lulumath

Finding an Equation of a Real-Life Quadratic Relation #2

Video Notes

Video Link

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Background Information:

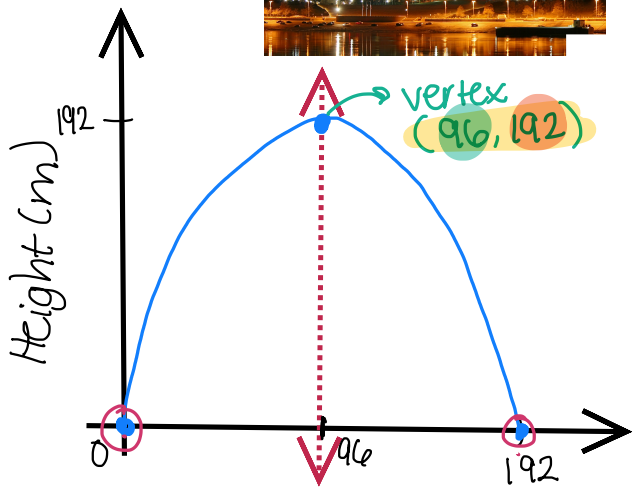
- Finding equations of quadratic relations in vertex or in factored form
  - Use vertex form if given the vertex and another point.
  - Use factored form if given the roots and another point.

The St. Louis Arch is 192 m wide and 192 m tall. Find an equation to represent the height, y, and the width, x, of the arch, in meters.

Define variables

Let width (m) = x = (ind)

Let height (m) = y = (dep)



Factored Form:

$y = a(x-r)(x-s)$

r and s are roots

Roots: $\{0, 192\}$

$y = a(x-0)(x-192)$

$y = ax(x-192)$

Substitute a point to solve for a.

$192 = a(96)(96-192)$

$\frac{192}{96} = a\frac{(96)}{96}(-96)$

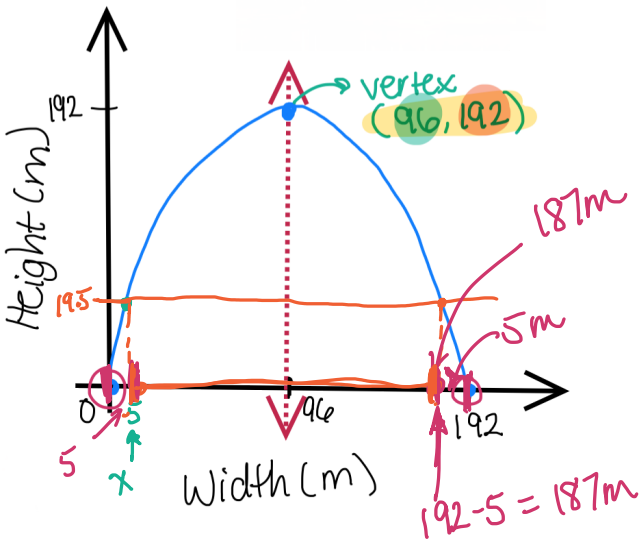
$2 = -96a$

$\frac{2}{-96} = a$

$a = \frac{2}{-96} \div \frac{2}{2} = -\frac{1}{48}$

$$y = -\frac{1}{48}x(x-192)$$

Cameron was five meters from the base of one side of the arch and looked up. How high above the ground was the arch?



$$y = -\frac{1}{48}x(x - 192)$$

$$y = -\frac{1}{48}(5)(5 - 192)$$

$$y = -\frac{1}{48}(5)(-187)$$

$$y = \frac{935}{48}$$

$$y \doteq 19.5 \text{ m}$$

∴ The arch was 19.5 m above the ground when Cameron was 5 m from the base of one side of the arch.

How much farther does Cameron need to walk for the arch to be the same height above the ground as when he was five meters from the base?

$$187 - 5 = 182 \text{ m}$$

∴ Cameron needs to walk an additional 182m to reach the same height on the other side of the arch.