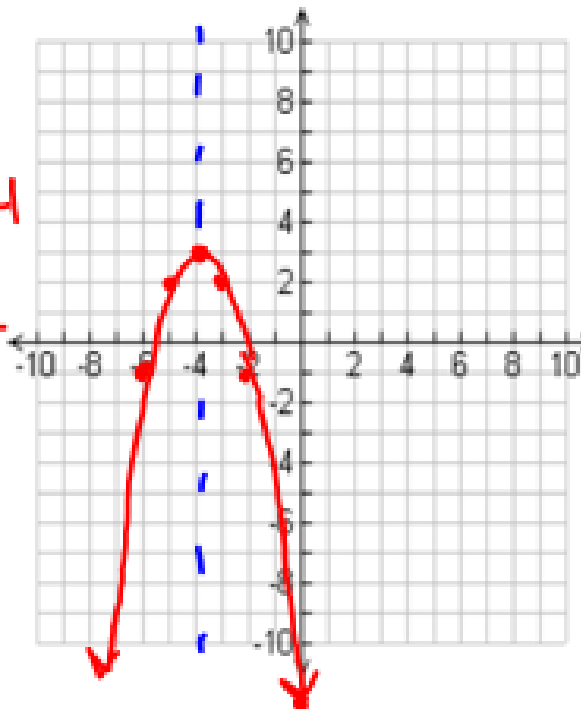
Table

x	y
-3	2
-2	-1

3) Write $f(x) = 4(x-1)^2 + 9$ in standard form. * Never distribute

multiply out & combine term the square !!

$$= 4(x-1)(x-1) + 9 \qquad \text{Foil the } (\quad)(\quad)$$

$$= 4(x^2 - x - x + 1) + 9 \qquad \text{Distribute the 4}$$

& combine like

terms.

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

$$f(x) = 4x^2 - 8x + 13$$

Try) Write $f(x) = -(x-2)^2 + 7$ in standard form.

$$= -(x-2)(x-2) + 7$$

$$= -(x^2 - 2x - 2x + 4) + 7$$

$$= -x^2 + 2x + 2x - 4 + 7$$

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

Write in vertex form

4) $y = 4x^2 - 8x + 13$

$$y = a(x - h)^2 + K$$

$$\boxed{y = 4(x - 1)^2 + 9}$$

Find the vertex:

$$a = 4 \quad b = -8$$

$$x = \frac{-b}{2a} = \frac{8}{2(4)} = 1 \rightarrow h$$

$$y = 4(1)^2 - 8(1) + 13$$

$$= 4 - 8 + 13$$

$$= -4 + 13$$

$$= 9 \rightarrow K$$

Write in vertex form

Try) $y = -4x^2 - 8x + 12$

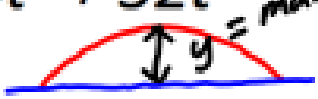$$y = a(x - h)^2 + k$$

$$\boxed{y = -4(x+1)^2 + 16}$$

Find the vertex:

$a = -4 \qquad b = -8$

$$x = \frac{-b}{2a} = \frac{8}{2(-4)} = -1 \rightarrow h$$

$$y = -4(-1)^2 - 8(-1) + 12$$

$$= 16 \rightarrow k$$

5) The height in feet of a dolphin as it jumps out of water at an aquarium can be modeled by the function $f(t) = -16t^2 + 32t$ where $\underline{t}$ is the time in seconds after it exits the water. ⌐max height
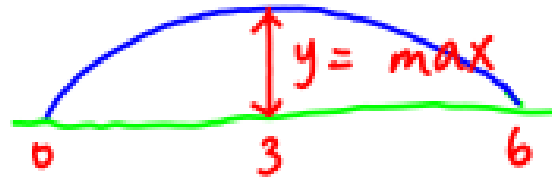
a) Find the dolphin's maximum height (y value of vertex)

$$y = -16(1)^2 + 32(1)$$

the max. height is 16 feet.

$$= -16 + 32 = 16 \; ;$$

b) Find the time it takes to reach maximum height (x value)

$$x = \frac{-b}{2a} = \frac{-32}{2(-16)} = \frac{-32}{-32} = 1 \; ; \text{ it take 1 second to}$$

reach the max height.

6) Golf ball $f(x) = -16x^2 + 96x$

$y = max$
0   3   6

a) maximum height:
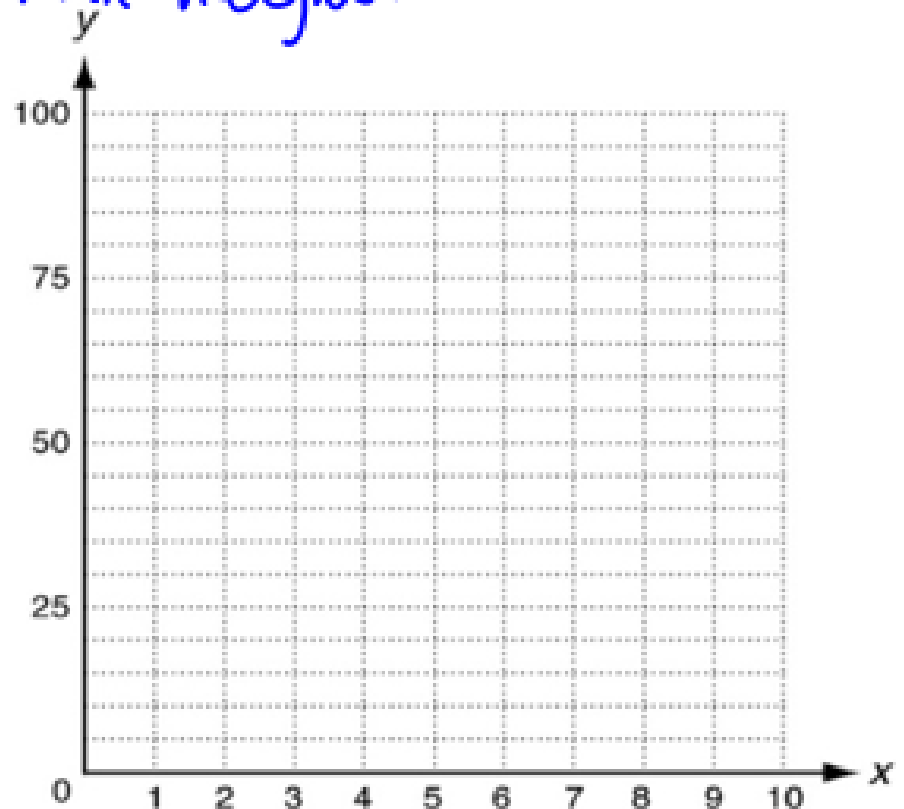
$y = -16(3)^2 + 96(3) = -16(9) + 288 = -144 + 288 = 144$

The max. height is 144 feet.

b) how long to reach height:

$x = \dfrac{-b}{2a} = \dfrac{-96}{2(-16)} = \dfrac{-96}{-32} = 3$; it takes 3 second to reach the max height.

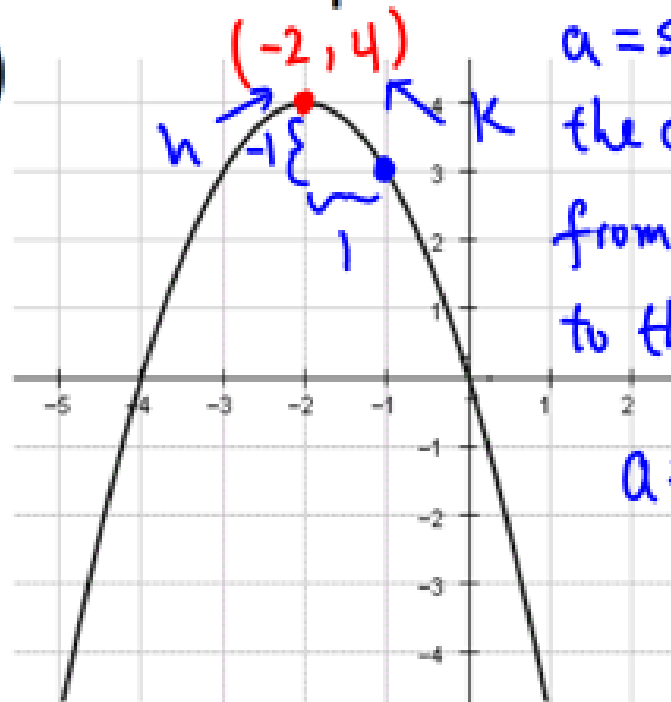c) total time in the air:

Total of 6 second in the air.

Write the equation in both forms.

7)

$(-2, 4)$

h $-1\{$

$a =$ slope of the closest pt from the vertex to the right

$a = -1$

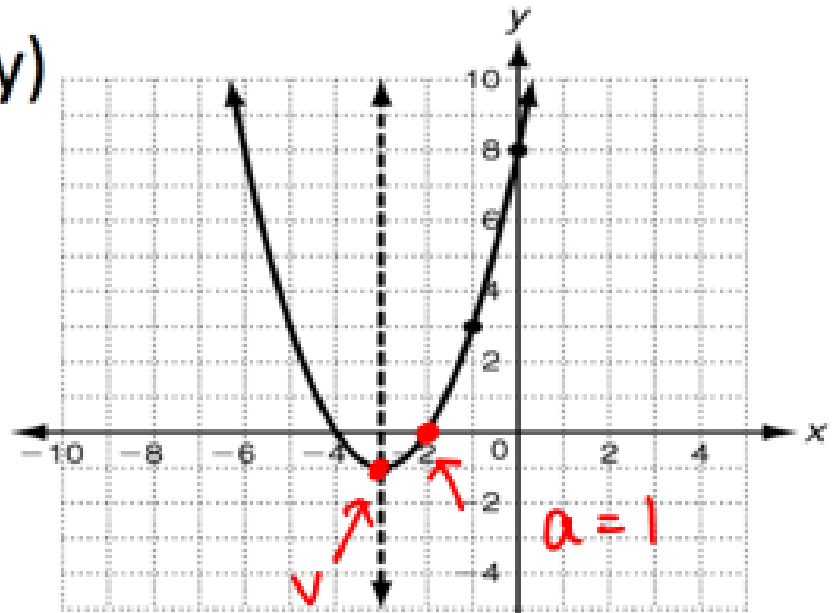Vertex Form: $y = a(x-h)^2 + K$

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

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

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

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

Standard Form: $y = -x^2 - 4x$

Try)

$a = 1$

$$y = (x+3)^2 - 1$$

$y = (x+3)(x+3) - 1$

$= x^2 + 3x + 3x + 9 - 1$

$$y = x^2 + 6x + 8$$