

### Kayak vs. Waterfalls

Carlos traveled to a small town in Argentina to find many rivers and hidden waterfalls. Since Carlos loves to kayak, he decided to take an enormous risk and kayak over waterfalls on the west coast of Argentina. His scary descent over Cascada Bonita falls can be modeled by the function

$h(x) = -16(x^2 - x - 6)$ . His vertical height,  $h(x)$ , is in feet and his horizontal length,  $x$ , is also in feet.

#### SHOW YOUR WORK!

1) Find the following critical points.

a) Y-intercept of  $h(x)$ : ( 0 , 96 )

i. Find the y-intercept.

$$h(0) = -16(0 - 0 - 6)$$

$$h(0) = -16(-6) = 96 \text{ feet}$$

ii. What is the real-life meaning of the y-intercept? Why would this be important to Carlos to know? ~~The height from where his kayak drops over the cliff.~~  
 The height from where his kayak drops over the cliff.

~~iii. Verify this point using your equation.~~

b) x-intercept of  $h(x)$ : ( 3 , ) and ( -2 , )

i. Find the x-intercepts and show your work using factoring.

$$\frac{0}{-16} = \frac{-16(x^2 - x - 6)}{-16}$$

$$0 = x^2 - x - 6$$

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

$$x = 3 \text{ feet from cliff}$$

$$x = -2 \text{ feet from cliff}$$

ii. Which x-intercept would the most be important for Carlos to know? What is the meaning of this x-intercept? 3 feet from the cliff. He needs to know that he won't hit a rock or part of the cliff as he falls with the waterfall.

iv. Verify this point using your equation.

$$h(3) = -16[(3)^2 - 3 - 6]$$

$$h(3) = -16(9 - 9)$$

$$h(3) = -16(0) = 0 \text{ feet high (Hit the water)}$$

c) vertex of  $h(x)$ :  $(0.5, 100)$

$$\frac{r_1 + r_2}{2} = \text{x-coordinate of vertex.}$$

i. Find the vertex and show your work using the x-intercepts.

$$\frac{3 + (-2)}{2} = 0.5 \text{ feet} \quad \left| \quad \begin{aligned} h(0.5) &= -16(.5^2 - .5 - 6) \\ h(0.5) &= -16(.25 - .5 - 6) \\ h(0.5) &= -16(-6.25) = 100 \text{ feet high} \end{aligned} \right.$$

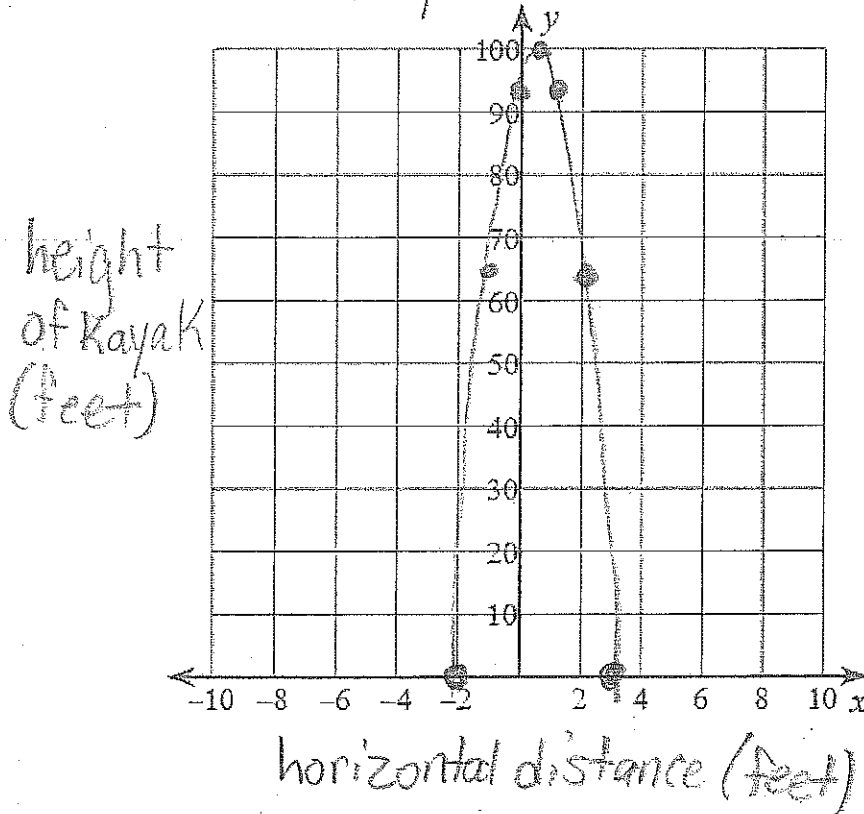
ii. What is the real-life meaning of the vertex?

The highest in the air that the kayak will be, and how far it is from the cliff at that height.

~~iii. Verify this point using your equation.~~

2) Use the critical points to draw a graph of the real-life situation. Remember to label axes!

Kayak over waterfalls



horizontal (feet)	height (feet)
x	y
-2	0
-1	64
0	96
.5	100
1	96
2	64
3	0

4) A shark is 20 feet from the cliff. Is Carlos safe from being eaten by the shark? What additional factors should be considered in this real-life situation?

Carlos hits the water 3 feet from the cliff. He is 17 feet from the shark! He better row fast or he will be caught by the shark!