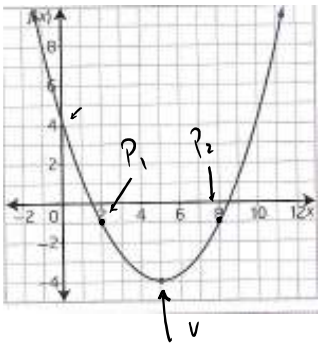
## DETERMINE A QUADRATIC FUNCTION IN VERTEX FORM GIVEN ITS GRAPH

**EX. 2** Determine a quadratic function in vertex form for each graph.

a)




P, Q

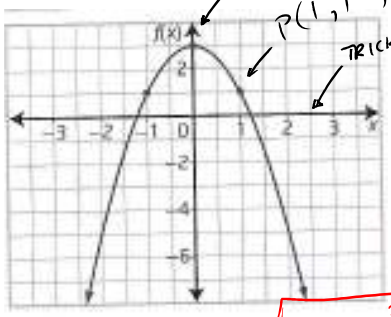
$V(5,-4)$

$P_1(2,-1)$

$P_2(8,-1)$

$y = \frac{1}{3}(x-5)^2 - 4$

b)




$y = -2x^2 + 3$

**METHOD 1: Using Substitution with the Vertex and a Point.**

a) $y = a(x-p)^2 + q$

$y = a(x-5)^2 + (-4)$

To Find "a" sub in a point for x, y $P_1$

$-1 = a(2-5)^2 - 4$

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

$-1 = 9a - 4$

$3 = 9a$

a) $\frac{1}{3} = a$

b) $y = a(x-p)^2 + q$

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

$y = a(x)^2 + 3$

$y = ax^2 + 3$

$1 = a\,1^2 + 3$

$1 = a + 3$

$-2 = a$

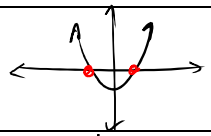
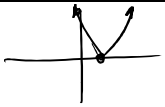
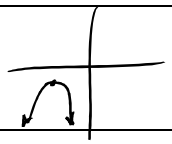
**METHOD 2: Compare With Graph $y = x^2$**

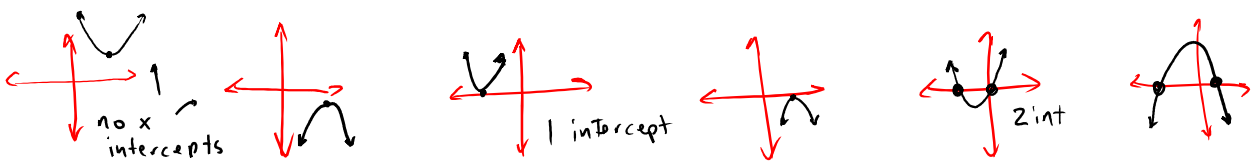
b)

| See Example 2 & Your Turn 151-153 | p. |
|---|---|

## DETERMINE THE NUMBER OF X-INTERCEPTS USING "a" and "q"

**EX. 3** Determine the number of x-intercepts for each quadratic function

| | Value of "a" | Value of "q" | Visualize Graph | Number of x-intercepts |
|---|---|---|---|---|
| a) $y = 0.8x^2 - 3$ | + opens up | -3 V below the x axis |  | 2 |
| b) $y = 2(x-1)^2$ | 2 | 0 |  | 1 |
| c) $y = -3(x+2)^2 - 1$ | -3 | -1 |  | 0 |

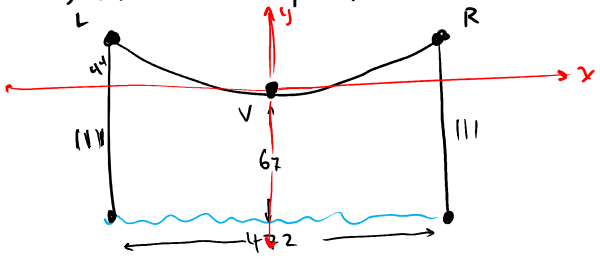


## MODEL PROBLEMS USING QUADRATIC FUNCTIONS IN VERTEX FORM

**EX. 4** The deck of the Lions' Gate Bridge in Vancouver is suspended from two main cables attached to the tops of two supporting towers. Between the towers, the main cables take the shape of a parabola as they support the weight of the deck. The towers are 111 m tall relative to the waters surface and are 472 m apart. The lowest point of the cables is approximately 67 m above the water's surface.

Where should you label the origin

a) Model the shape of the cables with a quadratic function in vertex form.




$V(0,0)$

$L\ (-236, 44)$

$R\ (236, 44)$

$y = a(x-p)^2 + q$

$y = a(x-0)^2 + 0$

$y = ax^2$

$44 = a(-236)^2$

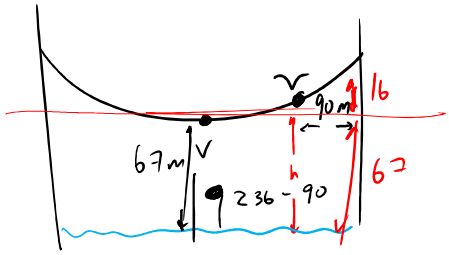
$\frac{44}{(-236)^2} = a$

$\frac{44}{55696} = a$

$\frac{11}{13924} = a$

$y = \frac{11}{13924}x^2$

b) Determine the height above the surface of the water of a point on the cables that is 90 m horizontally from one of the towers.




$y = \frac{11}{13924}x^2$

$y = \frac{11}{13924}(146)^2$

$y = 16.8\text{ m}$

$16.8 + 67 = 0$