Warm Up 6/8

Which equations represent quadratic relationships? ax^2+bx+c

A. $y = (3x + 4)(x+2)$ ✓ $3x^2+10x+8$

B. $y = (2 + x) + (4x – 1)$ ✗

C. $y = x^3 + 2x^2 + 1$ ✗ highest exponent on x must be 2

D. $5x(x – 1)$ ✓ $5x^2-5x$

E. $6x^2 – 5$ $6x^2+0x-5$ ✓

F. $y = (2x + 7)(4 – 1)$ ✗ $6x+21$

A. $(3x+4)(x+2)$ ✓

$3x^2+6x+4x+8$

$3x^2+10x+8$

B. $(2+x)+(4x-1)$ ✗ Addition

$5x+1$

Quadratic: highest exponent on $x = 2$

$y=ax^2+bx+c$

$y=ax^2$

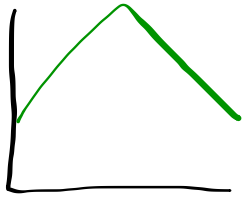
$y=ax^2+bx$

$y=ax^2+c$

All quadratic

Quadratic or not?

Why or Why Not?



x	y
0	2
1	4
2	6
3	8
4	6
5	4
6	2

+2, +2, +2 — this indicates linear

-2, -2, -2

Quadratic if:

- x^2 is highest order exponent on x
- 2nd difference is constant

x	y	1st diff	2nd diff
0	2		
1	4	+2	+0
2	6	+2	+0
3	8	+2	-4
4	6	-2	+0
5	4	-2	+0
6	2	-2	

Quadratic Word P

Homework Questions?

1) A jewelry maker would like to increase his profit by raising the price of his jade earrings. However, he knows that if he raises the price too high, he won't sell as many earrings and his profit will decrease.

The jewelry maker's business consultant develops the equation $P = 50s - s^2$ to predict the monthly profit, P, for a sales price, s. A table of a few data points are shown below.

s ($)	0	10	20	30	40	50	60
P ($)	0	400	600	600	400	0	-600

LOS

a) When the jewelry maker charges $10 for his earrings, how much profit does he make?

$400

b) When the jewelry maker charges $15 for his earrings, how much profit does he make? Hint: use the equation.

$P = 50(15) - 15^2$
$= 525$

His profit will be $525

c) What price will bring the maximum profit? How do you know?

The maximum profit is represented by the vertex. The price to charge is the x-variable of the vertex which is the LOS. You can see the symmetry in the table to identify where the LOS is.

Price to make max profit = $25

d) What is the maximum profit? Hint: use your answer from **question c** and the equation.

$P = 50(25) - 25^2$
$P = 625$

Max profit: $625

e) When the jewelry maker charges $60 for his earrings, how much profit does he make? Explain what this means in the context of the problem.

His profit is -600. This means he would lose $600 if he charged $60 for the earrings. He is still manufacturing and paying employees which cost $600.

f) If you were looking at the parabola, what graph key feature would have answered **question c**? (circle one)

y – intercept x – intercepts **Line of Symmetry** y value of Vertex

g) If you were looking at the parabola, what graph key feature would have answered **question d**? (circle one)

y – intercept x – intercepts Line of Symmetry **y value of Vertex**

2) The highest dive in the Olympic Games is from a 10-meter platform. The height above water, h (meters), of a diver t seconds after leaving the platform can be estimated by the equation $h = 10 + 4.9t - 4.9t^2$. A table with some of their data points is shown below.

Time (t)	Height (h)
0	10
0.2	10.784
0.4	11.176
0.6	11.176
0.8	10.784
1.0	10
1.2	8.824
1.4	7.256
1.6	5.296
1.8	2.944
2.0	0.2
2.2	−2.936

LOS

a) Approximately when will the diver hit the water's surface? How did you find this answer by using your table?

At 2 sec. the diver is at 0.2 m above the water, and at 2.2 seconds the diver is 2.936 m below the surface of the water so it has to be between 2 and 2.2 sec.

Approx. 2.1 sec.

b) How could you find the answer to **question a** by using a graph? What key feature would help you?

Find the 2nd x-intercept. It will be the x-int. with a positive value.

c) After how many seconds will the diver be at their max height? How do you know?

you can see that the line of symmetry (LOS) is between 0.4 and 0.6 sec. We know this because the heights on either side mirror each other.

0.5 seconds

d) What is the maximum height reached by the diver? Hint: Use your answer to **question c** and the equation.

$10 + 4.9t - 4.9t^2 = h$

$10 + 4.9(0.5) - 4.9(0.5)^2 = h$

$11.225 = h$

The maximum height the diver can reach is 11.225 meters.

e) After 2.2 seconds, the height is negative. Why would that make sense in the context of this problem?

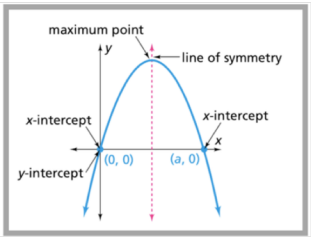
0m in height is the surface of the water. A negative height in this case would mean that the diver is under water.

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?

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.

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?

Homework

Finish classwork