Get out your homework and have it ready to check. Warm Up on the Real World Link on page 335.

Classwork - Quadratic Functions

Real-World Link

Kris kicked a soccer ball straight into the air. The height h in **feet of the** ball after t seconds is found using the equation $h = -16t^2 + 40t + 2$. What is the height of the ball after 1.5 seconds? _____

$t = 1.5$

$h = -16(1.5)^2 + 40(1.5) + 2$

$h = -16(2.25) + 40(1.5) + 2$

$h = -36 + 60 + 2$

$h = 26$ feet

Reminder→ To explain that a relationship is linear complete the statement, "*As x increase by _____, y increase/decreases by _____ each time.*"

1.

+1		+1	+1	+1
x	1	2	3	4
y	4	5	6	7
	+1	+1	+1	

Circle Answer

Linear or Nonlinear

Explanation: As x increases by 1 y increases by 1 each time.

2.

	+2	+2	+2	
x	0	2	4	6
y	2	6	18	38
	+4	+12	+20	

Circle Answer

Linear or Nonlinear

Explanation: There is not a constant rate of change because as x increases by 2 y increases by a different amount each time

3.

	+2.5	+2.5	+2.5	+2.5	
x	4	6.5	9	11.5	14
y	3	8	13	18	23
	+5	+5	+5	+5	

Circle Answer

Linear or Nonlinear

Explanation:

As x increases by 2.5 y increases by 5 each time

4.

	+1.5	+1.5	+1.5	
x	1.5	3	4.5	6
y	2	4	8	16
	+2	+4	+8	

Circle Answer

Linear or Nonlinear

Explanation:

As x increases by 1.5, y increases by a different amount each time.

5. The table shows the cost of long distance calls as a function of the number of minutes used. Is the cost a linear or nonlinear function of the number of minutes used? Explain.

		+40	+40	+40	+40
Number of Minutes	40	80	120	160	200
Cost ($)	4.00	8.00	12.00	16.00	20.00
		+4	+4	+4	+4

Circle Answer

Linear or Nonlinear

Explanation: As x increases by 40 y increases by 4 each time

6. **MINIMUM WAGE** The graph shows a state's minimum wage from 2005 to 2012. Would you describe the yearly increase as linear or nonlinear? Explain your reasoning.

Circle Answer

Linear or Nonlinear

Explanation:

As x increases by 1 year, y increases by a different amount of money each time.

Quadratic Functions

A quadratic function can be written in the form $y = ax^2 + bx + c$, where $a \neq 0$. The graph of a quadratic function is called a parabola. The graph opens upward if the coefficient of the variable that is squared is positive, downward if it is negative.

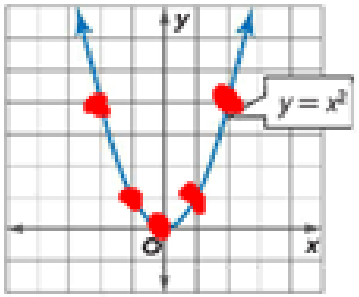
Examples

Tutor

1. Graph $y = x^2$.

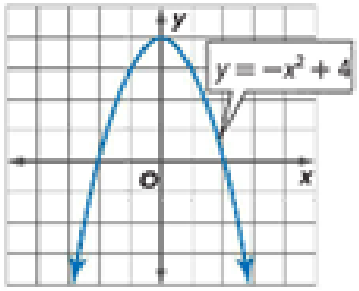
To graph a quadratic function, make a table of values, plot the ordered pairs, and connect the points with a smooth curve.

x	x^2	y	(x, y)
-2	$(-2)^2 = 4$	4	$(-2, 4)$
-1	$(-1)^2 = 1$	1	$(-1, 1)$
0	$(0)^2 = 0$	0	$(0, 0)$
1	$(1)^2 = 1$	1	$(1, 1)$
2	$(2)^2 = 4$	4	$(2, 4)$



2. Graph $y = -x^2 + 4$.

x	$-x^2 + 4$	y	(x, y)
-2	$-(-2)^2 + 4 = 0$	0	$(-2, 0)$
-1	$-(-1)^2 + 4 = 3$	3	$(-1, 3)$
0	$-(0)^2 + 4 = 4$	4	$(0, 4)$
1	$-(1)^2 + 4 = 3$	3	$(1, 3)$
2	$-(2)^2 + 4 = 0$	0	$(2, 0)$



$x = -2$

$y = -x^2 + 4$

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

$y = -(4) + 4$

$y = -4 + 4$

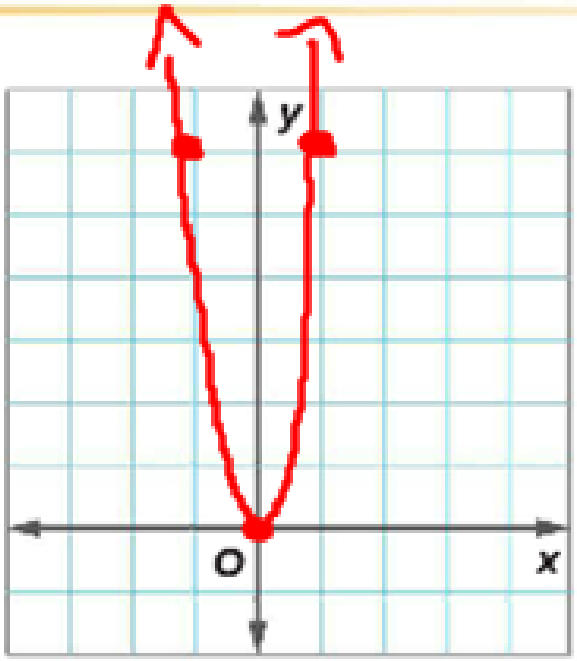
$y = 0$

$(-2, 0)$

Got it? **Do this problem to find out.**

a. Graph $y = 6x^2$.

x	y
-2	24
-1	6
0	0
1	6
2	24



$x = -2$

$y = 6(-2)^2$

$y = 6(4)$

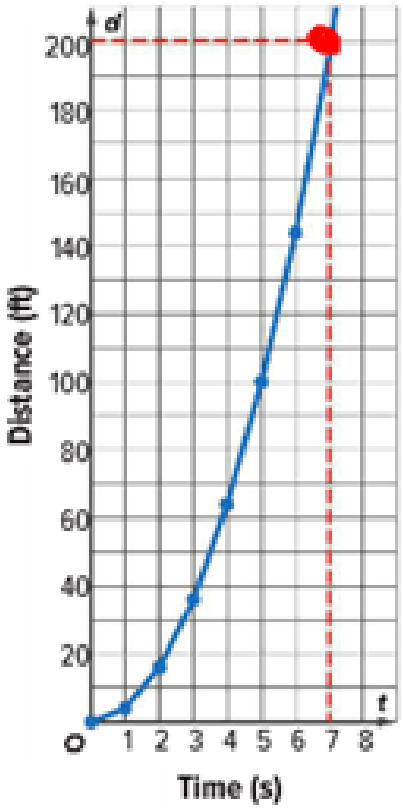
$y = 24$

Examples

3. **The function $d = 4t^2$ represents the distance d in feet that a race car will travel over t seconds with a constant acceleration of 8 feet per second. Graph the function. Then use the graph to find how much time it will take for the race car to travel 200 feet.**

Time cannot be negative, so only use positive values of t.

t	$d = 4t^2$	(t, d)
0	$4(0)^2 = 0$	(0, 0)
1	$4(1)^2 = 4$	(1, 4)
2	$4(2)^2 = 16$	(2, 16)
3	$4(3)^2 = 36$	(3, 36)
4	$4(4)^2 = 64$	(4, 64)
5	$4(5)^2 = 100$	(5, 100)
6	$4(6)^2 = 144$	(6, 144)



Locate 200 on the vertical axis. Move over to the graph and locate the corresponding value for the time.

The car will travel 200 feet after about 7 seconds.

$d = 4(3)^2$

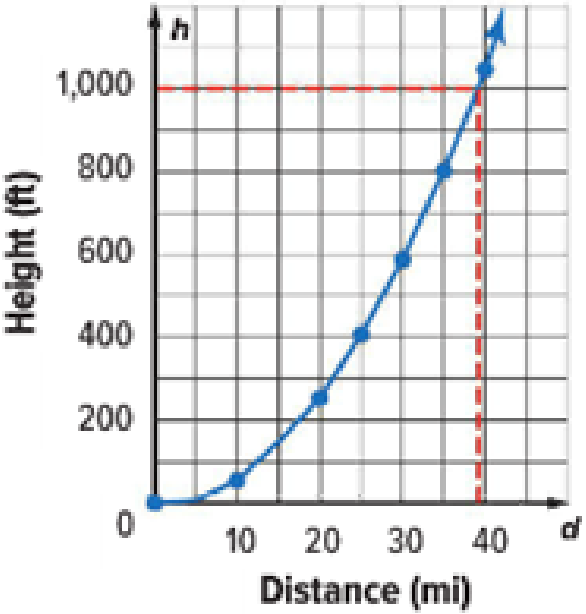
$d = 4(9)$

$d = 36$ ft

4. **The function $h = 0.66d^2$ represents the distance d in miles you can see from a height of h feet. Graph this function. Then use the graph to estimate how far you could see from a hot air balloon 1,000 feet in the air.**

Distance cannot be negative, so use only positive values of d.

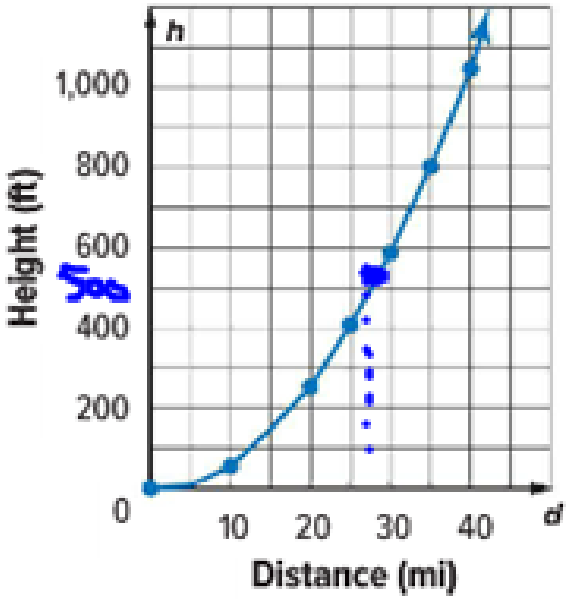
d	$h = 0.66d^2$	(d, h)
0	$0.66(0)^2 = 0$	(0, 0)
10	$0.66(10)^2 = 66$	(10, 66)
20	$0.66(20)^2 = 264$	(20, 264)
25	$0.66(25)^2 = 412.5$	(25, 412.5)
30	$0.66(30)^2 = 594$	(30, 594)
35	$0.66(35)^2 = 808.5$	(35, 808.5)
40	$0.66(40)^2 = 1{,}056$	(40, 1,056)



At a height of 1,000 feet, you could see approximately 39 miles.

Got it? **Do this problem to find out.**

b. The outdoor observation deck of the Space Needle in Seattle, Washington, is 520 feet above ground level. Use the graph to estimate how far you could see from the observation deck.



28 miles

Guided Practice

1. The function $a = 0.2v^2$ models the acceleration of a carnival ride, where a is the acceleration toward the center of the ride in meters per second every second and v is the velocity in meters per second. Graph this function. Then use your graph to estimate the velocity of the ride at an acceleration of 1 meter per second

v	a
0	0
1	0.2
2	0.8
3	1.8
4	3.2

2.2 m/s