

Warm - up

Sketch the following parabolas.

What is the vertex?

What is the step pattern?

$$y = 3(x-6)^2+2$$

$$y = 0.5(x+6)^2+2$$

$$y = -2(x-4)^2+7$$

$$y = -x^2+2$$

INTERPRETING GRAPHS OF QUADRATIC RELATIONS

Learning goal:

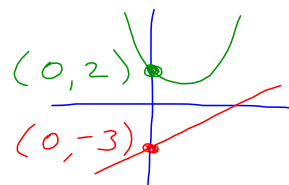
- relate graphs to real life examples

Recall:

The y-intercept is where the graph crosses the y-axis.

At this point $x = \underline{0}$

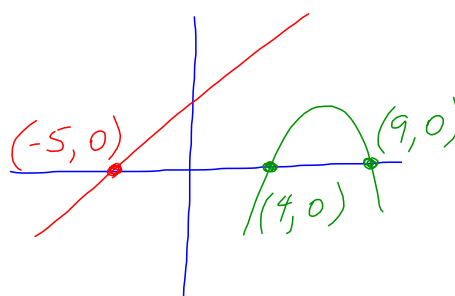
ex.



The x-intercept is where the graph crosses the x-axis.

At this point $y = \underline{0}$

ex.



For the graph below, determine the following:

(a) The y-intercept.

$(0, 3)$

(b) The x-intercepts.

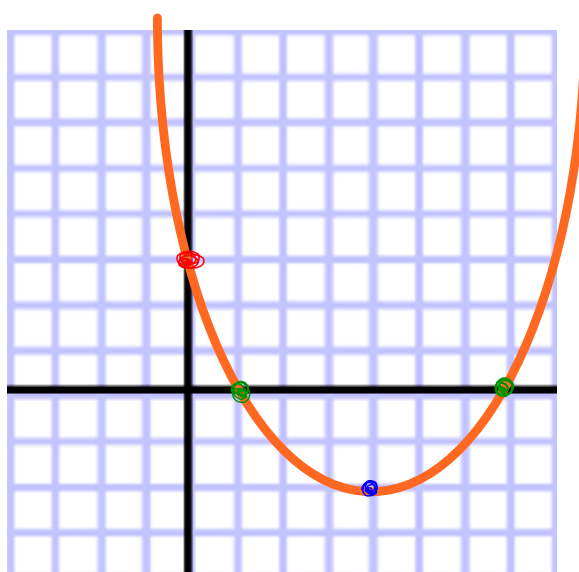
$(1, 0)$ $(7, 0)$

(c) The vertex

$(4, -2)$

(d) The max/min value.

$-2 \rightarrow$ optimal value



Determine the y-intercept from the equation.

$$y = -3(x+2)^2 - 9$$

$$y\text{-int} \Rightarrow x = 0$$

$$\begin{aligned} y &= -3(0+2)^2 - 9 \\ &= -3(2)^2 - 9 \\ &= -3(4) - 9 \\ &= -12 - 9 \\ &= -21 \end{aligned}$$

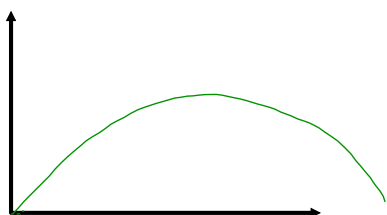
$$y = -15x^2 + 25x - 7$$

$$y\text{-int} \Rightarrow x = 0$$

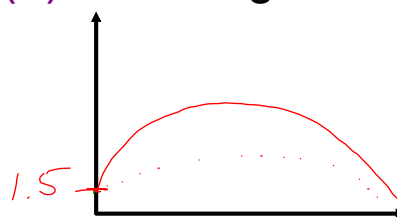
$$\begin{aligned} y &= -15(0)^2 + 25(0) - 7 \\ y &= -15(0) + 25(0) - 7 \\ y &= 0 + 0 - 7 \\ y &= -7 \end{aligned}$$

How to sketch "real life" quadratic relations:

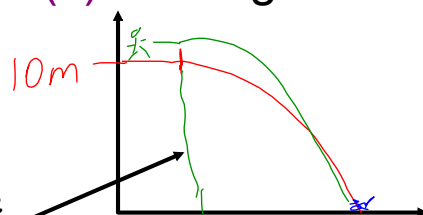
(a) hitting a golf ball



(b) throwing a football



(c) running off a cliff

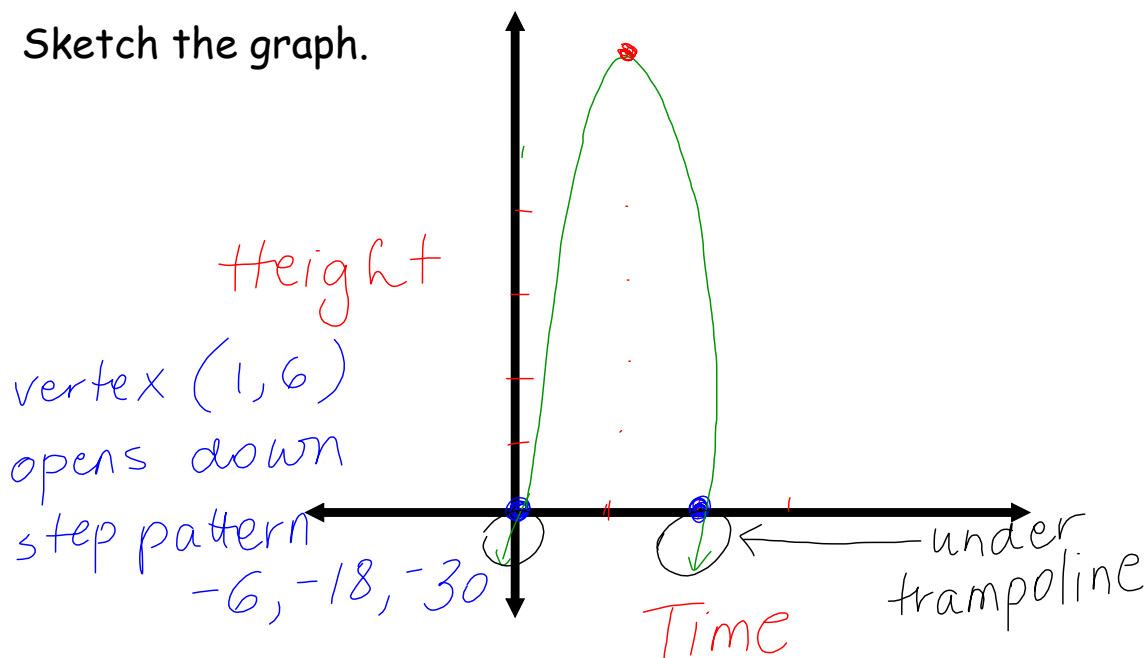


this is the
edge of the
cliff

The height of a trampolinist (h) in meters during one jump can be represented by the equation

$$h = -6(t-1)^2 + 6, \text{ where } t \text{ is the time, in seconds.}$$

Sketch the graph.



Determine the vertex.

$$(1, 6)$$

What does the vertex represent?

$$1 \rightarrow \text{at } 1 \text{ sec}$$

$$6 \rightarrow \text{max height at } 6 \text{ m}$$

What is the maximum height reached above the trampoline?

$$6 \text{ m}$$

How high was she after 2 seconds?

$$0 \text{ m} \quad t=2$$

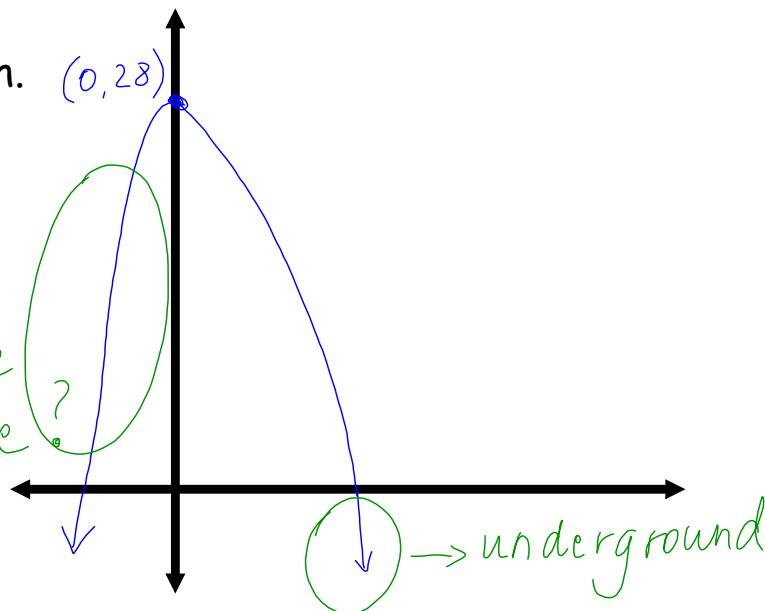
sub into equation
solve

A car drives off a cliff. The path that the car takes as it falls to the ground can be modelled by the equation $h = -d^2 + 28$, where h is the height and d is the distance, both in meters.

Sketch the graph. $(0, 28)$

On the Boards...

negative distance ?



What is the vertex of the parabola?

$$(0, 28)$$

How tall is the cliff?

$$28 \text{ m}$$

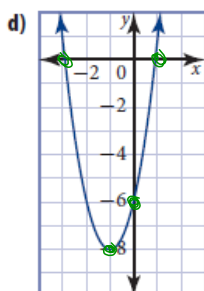
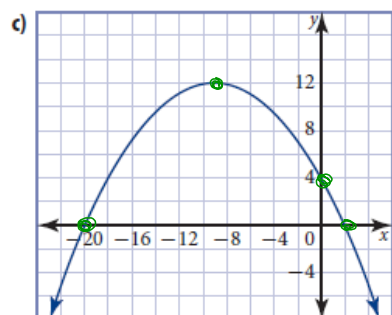
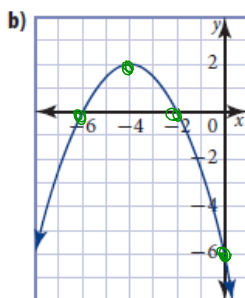
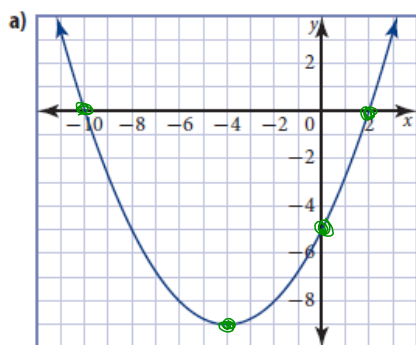
How far away from the cliff will the car be when it has dropped to a height of 12 meters?

$$\begin{aligned} y &= -d^2 + 28 \\ 12 &= -d^2 + 28 \\ -16 &= -d^2 \\ 16 &= d^2 \\ 4 &= d \end{aligned}$$

\therefore it will be 4 m away.

2. For each parabola, identify

- the x -intercepts
- the y -intercept
- the maximum or minimum value
- the coordinates of the vertex



1. Find the y -intercept for each relation.

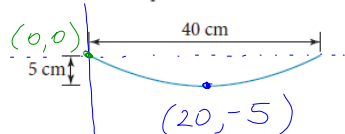
$$x = 0$$

a) $y = -15x^2 + 25x - 7$

c) $y = 20(x - 12)^2 + 15$

e) $y = 10x^2 + 8x - 3$

6. The shape of a satellite dish is parabolic. The dish is 5 cm deep and 40 cm wide. Write a relation of the form $y = a(x - h)^2 + k$ that models the shape of this dish. What assumption are you making?



$$y = a(x - 20)^2 - 5$$

$$0 = a(0 - 20)^2 - 5$$

$$5 = a(400)$$

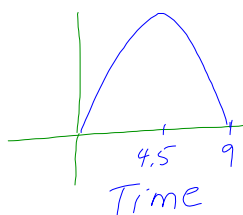
7. A projectile is fired straight up from the ground. It reaches a maximum height of 101.25 m after 4.5 s. Then, it falls to the ground 4.5 s later.

a) Write a relation that models this situation.

b) What is the height of the projectile after 3 s? Is there another time when the projectile is at the same height above the ground? Explain.

$$a = \frac{5}{400}$$

$$a = \frac{1}{80}$$



$$y = (x - 4.5)^2 + 101.25$$

$$0 = (0 - 4.5)^2 + 101.25$$

$$-101.25 = 20.25a$$

$$-5 = a$$

$$\therefore y = -5(x - 4.5)^2 + 101.25$$

Seatwork / Homework

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