

# Algebra 1B Live Lesson

U4L1: Quadratic Graphs and Their Properties  
(Chapter 9-1 in textbook)



# Agenda



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1. Review selected problems and topics from U4L1 – Quadratic Graphs and Their Properties.

2. Use the 2-column note system to take better notes in math class. Bring your math notebook and pen or pencil to each math LiveLesson class.

# 2-Column Notes Template



1. Announcements/To Do's
2. School-Wide Learner Outcomes
3. LL Objectives
4. Vocabulary words
5. Problems
6. Summary (End of class)

1. Write down important details.
2. What are you going to work on this week?
3. Write down the main idea of the lesson.
4. Definitions (fill in as we go)
5. Steps to solving problems
6. 1 or 2 sentences about the LL class.

# Reminders and To – Do's



## Information

1. Complete 1 math lesson per day.
2. Check your WebMail every day
3. Be prepared to spend 4 - 6 hours per day on schoolwork.
4. Remind your Learning Coach to take daily attendance

## What to do

1. Go to your Planner in Connexus to find the math lesson for the day
2. Go to Connexus to find WebMail
3. Complete lessons for the day from your Planner. Do not get behind on lessons.
4. Have your Learning Coach log into Connexus daily.

# Reminders and To – Do's



## Information

5. Go to the Message Board first for information about our math class.

6. Contact Mr. Elizondo for math questions.

Remember: You need at least 2 phone calls with Mr. Elizondo per semester.

## What to do

6. Call (559) 549 - 3244 and leave a voicemail if call is not answered.

Make an appointment at:  
<https://elizondo.youcanbook.me>

Send a WebMail

## U4L1 – California Common Core State Standards

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- HSA-APR.A.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

# U4L1 - Objectives



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Graph quadratic functions of the form  $y = ax^2$  and  $y = ax^2 + c$

# U4L1 - Vocabulary



- Quadratic function
- Standard form of quadratic function
- Quadratic parent function
- Parabola
- Axis of symmetry
- Vertex
- Maximum
- Minimum



# U4L1 - Introduction



- Recall polynomials of degree 2, such as  $-9x^2 + 80$
- Called quadratic polynomials
- Use quadratic polynomials to define quadratic functions

## ▪ **Graphs of quadratic functions:**

- Symmetric curve
- Has highest or lowest point (maximum or minimum value)

# U4L1 - Standard Form of a Quadratic Equation



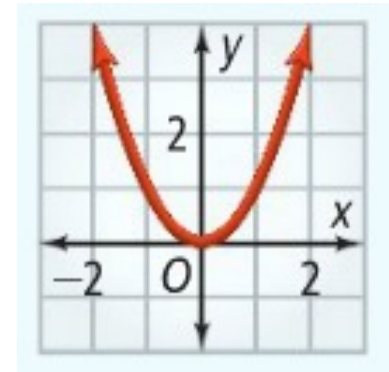
take note

## Key Concept Standard Form of a Quadratic Function

A **quadratic function** is a function that can be written in the form  $y = ax^2 + bx + c$ , where  $a \neq 0$ . This form is called the **standard form of a quadratic function**.

**Examples**  $y = 3x^2$        $y = x^2 + 9$        $y = x^2 - x - 2$

- **Quadratic parent function:  $y = x^2$**
- Graph of quadratic function is called a **parabola**
- There is a line that splits the parabola in “half” called the **axis of symmetry**



# U4L1 - The Vertex

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- The highest or lowest point of a parabola is called the **vertex**

$$y = ax^2 + bx + c$$

- It all depends on the value of  $a$

If  $a > 0$  in  $y = ax^2 + bx + c$ ,  
the parabola opens upward.



The vertex is the **minimum** point,  
or lowest point, of the parabola.

If  $a < 0$  in  $y = ax^2 + bx + c$ ,  
the parabola opens downward.

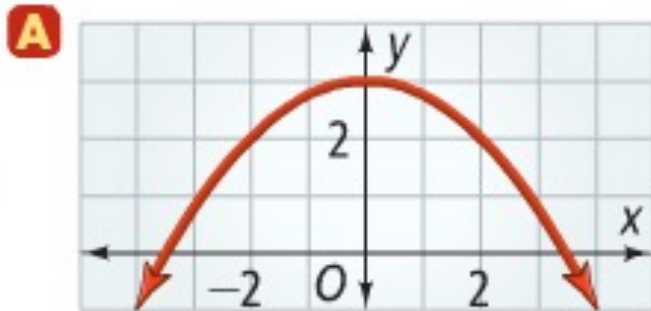


The vertex is the **maximum** point,  
or highest point, of the parabola.

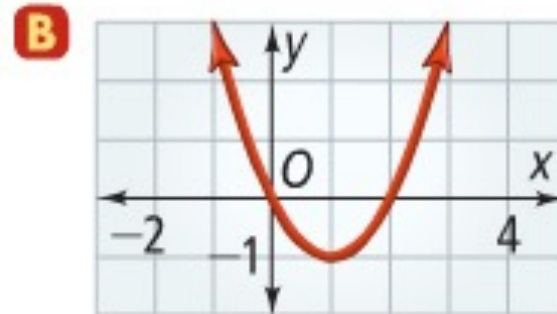
# U4L1 - Identifying a Vertex



What are the coordinates of the vertex of each graph? Is it a minimum or a maximum?



The vertex is  $(0, 3)$ . It is a maximum.



The vertex is  $(1, -1)$ . It is a minimum.

# U4L1 - Symmetry

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- A parabola is symmetric

\*\*The axis of symmetry passes through the vertex

- 1) Find the coordinates of the vertex
- 2) Find several points on one side of the vertex
- 3) Reflect the points across the axis of symmetry

For graphs of the form  $y=ax^2$ , the vertex is at the origin, and the axis of symmetry is the y-axis (the line  $x=0$ )

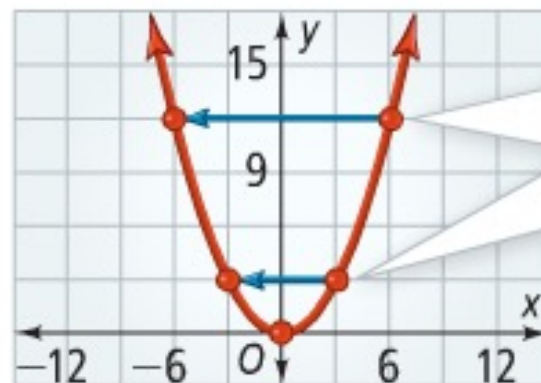
# U4L1 - Graphing $y = ax^2$



Graph the function  $y = \frac{1}{3}x^2$ . Make a table of Values. What are the domain and range?

$x$	$y = \frac{1}{3}x^2$	$(x, y)$
0	$\frac{1}{3}(0)^2 = 0$	$(0, 0)$
3	$\frac{1}{3}(3)^2 = 3$	$(3, 3)$
6	$\frac{1}{3}(6)^2 = 12$	$(6, 12)$

The domain is all real numbers.  
The range is  $y \geq 0$ .



Reflect the points from the table over the axis of symmetry,  $x = 0$ , to find more points on the graph.

# U4L1 - Widths of Parabolas

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The coefficient of the  $x^2$ -term affects the width of the parabola.

$$y = mx^2$$

$$y = nx^2$$

$$|m| < |n|$$

The graph of  $y = mx^2$  is wider than the graph of  $y = nx^2$ .

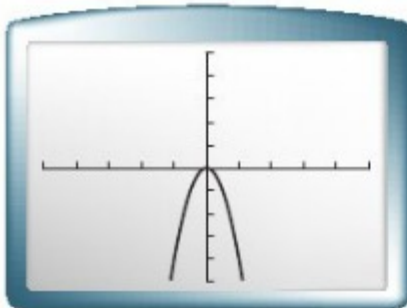
# U4L1 - Widths of Parabolas



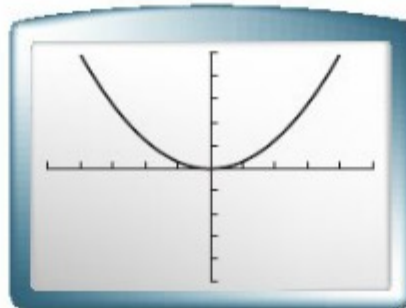
Use the graphs below. What is the order, from widest to narrowest, of the graphs of the quadratic functions  $f(x) = -4x^2$ ,  $f(x) = \frac{1}{4}x^2$ , and  $f(x) = x^2$ ?

$$|-4|=4$$

$$f(x) = -4x^2$$

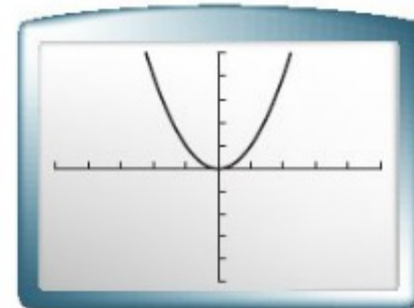


$$f(x) = \frac{1}{4}x^2$$



$$|1|=1$$

$$f(x) = x^2$$



Of the three graphs,  $f(x) = \frac{1}{4}x^2$  is the widest and  $f(x) = -4x^2$  is the narrowest. So, the order from widest to narrowest is  $f(x) = \frac{1}{4}x^2$ ,  $f(x) = x^2$ , and  $f(x) = -4x^2$ .



# U4L1 - Graphing $y = ax^2 + c$



$$y = ax^2 + c$$

Translates the graph of  
up  $c$  units

$$y = ax^2 - c$$

Translates the graph of  
 $y = ax^2$  down  $c$  units

**Multiple Choice** How is the graph of  $y = 2x^2 + 3$  different from the graph of  $y = 2x^2$ ?

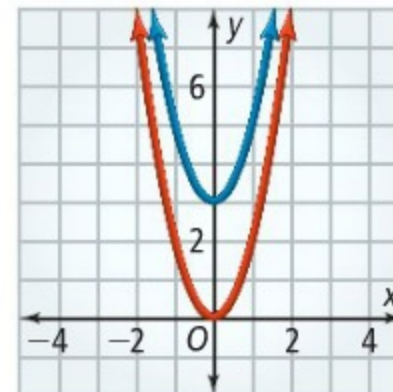
A It is shifted 3 units up.

B It is shifted 3 units down.

C It is shifted 3 units to the right.

D It is shifted 3 units to the left.

$x$	$y = 2x^2$	$y = 2x^2 + 3$
-2	8	11
-1	2	5
0	0	3
1	2	5
2	8	11



# U4L1 - FALLING OBJECTS

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A falling object's height can be modeled with the function:

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

*h*: feet

*t*: time in seconds

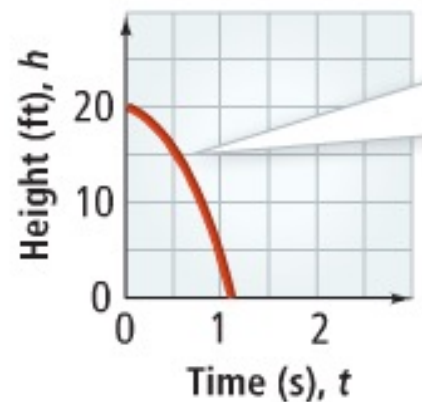
*c*: object's initial height (in feet)

# U4L1 – Falling Object Model



**Nature** An acorn drops from a tree branch 20 ft above the ground. The function  $h = -16t^2 + 20$  gives the height  $h$  of the acorn (in feet) after  $t$  seconds. What is the graph of this quadratic function? At about what time does the acorn hit the ground?

$t$	$h = -16t^2 + 20$
0	20
0.5	16
1	4
1.5	-16



Graph the function using the first three ordered pairs from the table. Do not plot  $(1.5, -16)$  because height cannot be negative.

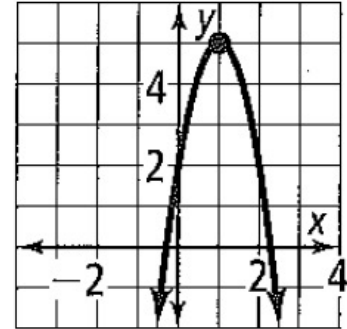
The acorn hits the ground when its height above the ground is 0 ft. From the graph, you can see that the acorn hits the ground a little after 1 second.

# U4L1 - Review Problems

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1) Identify the vertex of the graph. Tell whether it is a minimum or a maximum.



▣ The vertex is the point  $(1, 5)$

It is a maximum.

# Questions?

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- Check the Message Board first
- Send a WebMail
- You can also make an appointment at <https://elizondo.youcanbook.me>
- You can also call me at (559) 549-3244. If I'm not available to answer your call, please leave a voicemail with your full name and phone number.