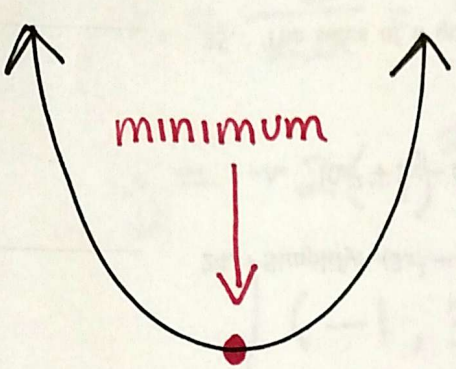
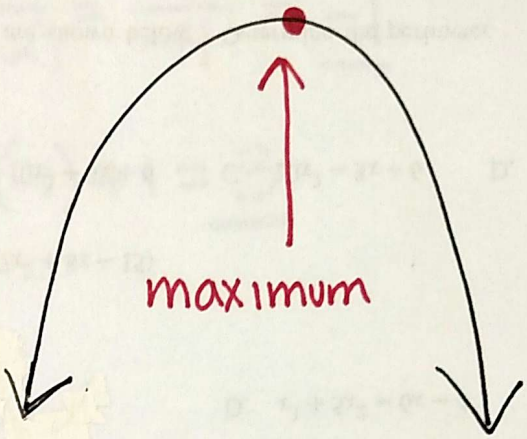
October 5

Vertex of a Parabola



"a" value is positive



"a" value is negative

$$y = ax^2 + bx + c$$

Ex1 Find the vertex of $y = x^2 + 4x + 8$

minimum

step1: Identify a, b, and c. a: 1 b: 4 c: 8

step2: Find x by using the formula $x = \frac{-b}{2a}$ $x = \frac{-(4)}{2(1)} = \frac{-4}{2} = -2$

step3: Find y by substituting x back into original equation $y = (-2)^2 + 4(-2) + 8 = 4$

step4: Write x and y as a point!

$(-2, 4)$

Ex 2 Find the vertex of $y = -2x^2 - 4x + 1$

maximum

a: -2 b: -4 c: 1

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

$$y = -2(-1)^2 - 4(-1) + 1 = 3$$

$$(-1, 3)$$

GUIDED NOTES: Modeling With Quadratic Equations

EX1. An arrow shot into the air is modeled by the equation $y = 112t - 16t^2$ feet above the ground t seconds after it is released. What period of time is the arrow above 96 feet?

$96 = 112t - 16t^2$

$96 = -16t^2 + 112t$

$-96 \quad\quad -96$

$-1 \cdot (0 = -16t^2 + 112t - 96)$

$0 = 16t^2 - 112t + 96$

a: 16 b: -112 c: 96

$t = \dfrac{-(-112) \pm \sqrt{(-112)^2 - 4(16)(96)}}{2(16)}$

$t = \dfrac{112 \pm \sqrt{6400}}{32}$

$t = 6, 1$

between 1 and 6 seconds

EX2. As a bird flies upward, it drops a berry. The equation $h = -16t^2 + 8t + 800$ describes the height, h, of the berry in feet t seconds after it is dropped. Ignoring air resistance, how long does it take the berry to hit the ground? $h = 0$

$-1 \cdot (0 = -16t^2 + 8t + 800)$

$0 = 16t^2 - 8t - 800$

a: 16 b: -8 c: -800

$t = \dfrac{-(-8) \pm \sqrt{(-8)^2 - 4(16)(-800)}}{2(16)}$

$t = \dfrac{8 \pm \sqrt{51,264}}{32}$

$t = 7.33, \cancel{-6.83}$ can't have negative time

7.33 seconds

EX3. A rock is thrown skyward from the top of a tall building. The distance, in feet, between the rock and the ground t seconds after the rock is thrown is given by $d = -16t^2 - 2t + 985$. How long after the rock is thrown is it 490 feet from the ground?

d

$490 = -16t^2 - 2t + 985$

$-490 \quad\quad -490$

$-1 \cdot (0 = -16t^2 - 2t + 495)$

$0 = 16t^2 + 2t - 495$

a: 16 b: 2 c: -495

$t = \dfrac{-(2) \pm \sqrt{(2)^2 - 4(16)(-495)}}{2(16)}$

$t = \dfrac{-2 \pm \sqrt{31684}}{32}$

$t = 5.5, \cancel{-5.63}$

5.5 seconds