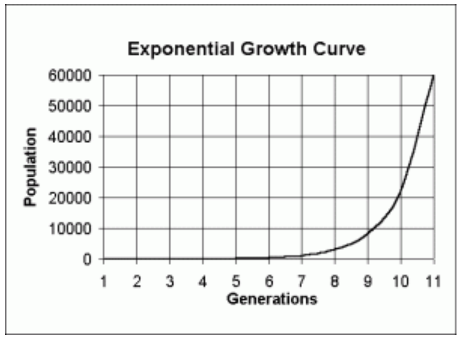
Unit 1 Notes:
Relationships and Reasoning in Quantities, Equations, and Graphs



Tentative Schedule

Day	Date	Class Work	Assignment
1	Thurs. 9/4	Piecewise Functions	Problem Set #1.1
2	Fri. 9/5 Mon. 9/8	Graphs of Quadratic Functions	Problem Set #1.2
3	Tues. 9/9	Graphs of Exponential Functions	Problem Set #1.3
4	Wed. 9/10 Thurs. 9/11	**Quiz #1.1** ***Take-Home Quiz #1.2 assigned***	Watch Video 1.4 – Sets of and Properties of Real Numbers
5	Fri. 9/12	Problem Set #1.4	Watch Video 1.5 – Adding, Subtracting and Multiplying Polynomials
6	Mon. 9/15 Tues. 9/16	Problem Set #1.5	Watch Video 1.6 – Simplifying Radicals
7	Wed. 9/17	Problem Set #1.5/1.6 ***Take-Home Quiz #1.2 due***	Finish Problem Set #1.5/1.6
8	Thurs. 9/18 Fri. 9/19	Review for Test #1	Review for Test #1
9	Mon. 9/22	**Test #1**	TBA

Name: ______________________________

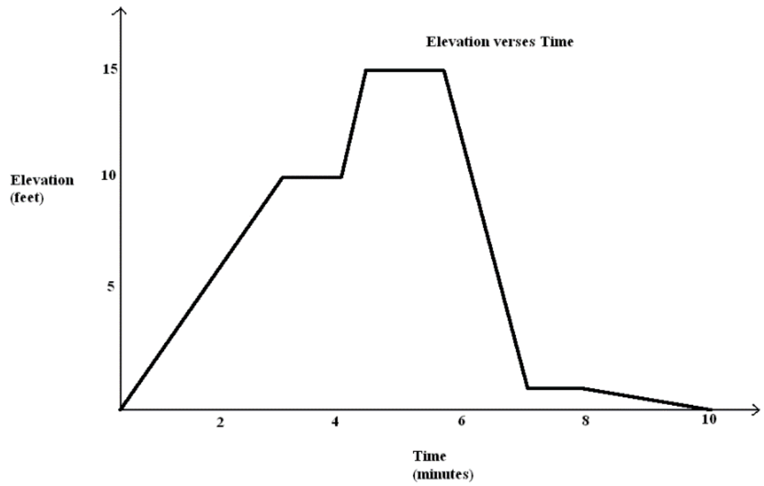
Notes 1.1 – Piecewise Functions

Example 1

Goal: Watch the video and describe the motion of the man.

Example 2

Here is an elevation-versus-time graph of a person's motion.



1. What is a story that could be represented by the graph?

2. What is happening in the story when the graph is increasing? Decreasing? Constant?

3. What does it mean for one part of the graph to be steeper than another?

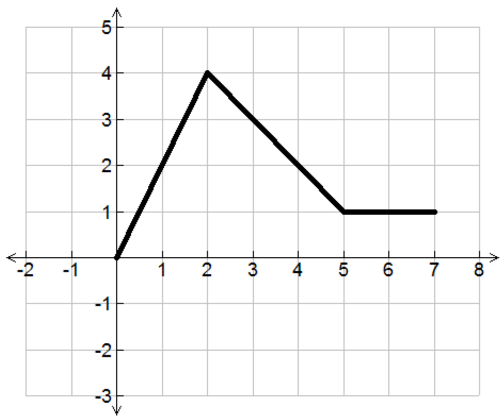
4. Is it reasonable that a person moving up and down a vertical ladder could have produced this elevation versus time graph? Explain.

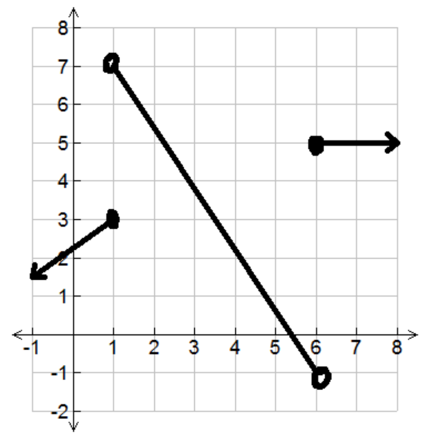
5. Is it possible for someone walking on a hill to produce this elevation versus time graph and return to her starting point at the 10-minute mark? If it is, describe what the hill would look like?

6. What was the average rate of change of the person's elevation between time 0 and 4 minutes?

Could one equation be used to create the graph on the previous page?

Piecewise-defined linear function – more than one linear equation graphed on the same graph so that each equation is only visible for a "piece" of the time. There are multiple pieces that are included on each graph.





7. The graph in Example 2 is made by combining pieces of seven linear functions (it is a piecewise linear function). Each linear function is defined over an interval of time, represented on the horizontal axis. List those seven time intervals.

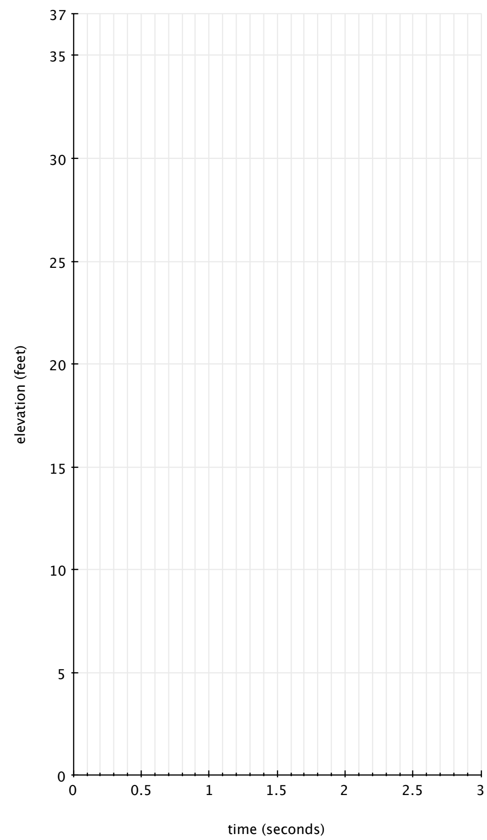
Notes 1.2 – Graphs of Quadratic Functions

Example 1

Goal: Watch the video and describe the motion of the ball.

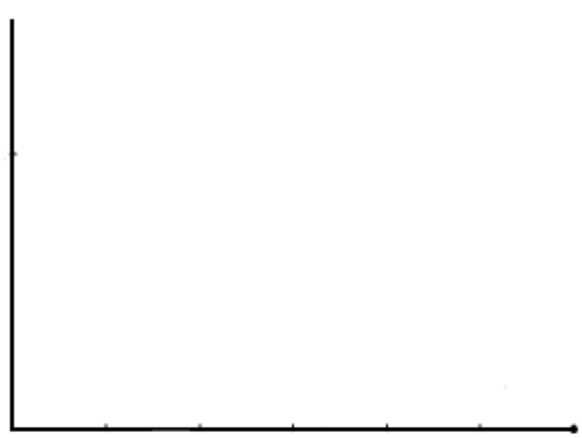
Example 2

Plot a graphical representation of change in elevation over time for the following "graphing story." It is a video of a man jumping from 36 feet above ground into 1 foot of water.



Example 3

If you jumped in the air three times, what might the elevation versus time graph look like? Label the axes appropriately.



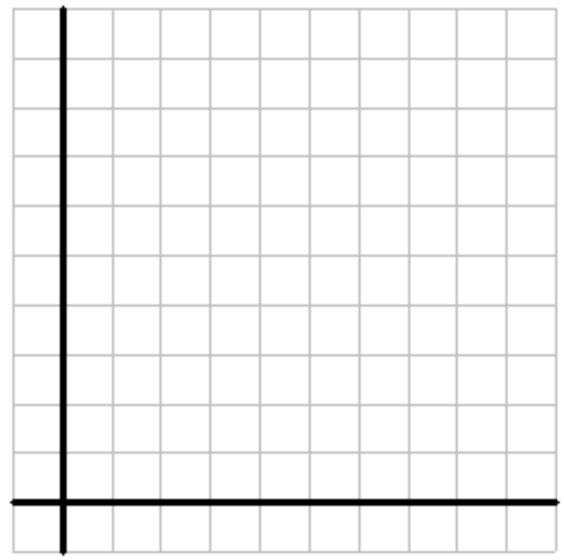
Notes 1.3 – Graphs of Exponential Functions

Example 1

Consider the story:

Darryl lives on the third floor of his apartment building. His bike is locked up outside on the ground floor. At 3:00 p.m., he leaves to go run errands, but as he is walking down the stairs, he realizes he forgot his wallet. He goes back up the stairs to get it and then leaves again. As he tries to unlock his bike, he realizes that he forgot his keys. One last time, he goes back up the stairs to get his keys. He then unlocks his bike, and he is on his way at 3:10 p.m.

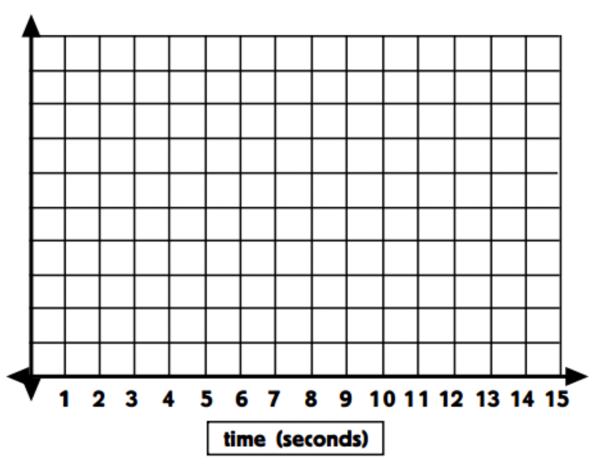
Sketch a graph that depicts Darryl's change in elevation over time.



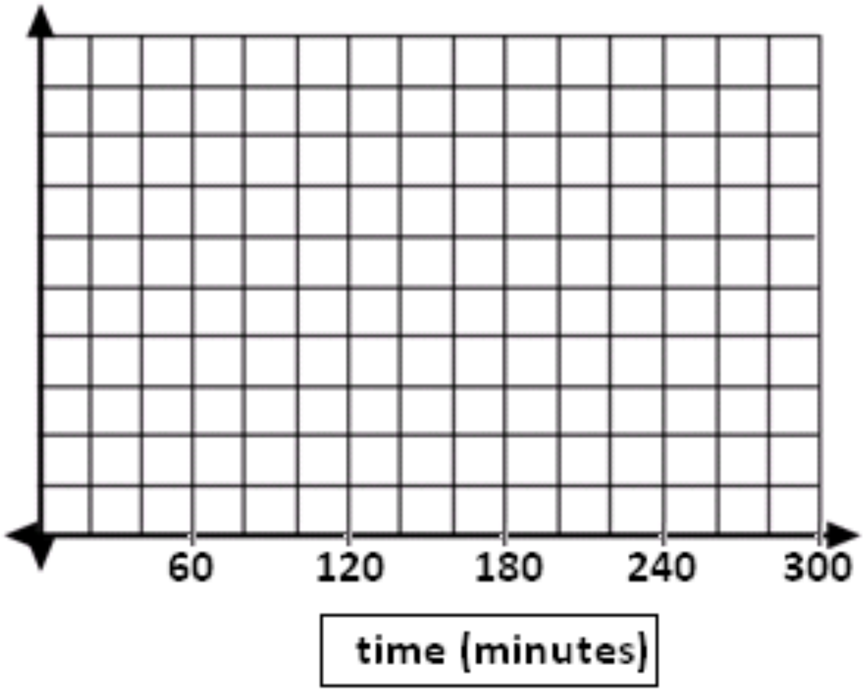
Example 2

Watch the graphing story. The video shows bacteria doubling every second.

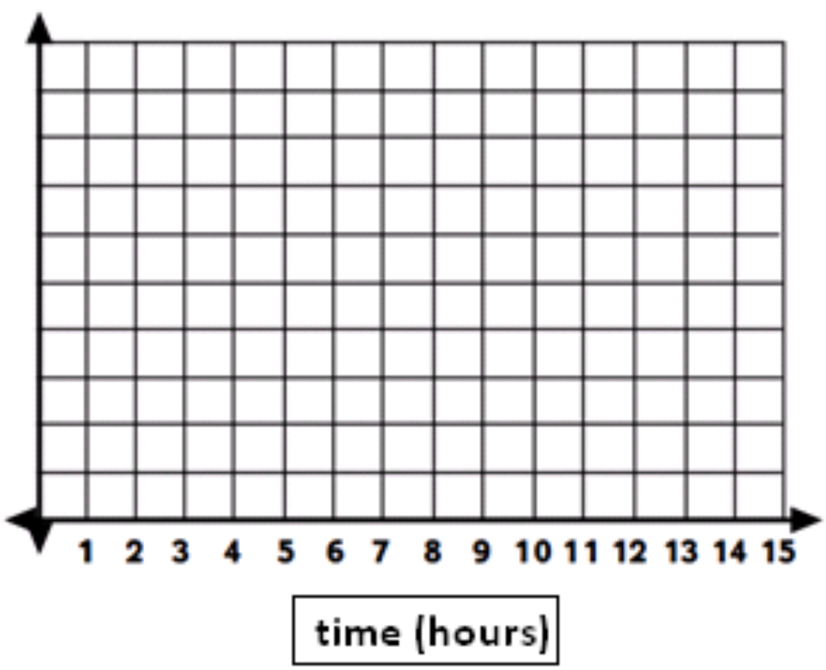
1. Graph the number of bacteria versus time in seconds. Begin by counting the number of bacteria each second and plotting appropriate points on the set of axes below. Consider how you might handle estimating these counts as the population of the bacteria grows.



2. Graph the number of bacteria versus time in minutes



3. Graph the number of bacteria versus time in hours (for the first five hours).



Notes 1.4 – Properties of Real Numbers

1. Leela is convinced that $(a+b)^2$ is a^2+b^2. Do you think she is right?

2. Draw a picture to represent the expression $(a+b+1)(b+1)$.

3. Draw a picture to represent the expression $(a+b)(c+d)$.

The Distributive Property

To distribute means ____.

In math, the distributive property means that we _________________________ each piece of an algebraic expression by the term or terms being distributed.

Examples:

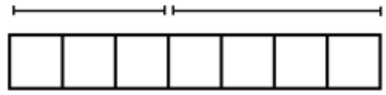
4. $3(x+2)$

5. $(4+a)(3x-7)$

6. $(y-2)(4x^2+x-3)$

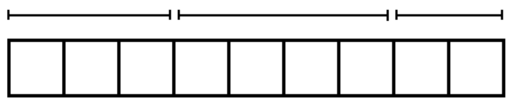
7. $-(7x^3+3x^2-x-1)$

8. Suzy draws the following picture to represent the sum 3 + 4:



Ben looks at this picture from the opposite side of the table and says, "You drew 4 + 3." Is Ben's thinking correct?

9. Suzy adds more to her picture and says, "the picture now represents (3 + 4) + 2."



How might Ben interpret this picture?

10. Suzy then draws another picture of squares to represent the product 3 x 4. Ben moves to the end of the table and says, "From my new seat, your picture looks like the product 4 x 3." What picture might have Suzy drawn? Why would Ben see it differently from his viewpoint?

Four Properties of Arithmetic

The Commutative Property of Addition: If a and b are real numbers, then $a + b = b + a$.

The Associative Property of Addition: If $a, b,$ and c are real numbers, then $(a + b) + c = a + (b + c)$

The Commutative Property of Multiplication: If a and b are real numbers, then $a \times b = b \times a$.

The Associative Property of Multiplication: If $a, b,$ and c are real numbers, then $(ab)c = a(bc)$.

Flow Chart Examples:

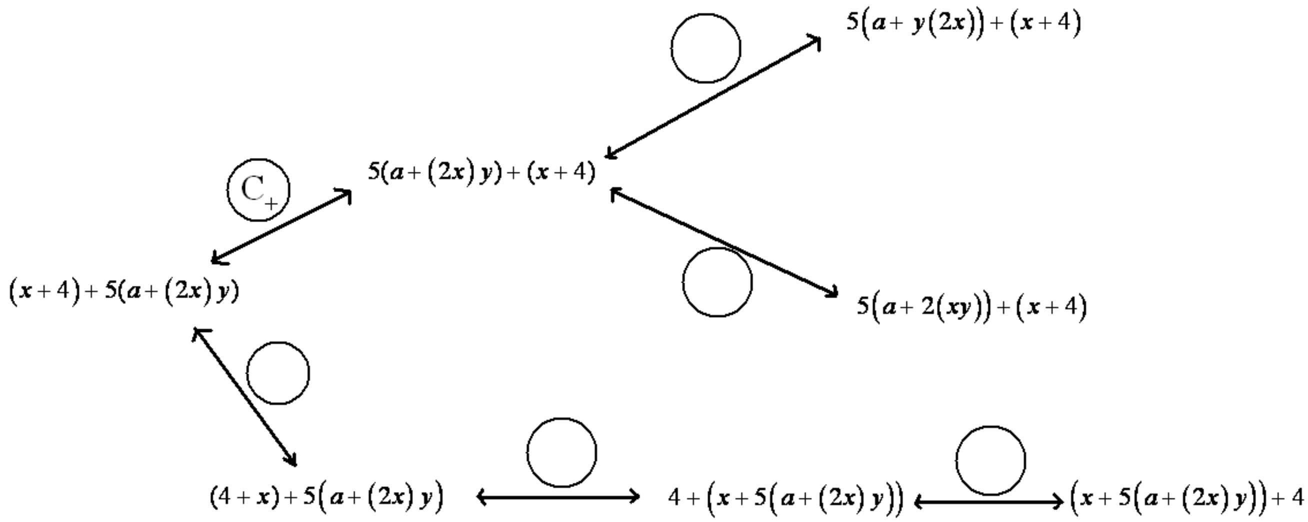
1. Use these abbreviations for the properties of real numbers and complete the flow diagram.

    C_+ for the commutative property of addition

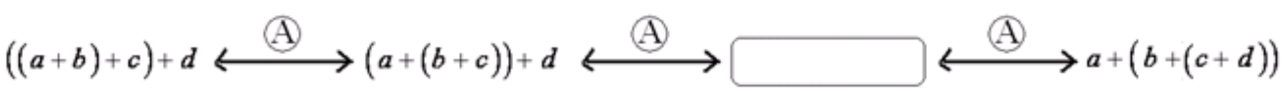
    $C_\times$ for the commutative property of multiplication

    A_+ for the associative property of addition

    $A_\times$ for the associative property of multiplication



2. Let $a, b, c,$ and d be real numbers. Fill in the missing term of the following diagram to show that $((a+b)+c)+d$ is sure to equal $a+(b+(c+d))$.



Notes 1.5 – Adding, Subtracting, and Multiplying Polynomials

When we are working with polynomial expressions (a sum or difference of two or more terms) we can only put things that are alike together. For example, pretend that x^2 is the same as an apple and x^4 is the same as an orange.

x^2 = apple
x^4 = orange

- $x^2 + x^2 = apple + apple = 2\ apples = 2x^2$
- $x^4 + x^4 = orange + orange = 2\ oranges = 2x^4$
- $x^2 + x^4 = apple + orange$ …. We can't combine apples and oranges, so it remains $x^2 + x^4$.

Define the following words:

Monomial	Binomial
Trinomial	Polynomial

Adding and Subtracting Polynomials – Find each sum or difference by combining the parts that are alike.

1. 417 + 231 = ________ hundreds + ________ tens + ________ ones
   + ________ hundreds + ________ tens + ________ ones
   = ________ hundreds + ________ tens + ________ ones

2. $(4x^2 + x + 7) + (2x^2 + 3x + 1)$

3. $(3x^3 - x^2 + 8) - (x^3 + 5x^2 + 4x - 7)$

4. $3(x^3 + 8x) - 2(x^3 + 12)$

5. $(5 - t - t^2) + (9t + t^2)$

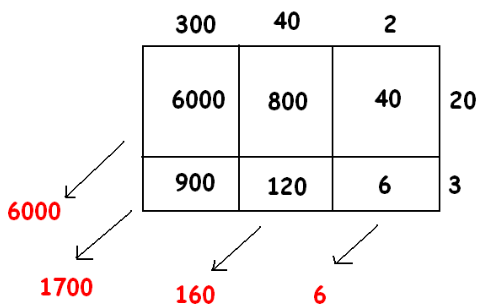
6. $(3p + 1) + 6(p - 8) - (p + 2)$

When multiplying powers with the same base, you ____________________ the exponents and multiply the _________________.

7. $x^3 \bullet x^4$

8. $5x^8 \cdot 2x^7$

9. Gisella computed 342 x 23 as follows:



Can you explain what she is doing? What is her final answer?

Use a geometric diagram to find the following products:

10. $(3x^2 + 4x + 2)(2x + 3)$

11. $(2x^2 - 10x + 1)(x^2 + x - 3)$

12. Multiply the polynomials using the distributive property: $(2x^2 - 10x + 1)(x^2 + x - 3)$

Notes 1.6 – Simplifying Radicals

In order to do any operations on radicals, you must know the first fifteen perfect squares by heart.

$1^2 =$	$2^2 =$	$3^2 =$	$4^2 =$	$5^2 =$
$6^2 =$	$7^2 =$	$8^2 =$	$9^2 =$	$10^2 =$
$11^2 =$	$12^2 =$	$13^2 =$	$14^2 =$	$15^2 =$

Topic A - Simplifying Radicals

Simplifying Radicals	Example: $\sqrt{80}$
1. Factor the number under the radical sign, if possible, so that one of its factors is the largest possible perfect square.	
2. You are allowed to split up a radical sign if there is multiplication underneath it.	
3. Evaluate the square root of the perfect square and leave the other factor underneath the radical sign.	

Examples:

1.) $\sqrt{200}$

2.) $5\sqrt{27}$

3.) $\sqrt{17}$

4.) $6\sqrt{52}$

5.) $\sqrt{81}$

6.) $\sqrt{17}$