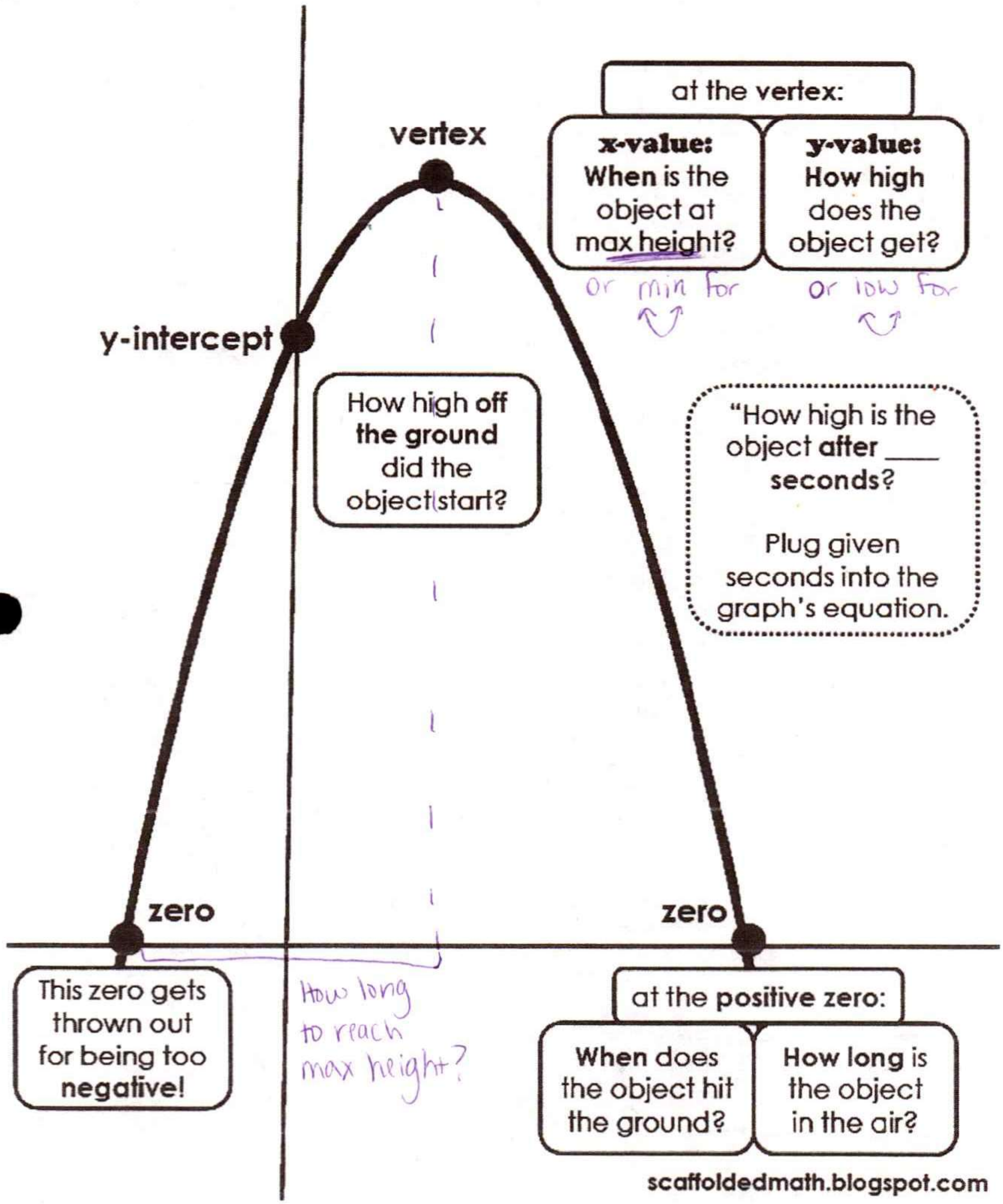
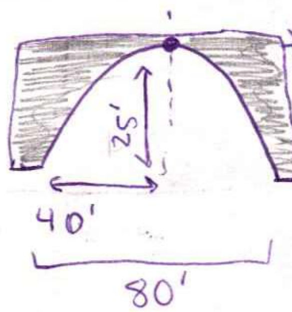
# Quadratic Keywords



# Day 11 – Applications of the Vertex

| Words that Indicate Finding Vertex | Quadratic Equations | |
|---|---|---|
| • Minimum/Maximum | Standard Form: $y = ax^2 + bx + c$ | y-int: (0, c) |
| • Minimize/Maximize | Vertex Form: $y = a(x-h)^2 + k$ | vertex: (h, k) |
| • Least/Greatest | Factored Form: $y = a(x-p)(x-q)$ | x-int: (p, 0) & (q, 0) |
| • Smallest/Largest | Vertex: $\left(\underbrace{\frac{-b}{2a}}_{x}, \underbrace{f\left(\frac{-b}{2a}\right)}_{y}\right)$ | |

1. *The arch of a bridge forms a parabola modeled by the function $y = -0.2(x-40)^2 + 25$, where x is the horizontal distance (in feet) from the arch's left end and y is the corresponding vertical distance (in feet) from the base of the arch. How tall is the arch?*




*need to find the vertex*

$y = -0.2(x-40)^2 + 25$

$h = 40 \quad k = 25$

V: (40, 25)

↑ height

$\boxed{\text{25 Feet high}}$

2. *Suppose the flight of a launched bottle rocket can be modeled by the equation $y = -x^2 + 6x$, where y measures the rocket's height above the ground in meters and x represents the rocket's horizontal distance in meters from the launching spot at $x = 0$.*

a. How far has the bottle rocket traveled horizontally when it reaches it maximum height? What is the maximum height the bottle rocket reaches?

*need vertex*

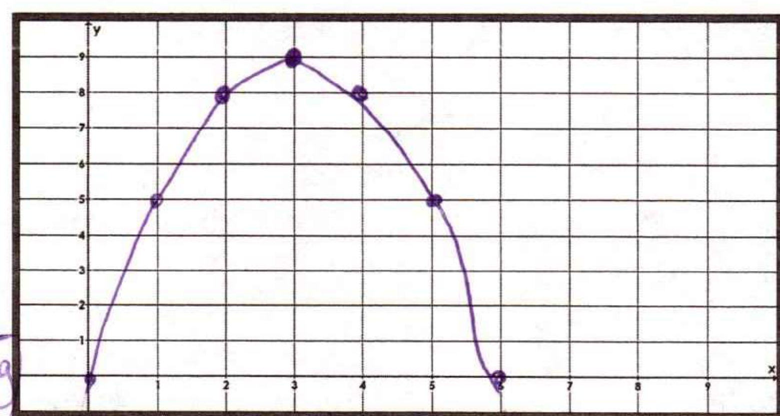
$y = -x^2 + 6x$

$a = -1 \quad x = \frac{-6}{2(-1)} \rightarrow 3$

$b = 6$

$y = -(3)^2 + 6(3) \rightarrow 9$

V: (3, 9)




$\boxed{\text{Traveled 3 meters before reaching max height of 9 meters.}}$

b. How far does the bottle rocket travel in the horizontal direction from launch to landing?

*look for zeros or x-int*

Graph - look for x-int.

Went from 0 to 6

$\boxed{\text{6 meters}}$

equation - factor & solve

$-x^2 + 6x \rightarrow -x \boxed{-x^2 \mid 6x}$

$x \quad -6$

$-x(x-6)$

$-x = 0 \quad x - 6 = 0$

$x = 0$ & $6$

$\boxed{\text{6 meters}}$

3. *A frog is about to hop from the bank of a creek. The path of the jump can be modeled by the equation $h(x) = -x^2 + 4x + 1$, where $h(x)$ is the frog's height above the water and x is the number of seconds since the frog jumped. A fly is cruising at a height of 5 feet above the water. Is it possible for the frog to catch the fly, given the equation of the frog's jump?*

*is the max height (vertex) at least 5 feet*

$-x^2+4x+1$

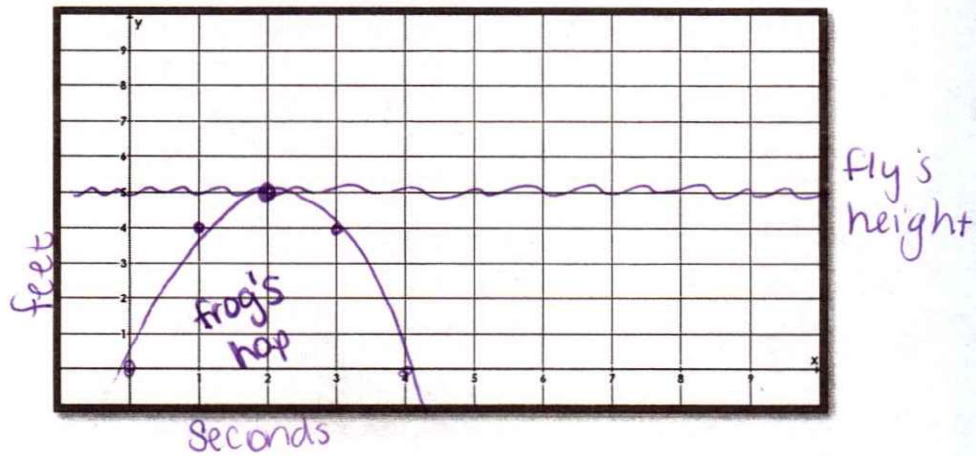
$a=-1$ $\quad x=\frac{-4}{2(-1)} \rightarrow 2$

$b=4$

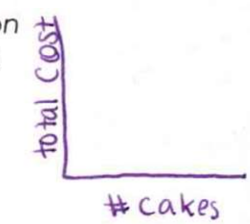
$c=1$ $\quad -(2)^2+4(2)+1 \rightarrow 5$

V: (2, 5) ← height of frog

$\boxed{\text{Yes the frog can catch the fly}}$




4. *A baker has modeled the monthly operating costs for making wedding cakes by the function $y = 0.5x^2 - 12x + 150$, where y is the total costs in dollars and x is the number of cakes prepared.*




a. How many cakes should be prepared each month to yield the minimum operating cost?

*minimum → vertex

$y=0.5x^2-12x+150$ $\qquad 0.5(12)^2-12(12)+150 \rightarrow \$78$

$a=0.5$

$b=-12$ $\quad x=\frac{12}{2(.5)} \rightarrow 12$ $\qquad (12, 78)$ $\qquad \boxed{\text{12 cakes for \$78}}$

$c=150$

b. What is the minimum monthly operating cost?

*y-value of min

$\boxed{\$78}$

*5. A street vendor sells about 20 shirts a day when she charges $8 per shirt. If she decreases the price by $1, she sells about 10 more shirts each day.*

a. How many shirts does she have to sell to maximize her revenue? What is her maximum revenue?

| Price | Number of Shirts Sold | Revenue |
|---|---|---|
| | | |
| $8 | 20 | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

b. How much more will she make a day?

Skip

c. Write a quadratic function that models the scenario.

*6. You run a canoe rental business on a small river in Georgia. You currently charge $12 per hour canoe and average 36 rentals a day. An industry journal says that for every fifty cent increase in rental price, the average business can expect to lose two rentals a day.*

a. Use this information to attempt to maximize your income. What should you charge?

| Price | Number of Rentals | Revenue |
|---|---|---|
| | | |
| | | |
| $12 | 36 | |
| | | |
| | | |
| | | |
| | | |
| | | |

b. Write a quadratic function that models the scenario.