4.3 Modeling with Quadratic Functions

Learning Targets for today

- To be able to model data with quadratic functions.
- To be able to calculate the rate of change over different time intervals.

Vocabulary

Standard Form of a Quadratic Formula – $y = ax^2 + bx + c$

Ex: $y = 4x^2$ / $y = x^2 + 9$ / $y = x^2 - x - 2$

Parabola – U-shaped curved line.

Axis of Symmetry - The fold or line that divides the parabola into two matching halves.

Vertex of a Parabola – The highest and lowest piont of a parabola, depending on whether the parabola opens up or down.

Parabola opens up → $y = ax^2 + bx + c$ (a is positive)
Vertex is lowest point!

Parabola opens down → $y = -ax^2 + bx + c$ (a is negative)
Vertex is highest point!

Writing an Equation of a Parabola

Example for you…	**Your turn to try…**
A parabola contain the following points. What is the equation of the parabola in standard form? $y=ax^2+bx+c$ $a=?$ $b=?$ $c=?$	A parabola contain the following points. What is the equation of the parabola in standard form?
1. $(0, 0), (-1, -2), (1, 6)$	1. $(0, 0), (1, -2), (-1, -4)$
$0=a(0)^2+b(0)+c$ $0=c$ ✓ $-2=a(-1)^2+b(-1)+0$ $-2=a-b$ $6=a(1)^2+b(1)+0$ $6=a+b$ $-2=a-b$ $6=a+b$ $4=2a$ $\frac{4}{2}=\frac{2a}{2}$ $2=a$ ✓ $6=2+b$ $-2\ \ -2$ $4=b$ ✓ $y=2x^2+4x$	$0=a(0)^2+b(0)+c$ $0=c$ ✓ $-2=a(1)^2+b(1)+0$ $-2=a+b$ $-4=a(-1)^2+b(-1)+0$ $-4=a-b$ $-2=a+b$ $-4=a-b$ $-6=2a$ $\frac{-6}{2}=\frac{2a}{2}$ $-3=a$ ✓ $-2=-3+b$ $+3\ \ +3$ $1=b$ ✓ $y=-3x^2+b$

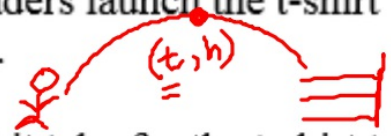
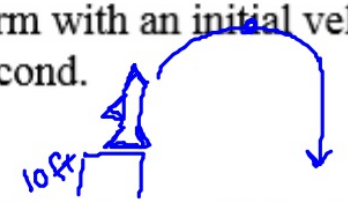
Using the Vertical Motion Model $h = -16t^2 + vt + c$

"a" "b"

$$h = -16t^2 + vt + c$$

h = *final height* ***v*** = *velocity* ***c*** = *starting height* ***t*** = *time*

"x"

Example for you…	Your turn to try…
1. At a basketball game cheerleaders launch a t-shirt into the stand at an initial velocity of 72 ft/s. The cheerleaders launch the t-shirt from 5 feet in the air. 	1. You launch a model rocket from a 10 foot platform with an initial velocity of 95 feet per second. 
a. How long will it take for the t-shirt to reach its maximum height? $t = \frac{-b}{2a}$ $h = -16t^2 + 72t + 5$ $t = \frac{-(72)}{2(-16)} = \frac{-72}{-32} = 2.25$ sec.	a. How long will it take for the rocket to reach its maximum height? $h = -16t^2 + 95t + 10$ $t = \frac{-b}{2a} = \frac{-(95)}{2(-16)} = \frac{-95}{-32} = 2.9 \approx 3$ sec.
b. What is the maximum height? $h = -16(2.25)^2 + 72(2.25) + 5$ $h = 86$ ft.	b. What is the maximum height? $h = -16(3)^2 + 95(3) + 10$ $h = 151$ ft.