Warm Up

6/10

Quadratic or not?

x	y
2	20
3	18
4	14
5	8
6	0

−2 −2
−4 −2
−6 −2
−8

yes

x	y
2	15
3	20
4	30
5	20
6	15

+5 +5
+10 −20
−10 +5
−5

no

How about recognizing with an equation?

$y = (3-x)(x^2+2)$

$= 3x^2+6-x^3-2x$

$= -x^3+3x^2-2x+6$

Not Quadratic

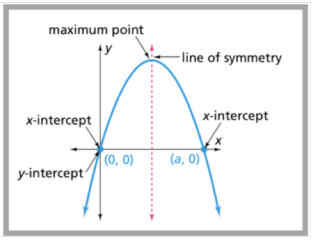
Expand before deciding if it's quadratic or not.

Using Key Features to Answer Questions

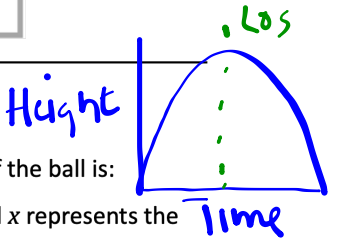
Quadratic relationships model many real-life situations. We can use the **Key Features** of the parabola to answer all sorts of questions about the situation.

Key Features:

- y-intercept
- first x-intercept
- second x-intercept
- line of symmetry
- vertex (max/min)



Problem 1



Steph is practicing golf at the driving range. The equation that models the height of the ball is: $y = -0.5x^2 + 12x$ where y represents the height of the ball measured in feet, and x represents the time in seconds.

Graph the equation above in Desmos, and answer the following questions, indicating which Key Feature gave you the answer.

Question	Key Feature	Answer
1. How long will it take for the golf ball to hit the ground?		
2. What is the highest point the golf ball reached?		
3. How long did it take the golf ball to reach its highest point?		

Other questions you can answer using the graph (move the cursor along the parabola to find point coordinates):

4. If the ball is 31.5 feet in the air, how many seconds have gone by? Is there only one answer?

5. How high will the ball be after 1 second?

6. How long was the golf ball above 40 feet?

Problem 2

Eric is sitting at the top of a cliff above the ocean's surface. He is waiting for his friends to climb up and meet him. As he waits, he decides to start casually tossing pebbles off the side of the cliff. The equation that represents the height of his pebble $y = -x^2 + 5x + 500$ where *y* represents the height of the pebble measured in feet, and *x* represents the time in seconds.

Graph the equation above in Desmos, and answer the following questions, indicating which Key Feature gave you the answer.

Question	Key Feature	Answer
1. How high above the ocean's surface does Eric toss the pebble from?		
2. How long before the pebble hits the surface of the ocean?		
3. How long after the pebble is tossed does it reach its highest point?		
4. What is the highest point that the pebble reaches?		

Other questions you can answer using the graph (move the cursor along the parabola to find point coordinates):

5. How high is the pebble after 1 second?

6. How long is the pebble higher that Eric?

7. How long after the pebble is tossed is it 200 feet above the surface of the ocean?

Without using Desmos, calculate the key features you will need to find answers to the following problems

Problem 3

A toy rocket is launched vertically upward. It's height in feet (h) after t seconds is given by the equation $h = -16t^2 + 128t$. Show all work below.

a. How long will it take for the rocket to return to the ground?
b. How high off the ground is the launch pad?
c. How long will it take the rocket to hit its maximum height?
d. What is the maximum height the rocket will reach?
e. How high was the rocket after 2 seconds?

2nd x int
y-int
LOS
y-value of vertex, sub in LOS

x: time in sec
y: height in ft

$y: -16x^2 + 128x + 0$

$h = -16t^2 + 128t$ → factored form

$0 = -16t(t-8)$

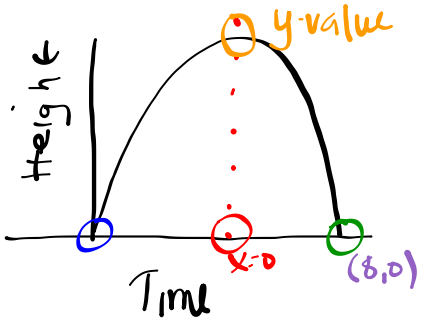
$\frac{-16t = 0}{-16 \quad -16}$

$t = 0$

$t - 8 = 0$

$+8 \quad +8$

$t = 8$



- started at height = 0 on the ground
- time when rocket landed
- how long it takes to reach maximum height
- maximum height

How long to get to max height?

$\frac{0+8}{2} = 4$ x=4 is LOS

4 sec

Problem 4

Peter jumped off of a cliff into the ocean in Acapulco while vacationing with some friends. His height as a function of time could be modeled by the function $h = -16t^2 + 16t + 480$ where t is the time in seconds and h is the height in feet. Show all work below.

$h = -16(t^2 - t - 30)$

a. How high above the water is Peter before he jumps?

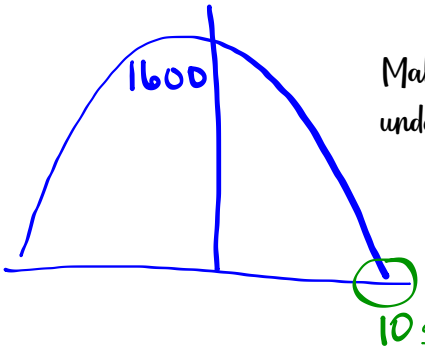
b. How long did it take for Peter to reach his maximum height?

c. What was the highest point that Peter reached?

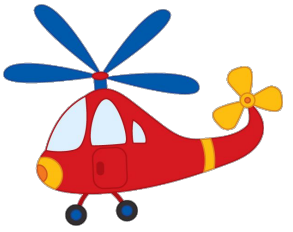
d. Peter hit the water after how many seconds?

e. How far above the water was Peter after 3 seconds?

1. A relief package is released from a helicopter at 1600 feet. The height of the package can be modeled by the equation $h = -16t^2 + 1600$, where h is the height of the package in feet and t is the time in seconds.



Make a quick sketch to understand the problem



a. What does the number 1600 in the equation represent?

"y-intercept" is NOT the answer here.

* The package was dropped from 1600 feet *

b. How long it will take for the package to hit the ground?

$y = -16x^2 + 1600$

$0 = -16x^2 + 1600$

$-1600 \qquad -1600$

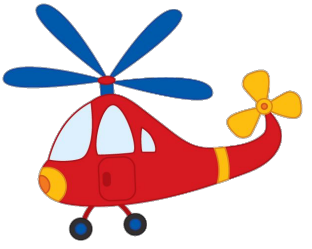
$-1600 = -16x^2$

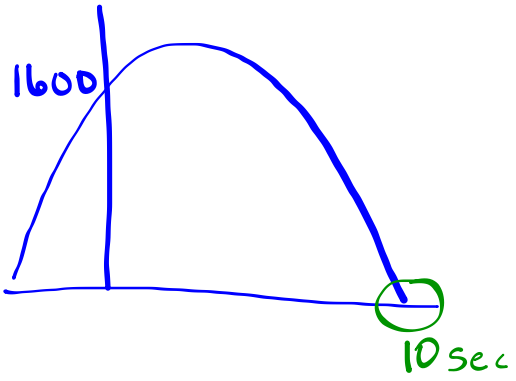
$\frac{-1600}{-16} = \frac{-16x^2}{-16}$

$\sqrt{100} = \sqrt{x^2}$

$10 = x$

1. A relief package is released from a helicopter at 1600 feet. The height of the package can be modeled by the equation $h = -16t^2 + 1600$, where h is the height of the package in feet and t is the time in seconds.





a. What does the number 1600 in the equation represent?

b. How long it will take for the package to hit the ground?

$0 = -16t^2 + 1600$

$-1600 \quad -1600$

$\frac{-1600}{-16} = \frac{-16t^2}{-16}$

$\sqrt{100} = \sqrt{t^2}$

$10 = t$

2. The height of a flare fired from the deck of a ship in distress can be modeled by $h = -16t^2 + 104t + 56$, where h is the height of the flare above water and t is the time in seconds.

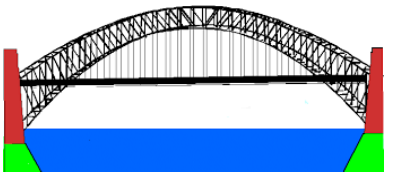
$$h = -16t^2 + 104t + 56$$

$$= -8(2t^2 - 13t - 7)$$

a. How high above the surface of the water is the deck of the ship?

b. How long will the flare be in the air?

3. Robert threw a rock off a bridge into the river. The distance from the rock to the river is modeled by the equation $h = -16t^2 - 16t + 60$, where h is the height in feet and t is the time in seconds.



a. How high above the river will the rock be 1 second after Robert throws it?

b. How long will it take for the rock to hit the surface of the water?

Homework

Finish classwork