Algebra 1

Unit 1: Family of Functions

Romeo High School

Contributors:

Jennifer Boggio
Jennifer Burnham
Jim Cali
Robert Leitzel
Kelly McNamara

Danielle Hart
Mary Tarnowski
Laura Troy
Josh Tebeau
Algebra 1 - Unit 1: Family of Functions

Prior Knowledge GLCE
A.PA.08.03; A.PA.08.04; A.FO.08.10;
G.SR.08.03 – G.SR.08.07; D.AN.08.01;
D.AN.08.02; D.PR.08.03 – D.PR.08.06;
N.ME.08.01; N.ME.08.03; N.FL.08.05;
N.FL.08.06; N.MR.08.07; N.MR.08.08;
N.FL.08.09; N.FL.08.11

HSCE Mastered Within This Unit
A1.1.1; A2.1.2; A2.3.1; A3.1.1; L1.1.3

HSCE Addressed Within Unit
A1.2.1; A1.2.2; A1.2.8; A2.1.1;
A2.1.3; A2.1.4; A2.1.6; A2.1.7;
A2.2.1 – A2.2.3; A2.3.3; A2.4.1;
A2.4.2; A3.1.2; A3.3.1; L1.1.1;
L1.1.2; L1.1.4; L1.1.5


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After successful completion of this unit, you will be able to:

- Use properties to simplify algebraic expressions.
- Use the graphing calculator as a tool to aide you in solving algebra problems.
- Determine if a relation is a function and find coordinate points on a graph using function notation.
- Use the pattern of points to draw graphs of linear, quadratic, cubic, and absolute value functions.
- Apply knowledge of integers, end behavior, critical points, domain, range and inverses.
- Understand the inverse relationship between exponential and logarithmic functions.
- Create greatest integer functions (step functions) based on real-life situations.
<table>
<thead>
<tr>
<th>HSCE Code</th>
<th>Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1.1.1</td>
<td>Give a verbal description of an expression that is presented in symbolic form, write an algebraic expression from a verbal description, and evaluate expressions given values of the variables.</td>
</tr>
<tr>
<td>A1.2.1</td>
<td>Write and solve equations and inequalities with one or two variables to represent mathematical or applied situations.</td>
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<tr>
<td>A1.2.2</td>
<td>Associate a given equation with a function whose zeros are the solutions of the equation.</td>
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<tr>
<td>A1.2.8</td>
<td>Solve an equation involving several variables (with numerical or letter coefficients) for a designated variable. Justify steps in the solution.</td>
</tr>
<tr>
<td>A2.1.1</td>
<td>Recognize whether a relationship (given in contextual, symbolic, tabular, or graphical form) is a function and identify its domain and range.</td>
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<tr>
<td>A2.1.2</td>
<td>Read, interpret, and use function notation and evaluate a function at a value in its domain.</td>
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<tr>
<td>A2.1.3</td>
<td>Represent functions in symbols, graphs, tables, diagrams, or words and translate among representations.</td>
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<tr>
<td>A2.1.4</td>
<td>Recognize that functions may be defined by different expressions over different intervals of their domains. Such functions are piecewise-defined (e.g., absolute value and greatest integer functions).</td>
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<tr>
<td>A2.1.6</td>
<td>Identify the zeros of a function and the intervals where the values of a function are positive or negative. Describe the behavior of a function as x approaches positive or negative infinity, given the symbolic and graphical representations.</td>
</tr>
<tr>
<td>A2.1.7</td>
<td>Identify and interpret the key features of a function from its graph or its formula(e), (e.g., slope, intercept(s), asymptote(s), maximum and minimum value(s), symmetry, and average rate of change over an interval).</td>
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<tr>
<td>A2.2.1</td>
<td>Combine functions by addition, subtraction, multiplication, and division.</td>
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<tr>
<td>A2.2.2</td>
<td>Apply given transformations (e.g., vertical or horizontal shifts, stretching or shrinking, or reflections about the x- and y-axes) to basic functions and represent symbolically.</td>
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<tr>
<td>A2.2.3</td>
<td>Recognize whether a function (given in tabular or graphical form) has an inverse and recognize simple inverse pairs.</td>
</tr>
<tr>
<td>A2.3.1</td>
<td>Identify a function as a member of a family of functions based on its symbolic or graphical representation. Recognize that different families of functions have different asymptotic behavior at infinity and describe these behaviors.</td>
</tr>
<tr>
<td>A2.3.3</td>
<td>Write the general symbolic forms that characterize each family of functions.</td>
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<tr>
<td>A2.4.1</td>
<td>Identify the family of functions best suited for modeling a given real-world situation.</td>
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<tr>
<td>A2.4.2</td>
<td>Graph lines (including those of the form $x = h$ and $y = k$) given appropriate information.</td>
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<tr>
<td>A3.1.1</td>
<td>Identify the family of functions best suited for modeling a given real-world situation.</td>
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<tr>
<td>A3.1.2</td>
<td>Adapt the general symbolic form of a function to one that fits the specifications of a given situation by using the information to replace arbitrary constants with numbers.</td>
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<tr>
<td>A3.3.1</td>
<td>Write the symbolic form and sketch the graph of a quadratic function given appropriate information (e.g., vertex, intercepts, etc.).</td>
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<tr>
<td>L1.1.1</td>
<td>Know the different properties that hold in different number systems and recognize that the applicable properties change in the transition from the positive integers to all integers, to the rational numbers, and to the real numbers.</td>
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<tr>
<td>L1.1.2</td>
<td>Explain why the multiplicative inverse of a number has the same sign as the number, while the additive inverse has the opposite sign.</td>
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<tr>
<td>L1.1.3</td>
<td>Explain how the properties of associativity, commutativity, and distributivity, as well as identity and inverse elements, are used in arithmetic and algebraic calculations.</td>
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<tr>
<td>L1.1.4</td>
<td>Describe the reasons for the different effects of multiplication by, or exponentiation of, a positive number by a number less than 0, a number between 0 and 1, and a number greater than 1.</td>
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<tr>
<td>L1.1.5</td>
<td>Justify numerical relationships.</td>
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</table>
“What do you remember after the summer?”
Pre-Test
Family of Functions
Algebra 1

Simplify the following.

1. $5 + (-8)$
2. $-66 ÷ 11$
3. $-19 - (-4)$
4. $3 \times 7$
5. $\frac{1}{3} + \frac{1}{2}$
6. $\frac{3}{4} \cdot 8$

Plot the following coordinate points.

7. A (-8, 5)
8. B (0, 6)
9. C (2, 1)
10. D (-4, -7)
11. E (9, 0)

Solve the following equations for $x$.

12. $5x + 4 = 19$
13. $2x - 8 = 4x$

Simplify the following using order of operations.

14. $12 + 9 ÷ 3 \cdot 2^2$
15. $(6 + 10) - 1 \cdot 4$
Given the following equations, state the slope and the y-intercept.

16. \( y = -\frac{4}{7}x + 8 \)
   slope=________________     y-intercept=_____________

17. \( y = 2x - 3 \)
   slope=_________________     y-intercept=_____________

18. What is the slope between the points (-4, 3) and (5, 1)?

19. Graph the following line on the given coordinate plane:
   \( y = -\frac{3}{2}x - 1 \)

20. Given the following graph, what is the equation to the line?
   \( y = \) ________________________
“What do you remember after the summer?”

HW

Family of Functions

Algebra 1

Simplify the following.

1.  $8 + (-15)$

2.  $-88 ÷ 8$

3.  $-29 - (-7)$

4.  $-3 \times 9$

5.  $\frac{1}{4} + \frac{1}{3}$

6.  $\frac{3}{4} \cdot 12$

Plot the following coordinate points.

7.  A (-5, 8)

8.  B (0, 2)

9.  C (4, 7)

10.  D (-3, -7)

11.  E (10, 0)

Solve the following equations for $x$.

12.  $3x + 4 = 49$

13.  $2x - 24 = 5x$

Simplify the following using order of operations.

14.  $12 + 15 ÷ 3 \cdot 2^2$

15.  $(6 + 2)^2 - 1 \cdot 4$
Given the following equations, state the slope and the y-intercept.

16. \( y = -\frac{4}{3}x + 11 \)
   slope=_____________  
   y-intercept=___________

17. \( y = 5x - 9 \)
   slope=_____________  
   y-intercept=___________

18. What is the slope between the points (-3, 3) and (5, 11)?

19. Graph the following line on the given coordinate plane: \( y = \frac{3}{2}x + 1 \)

20. Given the following graph, what is the equation to the line?

   \( y = \_______________ \)
Multiplying and Dividing Two Integers:
Rule 1. When multiplying or dividing two integers with the same sign the product/quotient is positive.

Ex. \((-12) \div (-4) = 3\)

Rule 2. When multiplying or dividing two integers with different signs the product/quotient is negative.

Ex. \((-7)(5) = -35\)

Adding Two Integers:
Rule 1. When adding integers with the same sign, add the absolute values. The sum will have the same sign as the two numbers you added.

Ex. \((-12) + (-8) = -20\)

Rule 2. When adding two integers with different signs, subtract absolute values. The sum will have the same sign as the number with the larger absolute value.

Ex. \(45 + (-5) = 40\)

Subtracting Two Integers:
Rule: Add the opposite of the number that follows the subtraction sign to the first number. Follow the rules of addition after you change the subtraction problem to addition.

\[
\begin{align*}
17 - (-3) &= 20 \\
17 + 3 &= 20 \\
(-20) - 14 &= (-20) + (-14) \\
-34 &= -34
\end{align*}
\]

Practice Problems:

1. \(7 + (-40)\) 
2. \((-16) - (-10)\) 
3. \((13)(-3)\) 
4. \((-2) \div 4\)
Simplifying Expressions using The Order of Operations:

Step 1: Simplify expressions in grouping symbols starting with the innermost set of grouping symbols.

Step 2: Simplify all exponents.

Step 3: Simplify multiplication and division as they appear from left to right.

Step 4: Simplify addition and subtraction as they appear from left to right.

Example.

\[
(7 - 5(12 \div 2^2)) + 6 \\
(7 - 5(12 \div 4)) + 6 \\
(7 - 5(3)) + 6 \\
(7 - 15) + 6 \\
(-8) + 6 \\
2
\]

Practice Problems:

1. \((2 + 6(2) + 2 - 4)\) 

2. \(\frac{8}{5 - 1} + 7 - 3 \cdot 2\)

3. \(\frac{43 - 1}{4 + 2} + 10\)

4. \((6 - 4) \cdot 49 \div 7\)
Order of Operations

Evaluate each expression.

1. \((-8) - (-2)\)  
2. \((-44) + (-9)\)  
3. \(16 - (-13) - (-5)\)

4. \((-3) + 5 + (-5) + 12\)  
5. \(1.8 - (3.7)\)  
6. \(\frac{7}{4} - \left(-\frac{1}{2}\right) \left(\frac{9}{4}\right)\)

7. \(\frac{-66}{-6}\)  
8. \(-120 \div -20\)  
9. \(128 \div -16\)
10. \(-3 \cdot 3 \cdot -6\)  
11. \((8)(-2)(-3)\)  
12. \(48 \div (4 + 4)\)  

13. \((8 + 5) \cdot \frac{35}{5} + 6\)  
14. \(8 \cdot \frac{15}{5} - (5 + 9)\)  
15. \(\frac{49}{7} \cdot \frac{60}{2 \cdot 5}\)
The identity and equality properties below can help you solve algebraic equations and evaluate algebraic expressions.

Property 1: **Additive Identity Property** - For any number \(a\), \(a + 0 = 0 + a = a\)

Example: Let \(a = 5\) \(\Rightarrow\) \(5 + 0 = 5\) or \(0 + 5 = 5\)

Property 2: **Multiplicative Identity Property** - For any number \(a\), \(a \cdot 1 = 1 \cdot a = a\)

Example: Let \(a = -4\) \(\Rightarrow\) \(-4 \cdot 1 = -4\) or \(1 \cdot -4 = -4\)

Property 3: **Multiplicative Property of Zero** - For any number \(a\), \(a \cdot 0 = 0 \cdot a = 0\)

Example: Let \(a = 3\) \(\Rightarrow\) \(3 \cdot 0 = 0\) or \(0 \cdot 3 = 0\)

Property 4: **Substitution Property** - For any numbers \(a\) and \(b\), if \(a = b\) then \(a\) may be replaced by \(b\).

\[6 + 10 \div 5\]

Example: \(6 + 2\), \(10 \div 5\) is replaced with \(2\) and \(6 + 2\) is replaced with \(8\)

Name the property illustrated by each statement.

\[
\begin{align*}
0 + 21 &= 21 & (0)15 &= 0 \\
(14 - 6) + 3 &= 8 + 3 & 23 \cdot 1 &= 23
\end{align*}
\]
Evaluate the expression and indicate the property used in each step.

\[24 \cdot 1 - 8 + 5(9 \div 3 - 3)\]

\[= \quad \text{______________________________}\]

\[= \quad \text{______________________________}\]

\[= \quad \text{______________________________}\]

\[= \quad \text{______________________________}\]

\[= \quad \text{______________________________}\]
Name the property illustrated by each statement.

1. (1)94 = 94
   _________________________________

2. -7 + 0 = -7
   _________________________________

3. 5 + (4 - 11) = 5 + (-7)
   _________________________________

4. 0 • 8 = 0
   _________________________________

Evaluate each expression and indicate the property used in each step.

5. \[10 ÷ 5 - 2^2 ÷ 2 + 13\]
   = _________________________________
   = _________________________________
   = _________________________________
   = _________________________________
   = _________________________________
   = _________________________________

6. \[3(5 - 5 \cdot 1^2) + 21 ÷ 7\]
   = _________________________________
   = _________________________________
   = _________________________________
   = _________________________________
   = _________________________________
   = _________________________________
Simplify.

7. 5 + (-10)

8. (-20) ÷ -2

9. \( \frac{16}{4} + 9(3^2 + 1) \)

10. \(-8 + \frac{-1}{2} \cdot 2^4\)

11. \((7 + 15 ÷ 5) ÷ 2 - 16 + 17\)

12. \( \frac{9}{2} - \left( -\frac{4}{2} \right) \)
1. What is the formula for the area of a rectangle?

2. What is the area of this shape?  

3. What is the area of this shape?  

4. What is the area of this shape?  

When combining like terms, you can only combine terms (shapes) that are alike.

Example 1. Simplify $3x + 5 + 2x^2 + x + 4$

*Model the expression using Algebra Tiles.*

```
3x  +  5  +  2x^2  +  x  +  4
```

*Combine like terms (shapes).*

```
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*Write simplified expression.*  

$2x^2 + 4x + 9$
Simplify each expression. Draw the Algebra Tiles and write the simplified expression.

1. \(5 + 4x + 1 + 3x\)

<table>
<thead>
<tr>
<th>Drawing of Algebra Tiles:</th>
<th>Simplified Expression:</th>
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<tbody>
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</table>

2. \(4x + x^2 + 6 + 2x + 4\)

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3. \(x^2 + 3 + 5x - x + x^2 - 2\)

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<th>Simplified Expression:</th>
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4. \(3x^2 + 4x - x^2 + 3\)

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<th>Simplified Expression:</th>
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</table>
Simplify each expression. Draw the Algebra Tiles and write the simplified expression.

1. \(5x + 3 - x + 7\)

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</table>

2. \(3x^2 + 4x + 2 + 2x\)

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<th>Drawing of Algebra Tiles:</th>
<th>Simplified Expression:</th>
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</table>

3. \(x^2 + 8 + 2x^2 + 3x + x\)

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<tr>
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<th>Simplified Expression:</th>
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</table>
Simplify each expression.

4. \(3x^2 + 8x + 5 + x^2 + 2x\) 

5. \(5x + 4x^2 + 3x - 2x^2\)

6. \(8x^2 + 4x - \frac{1}{2}x^2 + 7 - 2x\) 

7. \(2x^2 + 4x + 3x + 5 + x^2\)

8. \(7x + 3x^2 + 12 - x^2 + 3x\) 

9. \(4x + \frac{4}{3}x + 3 - x + 1\)

Simplify using the order of operations.

10. \(3 + (8 - 4) + 10 \div 2\) 

11. \(3(-4) \div 2 + 7\)

12. \(7(2) + 3(5) - 5\) 

13. \(\frac{2 + 2(4)}{4(3) - 7}\)

14. Evaluate the following expression and indicate the property used in each step.

\(-2(5) \bullet (3 - 3) + (-6)\)

= 

= 

= 

= 

= 

= 

= 

= 

= 

= 

= 

=
Example: Solve $3(2x + 1)$ using Algebra Tiles.

*Model 3 on one axis and $2x + 1$ on the other axis.*

*Fill the inside with blocks to make a rectangle. A block should not cover the seam where two blocks meet. The blocks that make up the rectangle represent the product of 3 and $2x + 1$. *</n
*Notice there are 6 $x$ blocks and 3 unit cubes.*

*Write product of $3(2x + 1)$.*

$$3(2x + 1) = 6x + 3$$
Draw and solve using Algebra Tiles.

1. \(4(x + 2) = \) ________________

2. \(2x(2x + 1) = \) ________________

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You can also think of \(3(2x + 1)\) as 3 groups of \(2x + 1\). Model this using Algebra Tiles by make 3 groups of \(2x + 1\) and then combine like terms.

<table>
<thead>
<tr>
<th>Model:</th>
<th>Combine like terms:</th>
<th>Product:</th>
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<tbody>
<tr>
<td><img src="image1" alt="Model" /></td>
<td><img src="image2" alt="Combine like terms" /></td>
<td>6x + 3</td>
</tr>
</tbody>
</table>

Draw and solve using Algebra Tiles.

3. \(3(2x + 3)\)

<table>
<thead>
<tr>
<th>Model:</th>
<th>Product:</th>
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<tbody>
<tr>
<td><img src="image3" alt="Model" /></td>
<td></td>
</tr>
</tbody>
</table>
Distributive Property with Algebra Tiles

1. \[ 5(2x + 4) = \] 
2. \[ 3(x + 6) = \] 
3. \[ 2x(2x + 3) = \] 
4. \[ 4x(x + 2) = \] 

Simplify using the distributive property, and if appropriate, combine like terms.

5. \[ -2(7x + 3) = \] 
6. \[ -4(10x + 5) = \] 
7. \[ 8(-6x + 1) = \] 
8. \[ -9(5x - 1) = \] 
9. \[ -10(3x + 5) + 2(4x - 1) = \] 
10. \[ 6x(3x - 4) - 5x(2x - 7) = \]
Simplify using the order of operations.

11. \( \frac{5(2) - 3(2)}{8 - 6} \)

12. \( 15 - (3 - 6) + 8 \)

13. Evaluate the following expression and indicate the property used in each step.

\[
5(7 - 6) + 2(2 \cdot 3 - 6)
\]


14. \( 3x^2 + 6 + 4x - x^2 + 2x - 3 \)

15. \( 5 + 7x + 3x^2 - 2x + 8 \)

16. \( 9 + 4x + 5x - 3 + 8x \)

17. \( 4x^2 + 7 + 3x + 4 - x^2 \)
1. Press \(2^{\text{nd}}\) + ENTER What is the ID# of your calculator? ______________

2. For help, what website can you visit? _______________ (Hint: Look at the back of calculator)

3. What happens to the screen when you push \(2^{\text{nd}}\) ▲ over and over? \(2^{\text{nd}}\) ▼ over and over? ________________________________________________

4. \(^\wedge\) is called the "caret" button, and is used to raise a number to a power. Find \(6^5 = \) _______. To square a number use \(x^2\) What is \(56^2\)? _______ To cube a number, press MATH and select option 3. What is \(36^3\)? __________

5. Press \(2^{\text{nd}}\) [Y=] to access the STAT PLOTS menu, how many stat plots are there? _____ Which option turns the stat plots off? ________________

6. Press STAT which option will sort data in ascending order? What do you think will happen if option 3 is selected? __________________________________

7. What letter of the alphabet is located above \(\div\)? _______________

8. To get the calculator to solve the following problem \(2\{3 + 10/2 + 6^2 - (4 + 2)\}\), what do you do to get the { and }? _______________ The answer to the problem is __________.

9. Use your calculator to answer the following:
   \[2 \times 41.587 \quad 2578/4 \quad 369 + 578\]
   Now press \(2^{\text{nd}}\) ENTER two times. What pops up on your screen? _______________ Arrow over and change the 4 to a 2. What answer do you get? __________
   How will this feature be helpful? ________________________________________________

10. What happens when the \(10^9\) and \(6\) keys are pressed? ______________

11. The \(\text{STO} \rightarrow\) button stores numbers to variables. To evaluate the expression \(\dfrac{2a + 3b}{4 - c}\), press \(9\) \(\text{STO} \rightarrow\) ALPHA MATH ENTER to store the number 9 to A. Repeat this same process if B = 2 and C = 1, then evaluate the expression by typing in the expression \(\dfrac{2a + 3b}{4 - c}\) and pressing ENTER. Is it faster just to substitute the values into the expression and solve the old-fashioned way with paper and pencil? _______
   When might this feature come in handy? ______________________________________________

12. Press \(2^{\text{nd}}\) 0 to access the calculator's catalogue. Scroll up, to access symbols. What is the first symbol? _______________ What is the last symbol? _______________
13. Press \( \text{2nd} \ [0] \) to access the calculator's catalogue. An \( \text{A} \) appears in the top right corner of the screen. This means the calculator is in alphabetical mode. Press \( \text{1} \). What is the 5\(^{th}\) entry in the L's? What do these letters stand for? ____________

14. Press \( \text{MATH} \), what do you think the first entry will do? ______________________
    Now press \( \text{CLEAR} \), then press \( \text{0} \), \( \text{5} \), \( \text{6} \) \( \text{MATH} \) and select option 1. What answer do you get? __________

15. Press \( \text{4} \) \( \text{MATH} \), choose option 5, then press \( \text{1} \), \( \text{6} \) and \( \text{ENTER} \). What did this option do? _____________________________________________________________

16. Press \( \text{Y=} \) type in \( 2x - 1 \). Press \( \text{ZOOM} \) then select 6, press \( \text{MODE} \) arrow to the bottom and arrow over to G-T and press \( \text{ENTER} \). Now press \( \text{GRAPH} \). What appears on the screen? __________________________
    Press \( \text{MODE} \) and scroll down to Full and press \( \text{ENTER} \) to restore to full screen.

17. Press \( \text{5} \) \( \div \) \( \div \) \( \text{9} \) \( \text{ENTER} \). Press \( \text{2} \) to go to the error. The cursor should be blinking on the second \( / \), press \( \text{DEL ENTER} \). What answer did you get? ____________ To convert this number to a fraction, press \( \text{MATH ENTER ENTER} \) ________

18. Enter this problem into the calculator and press \( \text{ENTER} \). \( 2.4 \times 3.7 = \) ________.
    Now press \( \text{MODE} \) \( \text{▼} \) \( \text{Float} \text{▼} \) to 0 and press \( \text{ENTER} \).
    Now press \( \text{2nd} \) \( \text{Quit} \) to return to the home screen and press \( \text{2nd} \) \( \text{ENTER} \) and the original problem should appear on the screen, now press \( \text{ENTER} \). What appears on the screen? __________ Think about this number in relation to the answer you got before.
    What did the calculator do? ______________________________
    Repeat this same process except select 2 under the Float option. Return to the home screen, recall the original problem and press \( \text{ENTER} \). What number appears on the screen? ________ What did the calculator do this time? __________________________

19. Enter \((-2)^2\) into the calculator, what answer did you get? ____________ Now enter \(-2^2\) into the calculator, what answer did you get this time? _________ Why do you think you got two different answers? ____________________________ Would \((-2)^3\) and \(-2^3\) give you two different answers? Why or why not? __________________________

20. Press \( \text{Y=} \) type \(-3x + 1\). Press \( \text{2nd} \) \( \text{GRAPH} \). What is the value of \( y \) when \( x=12 \)? _________

21. Press \( \text{Y=} \) type \(-2x+1\) into \( Y_1 \) and type \( x-2 \) into \( Y_2 \). Press \( \text{GRAPH} \). To find the point where the two lines intersect, press \( \text{2nd} \) \( \text{TRACE} \), 5:intersect, \( \text{ENTER ENTER ENTER ENTER} \). What is the point of intersection? __________
Simplify or evaluate each expression.

1. $5 + 6 \cdot (-2)$  
2. $2 - 10 + 7$  
3. $(3 + 2 \cdot 2)^2 + 14 \div 7$  
4. $7 - 5(3 + 2 \cdot 4)$

5. $3x(5 + x) - 17 - 10x$  
6. $2x^2 - 8x^2 + 6 + 11x - 5$  
7. $9(x - 1) + 9x + 9$

Evaluate the expression and indicate the property used in each step.

8. $5(2 - 10 \div 5) + 4 \cdot 1(14 \div 2 + (-2))$

Properties

= ________________________________
= ________________________________
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= ________________________________
= ________________________________
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= ________________________________
Simplify or evaluate each expression.

1. \((-6) + 6 \cdot (2)\)  
2. \(22 - 10 + 7\)  
3. \(6^2 + 14 \div 2\)  
4. \(9 - 8(3 + 2 \cdot 3)\)  

5. \(7x(5 - x) - 9 - 13x\)  
6. \(14x^2 + 6x^2 + 3 + 11x - 5\)  
7. \(5(x^2 - 1) + 9x + 15\)

Evaluate the expression and indicate the property used in each step.

8. \(3(2 - 15 \div 5) + 4 \cdot 1(14 \div 2 + (-7))\)  
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A water balloon is launched from a dorm room window. Its height, in feet, after \( t \) seconds is given by the equation \( h(t) = 128 + 64t - 16t^2 \).

1. Enter the equation into \( Y_1 \) (press \( Y= \)). Complete the table below using TABLE on your calculator (press the 2\(^{nd}\) button then GRAPH).

<table>
<thead>
<tr>
<th>( t )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h(t) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Why does the table stop after 6 seconds?

3. Use the information you find to create a graph of the flight of the balloon. Be sure to label the \( x \) and \( y \) axis along with the title of the graph.

4. Adjust the WINDOW on your calculator to view the function. You want to be able to see the maximum height of the balloon along with when it hits the ground. How is your WINDOW set?

- \( X_{\text{min}} = \)  
- \( Y_{\text{min}} = \)  
- \( X_{\text{max}} = \)  
- \( Y_{\text{max}} = \)  
- \( X_{\text{scale}} = \)  
- \( Y_{\text{scale}} = \)
5. What is the height of the dorm room window? How do you know this?

6. What is the maximum height of the balloon?

   Step 1: press the 2nd button then TRACE
   Step 2: #4
   Step 3: press the left arrow button to the left of the maximum, press ENTER
   Step 4: press the right arrow button to the right of the maximum, press ENTER
   Step 5: arrow over to the maximum to guess, press ENTER
   Step 6: the maximum is listed at the bottom

7. When does the balloon reach its maximum height? (Use the same screen from #6)

8. What is the height of the balloon when it hits the ground? When does the balloon hit the ground? (You may have to change your window so that the words and numbers are not in the way of the x-axis.)

   Step 1: press the 2nd button then TRACE
   Step 2: #2
   Step 3: arrow over to the left of the zero (x-intercept), press ENTER
   Step 4: arrow over to the right of the zero (x-intercept), press ENTER
   Step 5: arrow over to the zero (x-intercept) to guess, press ENTER
   Step 6: the zero (x-intercept) is listed at the bottom

9. Explain the value you found for h(6) (the height of the balloon after 6 seconds).

10. Find the times, rounded to the nearest hundredth, when the balloon will be 150 ft in the air.

    hundredth is ______ decimal places

    150 represents the _____ value, which represents _________________

    Step 1: press Y= and enter 150 under Y2
    Step 2: press GRAPH, you are looking at the intersection points (where y=150)
    Step 3: press the 2nd button then TRACE
    Step 4: #5
    Step 5: scroll to an intersection point and press ENTER 3 times
    Step 6: the intersection point is listed at the bottom
    Step 7: repeat steps 3-6 for the other intersection point
Simplify by distributing and combining like terms.

1. \(9xy + 4x - 7 - 19xy + 11x\) \\
2. \(6(x - 7) + 24x\)

3. \(2x(x + 1) - 3(x - 8)\) \\
4. \(-7x + 16x^2 + \frac{5}{2}x^2 + 10x\)

Evaluate the expression and indicate the property used in each step.

5. \(\frac{13 + 3}{2} \cdot 1 + 4(5 - 5 + 11)\)

\[= \]
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A rocket is launched with an initial velocity of 192 ft/sec. Its height, in feet, after $t$ seconds is given by the equation $h(t) = 192t - 16t^2$.

1. Enter the equation into Y1 (press Y=). Complete the table below using TABLE on your calculator (press the 2nd button then GRAPH).

<table>
<thead>
<tr>
<th>$t$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h(t)$</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

2. Why does the table stop after 13 seconds?

3. Use the information you find to create a graph of the flight of the rocket. Be sure to label the $x$ and $y$ axis along with the title of the graph.

4. Adjust the WINDOW on your calculator to view the function. You want to be able to see the maximum height of the rocket along with when it hits the ground. How is your WINDOW set?

$$X_{\text{min}} = \phantom{000} \quad Y_{\text{min}} = \phantom{000}$$

$$X_{\text{max}} = \phantom{000} \quad Y_{\text{max}} = \phantom{000}$$

$$X_{\text{scl}} = \phantom{000} \quad Y_{\text{scl}} = \phantom{000}$$

5. Explain why you know that the rocket is being launched from the ground.
6. What is the maximum height of the rocket?

7. When does the rocket reach its maximum height? (Use the same screen from #6)

8. When does the rocket hit the ground?

9. Explain the value you found for h(13) (the height of the rocket after 13 seconds).

10. Find the times, rounded to the nearest hundredth, when the rocket will be 200 ft in the air.

   hundredth is ______ decimal places

   200 represents the ______ value, which represents ___________________
A function is a set of ordered pairs where each x-value is paired with exactly one y-value.

The vertical line test is used to identify functions on a graph. A vertical object placed over a graph can only cross the graph in one place for the graph to be considered a function.

Decide if each set of ordered pairs represents a function:

1. \{ (1, 2), (3, 4), (5, 6) \} Yes, the set of ordered pairs is a function since each x-value is paired with exactly one y-value (no repeated x-values).

2. \{ (1, 2), (1, 3), (1, 4) \}

Do the following graphs represent a function?

3. Yes, the graph in #3 passes the VLT.

4. 

DOMAIN: The set of all x-values of the ordered pairs.

What is the domain for #1-4 above?

1. \{1,3,5\} 

2. 

3. \(-\infty, \infty\) 

4. 

RANGE: The set of all y-values of the ordered pairs.

What is the range for #1-4 above?

1. \{2,4,6\} 

2. 

3. \(-\infty, \infty\) 

4. 

(# least to greatest)
Identify if each is a function or not a function and identify the domain and range.

5.

Function? Yes / No
Domain: _____ $(-\infty, \infty)$
Range: _____ $(-\infty, \infty)$

6.

Function? Yes / No
Domain: ______________________
Range: ______________________

7.

Function? Yes / No
Domain: ______________________
Range: ______________________

8.

Function? Yes / No
Domain: ______________________
Range: ______________________
9. Roast in the Oven
   a. Why doesn't the oven's initial temperature start at the origin?
   b. Why does the graph have a wavy appearance?

10. Lemonade Stand
    a. Why does the graph show values below zero?
    b. What is the meaning of the point where the graph crosses the horizontal axis?

11. A hot piece of aluminum foil cools to the temperature of the room. Circle the graph that matches the situation. Explain what is incorrect for each of the other three graphs.

   A
   B
   C
   D
Function, Domain, Range & Vertical Line Test

For each of the following:

a. Determine whether each is a function.
b. State the domain.
c. State the range.

1.

1a. ________________
1b. ________________
1c. ________________

2.

2a. ________________
2b. ________________
2c. ________________

3.

3a. ________________
3b. ________________
3c. ________________

4.

4a. ________________
4b. ________________
4c. ________________

5.

5a. ________________
5b. ________________
5c. ________________

6.

6a. ________________
6b. ________________
6c. ________________
7. \{(3,4),(2,4),(-6,4)\}

7a. \\
7b. \\
7c. \\

8. \{(-1,2),(1,-2),(2,1),(-2,-1)\}

8a. \\
8b. \\
8c. \\

9. \{(-5,4),(-5,-8),(-5,10)\}

9a. \\
9b. \\
9c. \\

10. \{(7,3),(6,2),(5,1),(4,0)\}

10a. \\
10b. \\
10c. \\
11. The event “climbing a hill and sledding down” is graphed. Describe the sledder's journey at points A – F. (Be careful, the y-axis is labeled Speed, NOT height.)

A

B

C

D

E

F

Evaluate each expression.

12. $15 - 10\left(12 \div 2^2 + 2\right)$

13. $\left(25 \div \left(10 - 5 + (8 - 2^3)\right)\right)^2$

14. $\frac{36 - 6 \cdot 2^0}{100 \div 4^1}$

Name the property illustrated:

15. $145 + 0 = 145$

16. $1 \cdot 36 = 36$

17. $123,456 \cdot 0 = 0$
A ball is dropped from a 400 foot tower. Its height, in feet, after t seconds is given by the equation $h(t) = 400 - 16t^2$.

1. Enter the equation into $Y_1$. Create and complete a table below using TABLE on your calculator.

2. Use the information you find to create a graph of the flight of the ball. Don’t forget to label!

3. Adjust the WINDOW on your calculator to view the function. How is your WINDOW set?

4. What was the height of the ball at time 0?

5. When does the ball hit the ground?
6. What is the domain?

7. What is the range?

8. Find the time, rounded to the nearest hundredth, when the ball will be 100 ft in the air.
ZEROS - Coordinate(s) where a function intersects the x-axis; y-value of zero; also called the x-intercept.

Y-INTERCEPT - The coordinate where a function intersects the y-axis; x-value of zero.

Identify the x- and y-intercepts of the functions.

Example:

1. $x$-intercept(s): $(-7, 0)$ & $(3, 0)$
   
   $y$-intercept: $(0, 5)$

2. $x$-intercept(s):
   
   $y$-intercepts:

Without your calculator, find the zeros (x-intercepts) and y-intercepts.

Example: $f(x) = (x - 7)(x + 4)$

zero (x-intercept)

*Set each quantity ($(x - 7)$ & $(x + 4)$) equal to 0 and solve for $x$. 

$$\begin{align*}
X - 7 &= 0 \\
+7 &

x + 4 &= 0 \\
-4 &

X &= 7 \\
+x &= -4 \\
\end{align*}$$

$x$-intercepts are $(7, 0)$ and $(-4, 0)$

y-intercept

*Substitute 0 in for $x$ and solve for $y$. 

$$\begin{align*}
f(x) &= (0 - 7)(0 + 4) \\
&= (-7)(4) \\
f(x) &= -28
\end{align*}$$

$y$-intercept is $(0, -28)$

3. $f(x) = (2x - 1)(3x + 5)$
Use your calculator to find the zeros and y-intercepts (round to the nearest hundredth).

Example: \( f(x) = x^2 + 9x - 17 \)

To find the y-intercept:

Press \( \boxed{Y=} \) and enter \( x^2 + 9x - 17 \) into \( y_1 \).

Set your window as shown.

Press graph.

Press \( \boxed{2^{nd}} \) \( \boxed{TRACE} \) to get to the calculate menu. Select 1:value.

Enter 0 for the value of \( x \). Press \( \boxed{ENTER} \) and get the y-intercept as \((0, -17)\).

To find the x-intercepts:

*You should already have \( x^2 + 9x - 17 \) in \( Y_1 \). Press \boxed{GRAPH}.

Press \( \boxed{2^{nd}} \) \( \boxed{TRACE} \) to get to the calculate menu. Select 2:zero.

Using the arrow keys, move the cursor so it is to the left of the point where the graph crosses the x-axis and press \( \boxed{ENTER} \).

Move the arrow to the right of that point and press \( \boxed{ENTER} \).

Press \( \boxed{ENTER} \) once more when you see \textit{Guess?} on your screen.

One zero (x-intercept) is \((-10.60, 0)\).

Repeat the steps above to find the other zero (x-intercept).

The other zero (x-intercept) is \((1.60, 0)\).
4. \( f(x) = -2x^2 + 4x + 30 \)

x-intercept(s):

y-intercept:

Given \( f(x) = 2x - 6 \) and \( g(x) = 2 - 2x^2 \), determine each value.

Example: Find \( f(2) \).

\[
\begin{align*}
  f(2) &= 2(2) - 6 \quad \text{Substitute 2 for } x \text{ and solve.} \\
  f(2) &= 4 - 6 \\
  f(2) &= -2 \\
  &\quad \text{This means (2, -2) is a point on the line } 2x - 6. 
\end{align*}
\]

5. \( f(-2.5) \)

6. \( g(-1) \)

7. \( g(3) \)
Give the coordinates of the intercepts.

1. 
   zeros: 
   y-intercept: 

2. 
   zeros: 
   y-intercept: 

3. 
   zeros: 
   y-intercept: 

Find the zeros (x-intercepts) and y-intercepts algebraically.

4. \( f(x) = (x - 2)(3x + 4) \)

5. \( f(x) = (3x + 5)(2x + 8) \)

Use your calculator to find the zeros and y-intercepts of the following. Round to the nearest hundredth.

6. \( f(x) = 4x^2 - 5x - 6 \)

7. \( f(x) = 4x + 5 \)

8. \( f(4) \)

9. \( g(-2) \)

10. \( f\left(\frac{1}{2}\right) \)

Given \( f(x) = 4x - 2 \) and \( g(x) = x^2 + 5x \), determine each value.

8. \( f(4) \)

9. \( g(-2) \)

10. \( f\left(\frac{1}{2}\right) \)
Simplify each expression.

11. $2(x + 3) + 7x$  
12. $5(t - 2) + 14$

13. $-3(n + 2) + 7(2)$  
14. $5(r + 7) + 2r$

Evaluate each expression and indicate the property used in each step.

15. $(2 + 3)^2 - 4(1)$

\[
\begin{align*}
&= \\
&= \\
&= \\
&= \\
&= 
\end{align*}
\]

State the domain and range of each function.

16. 
   \[
   \text{Domain:} \\
   \text{Range:}
   \]

17. 
   \[
   \text{Domain:} \\
   \text{Range:}
   \]
CRITICAL POINT - The point(s) at which the nature of the graph changes.

ABSOLUTE MAXIMUM / MINIMUM - Highest / lowest point on the graph.

RELATIVE MAXIMUM / MINIMUM - Highest / lowest point for a portion of the graph.

INFLECTION POINT - The point where the graph changes.

Functions are INCREASING if the y-values are increasing as you read left to right.

Functions are DECREASING if the y-values are decreasing as you read left to right.

Name and identify the critical point(s) for each graph. Describe the behavior as “increasing” or “decreasing” and give the appropriate interval in which the graph increases or decreases.

1. Because the graph is read left to right the x values are used when writing the interval

The graph is decreasing:
\(-\infty < x < \infty\) or \((-\infty, \infty)\)
2. The graph is decreasing:
\(-\infty < x < 4.75\) or \((-\infty, 4.75)\)

The graph is increasing:
\(4.75 < x < \infty\) or \((4.75, \infty)\)

3. Absolute Minimum \((4.75, -5)\)
Name ______________________________

Family of Functions
Algebra 1

Name and identify the critical point(s) and describe the behavior for each graph.

1.

2.

3.

4.
Mixed Review.

5. Use the set of ordered pairs to answer the following questions:
\[ \{(−5, 0),(−8, 0),(−6, 2),(3, −8),(−5, 7),(5, 10)\} \]

State the domain:________________________________________________________

State the range:__________________________________________________________

Graph the set of points:

\[
\begin{array}{c}
\begin{array}{c}
\text{X Axis}
\end{array}
\end{array}
\]

Is the graph a function? Yes / No Why?

6. The height \( h \) in feet of a rocket \( t \) seconds after blast-off is given by the formula:
\[ h(t) = 1440t - 16t^2 \]

Find each of the following:

\[ h(0) = \] ________________

\[ h(1) = \] ________________

\[ h(2) = \] ________________

\[ h(3) = \] ________________
A water balloon is launched from a dorm room window. Its height, in feet, after $t$ seconds is given by the equation $h(t) = 144 + 96t - 16t^2$.

1. Enter the equation into $Y_1$. Create and complete a table below using TABLE on your calculator.

2. Use the information you find to create a graph of the flight of the balloon. Don’t forget to label!

3. What is the height of the dorm room window?

4. What is the maximum height of the balloon?

5. When does the balloon hit the ground?

6. What is the domain?

7. What is the range?

8. Find the times, rounded to the nearest hundredth, when the balloon will be 200 ft in the air.
9. \{(-5,7),(4,-2),(-5,11),(3,6),(2,6)\}

State the domain.

State the range.

Is this a function? Why or why not?

10. State the domain.

State the range.

Is this a function? Why or why not?

11. Find the x and y intercepts of the following function. Be sure to write them as coordinate points.

\[ f(x) = (x + 7)(2x - 5) \]

x-intercept(s) y-intercept

12. Given the following graph, find the x and y intercepts (be sure to write them as coordinate points).
13. Given $f(x) = 2x + 11$, find $f(3)$ and $f(-10)$. Be sure to write the answers as coordinate pts.

\[ f(3) = \]
\[ f(-10) = \]

For each graph, give the type and location of the critical point(s) and describe the behavior.

14.  

\[ \text{Critical point(s):} \]
\[ \text{Behavior:} \]

15.  

\[ \text{Critical point(s):} \]
\[ \text{Behavior:} \]

16.  

\[ \text{Critical point(s):} \]
\[ \text{Behavior:} \]

17.  

\[ \text{Critical point(s):} \]
\[ \text{Behavior:} \]
Pattern of Points
Notes
Family of Functions
Algebra 1

PATTERN OF POINTS – a system used to draw graphs without a calculator

Quadratic:
Parent Function: \( y = x^2 \)

- not flipped
- flipped

Shape: ______________________

Compare the left and right values with the up and down values. Given the \( x \) values, how can we find the \( y \) values?

Cubic:
Parent Function: \( y = x^3 \)

- not flipped
- flipped

Shape: ______________________

Compare the left and right values with the up and down values. Given the \( x \) values, how can we find the \( y \) values?
Linear:  
Parent Function:  \( y = x \)

<table>
<thead>
<tr>
<th>not flipped</th>
<th>flipped</th>
</tr>
</thead>
</table>

Compare the left and right values with the up and down values. Given the \( x \) values, how can we find the \( y \) values?

Absolute Value:  
Parent Function:  \( y = |x| \)

<table>
<thead>
<tr>
<th>not flipped</th>
<th>flipped</th>
</tr>
</thead>
</table>

Compare the left and right values with the up and down values. Given the \( x \) values, how can we find the \( y \) values?
Linear Functions
Notes
Family of Functions
Algebra 1

$y = -(x + 3) + 5$ is a linear function. Its graph looks like:

From the origin the graph’s starting point shifted left 3 and up 5, and the graph flipped. There is an $x$-intercept at (2,0). There is a $y$-intercept at (0,2). The domain of the function is $(-\infty, \infty)$, and the range of the function is $(-\infty, \infty)$. There are no critical points. The function is decreasing from $(-\infty, \infty)$.

The graph of the linear parent function has a starting point at the ________________.

Graphs of linear functions are (look like) ________________________________________.

*A number inside parenthesis shifts the graph’s starting point __________________________

______________________________.

(* remember to think “opposite” when plotting left and right)

A number outside parenthesis shifts the graph’s starting point________________________

______________________________.

A negative in front of the parenthesis means the graph ________________________________.

X-intercepts are where the graph crosses the ________________________________.

Y-intercepts are where the graph crosses the_______________________________________.

Linear functions have ________ critical points.
For each of the following: **a. Graph (use pattern of points)**  
**b. Explain the translations (shifting)**  
**c. Find the x and y intercepts (give answers as coordinate points)**  
**d. Give the domain and range**  
**e. Give the type and find the location of the critical point**  
**f. Describe the behavior of the graph (increasing/decreasing)**  
**g. Find f(x) (give answer as a coordinate point) and show the point on the graph.**

1. \( f(x) = -(x + 3) \)
   
   **a.**
   
   **b.**
   
   **c.**
   
   **d.**
   
   **e.**
   
   **f.**
   
   **g.**
   
   \( f(-9) = \)

2. \( f(x) = (x - 2) - 7 \)
   
   **a.**
   
   **b.**
   
   **c.**
   
   **d.**
   
   **e.**
   
   **f.**
   
   **g.**
   
   \( f(1) = \)

3. \( f(x) = (x - 6) + 2 \)
   
   **a.**
   
   **b.**
   
   **c.**
   
   **d.**
   
   **e.**
   
   **f.**
   
   **g.**
   
   \( f(7) = \)
For each of the following: **a.** Graph (use pattern of points) **b.** Explain the translations (shifting) **c.** Find the $x$ and $y$ intercepts (give answers as coordinate points) **d.** Give the domain and range **e.** Give the type and find the location of the critical point **f.** Describe the behavior of the graph (increasing/decreasing) **g.** Find $f(x)$ (give answer as a coordinate point) and show the point on the graph

1. $f(x) = -(x + 7) + 5$

   **Type:**

   **a.**

   **b.**

   **c.**

   **d.**

   **e.**

   **f.**

   **g.** $f(8) =$

2. $f(x) = -(x – 3)^2 – 2$

   **Type:**

   **a.**

   **b.**

   **c.**

   **d.**

   **e.**

   **f.**

   **g.** $f(4) =$
3. \( f(x) = (x - 1) - 6 \)  

Type:_______________________

a. 

b.__________________________________________ 

c.__________________________________________ 

d.__________________________________________ 

e.__________________________________________ 

f.__________________________________________ 

g. \( f(9) = \) 

g._________ 

4. \( f(x) = -(x) + 4 \)  

Type:_______________________ 

a. 

b.__________________________________________ 

c.__________________________________________ 

d.__________________________________________ 

e.__________________________________________ 

f.__________________________________________ 

g. \( f(-5) = \) 

g._________ 

Write an equation for each translation.

5. A linear function right three, up fifteen and flipped.

6. A cubic function up four, flipped and left two.

7. A linear function left eight and down five.
$y = (x + 3)^2 - 4$ is a quadratic function. Its graph looks like:

![Graph of a quadratic function]

From the origin the graph’s starting point shifted left 3 and down 4. There are $x$-intercepts at (-5,0) and (-1,0). There is a $y$-intercept at (0,5). The domain of the function is $(-\infty, \infty)$, and the range of the function is $[-4, \infty)$. There is an absolute minimum at (-3,-4). The function is decreasing from $(-\infty,-3)$ and increasing from $(-3,\infty)$.

The graph of the quadratic parent function has a starting point at the ___________________.

Graphs of quadratic functions are (look like) ________________________________________.

*A number inside parenthesis shifts the graph’s starting point __________________________
____________________________________________________________________________.

(* remember to think “opposite” when plotting left and right)

A number outside parenthesis shifts the graph’s starting point________________________
____________________________________________________________________________.

A negative in front of the parenthesis means the graph ________________________________.

$X$-intercepts are where the graph crosses the ________________________________.

$Y$-intercepts are where the graph crosses the______________________________.

Quadratic functions have two types of critical points:__________________________________
____________________________________________________________________________.
For each of the following: a. Graph (use pattern of points)  
b. Explain the translations (shifting)  
c. Find the x and y intercepts  (give answers as coordinate points) 
d. Give the domain and range  
e. Give the type and find the location of the critical point  
f. Describe the behavior of the graph (increasing/decreasing)  
g. Find f(x) (give answer as a coordinate point) and show the point on the graph.

1. \( f(x) = -(x - 3)^2 + 4 \)  
   a.  
   b.  
   c.  
   d.  
   e.  
   f.  
   g.  
   g. \( f(2) = \)  

2. \( f(x) = -(x + 4)^2 + 9 \)  
   a.  
   b.  
   c.  
   d.  
   e.  
   f.  
   g.  
   g. \( f(-8) = \)  

3. \( f(x) = (x + 7)^2 + 1 \)  
   a.  
   b.  
   c.  
   d.  
   e.  
   f.  
   g.  
   g. \( f(-5) = \)
Quadratic Functions
HW
Family of Functions
Algebra 1

For each of the following: 

a. Graph (use pattern of points)  
b. Explain the translations (shifting)  
c. Find the \( x \) and \( y \) intercepts (give answers as coordinate points)  
d. Give the domain and range  
e. Give the type and find the location of the critical point  
f. Describe the behavior of the graph (increasing/decreasing)  
g. Find \( f(x) \) (give answer as a coordinate point) and show the point on the graph

1. \( f(x) = -(x)^2 \)  

Type: ____________________________

a. 

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. \( f(3) = \) 

g. _________

2. \( f(x) = (x)^2 - 9 \)  

Type: ____________________________

a. 

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. \( f(-1) = \) 

g. _________
3. \( f(x) = (x + 5)^2 - 9 \)

Type:_______________________

a. 

\[
\begin{array}{c}
\includegraphics[width=\textwidth]{image1.png}
\end{array}
\]

b. 

c. 

d. 

e. 

f. 

g. \( f(-3) = \)

g.________

4. \( f(x) = -(x - 2)^2 + 4 \)

Type:_______________________

a. 

\[
\begin{array}{c}
\includegraphics[width=\textwidth]{image2.png}
\end{array}
\]

b. 

c. 

d. 

e. 

f. 

g. \( f(3) = \)

g.________
$y = (x - 4)^3 - 1$ is a cubic function. Its graph looks like:

From the origin the graph’s starting point shifted right 4 and down 1. There is an $x$-intercept at (5,0). There is a $y$-intercept at (0, -65). The domain of the function is $(-\infty, \infty)$, and the range of the function is $(-\infty, \infty)$. There is an inflection point at (4, -1). The function is increasing from $(-\infty, \infty)$.

The graph of the cubic parent function has a starting point at the ______________________.

Graphs of cubic functions look like ________________________________________________.

*A number inside parenthesis shifts the graph’s starting point __________________________ ________________________________.

(* remember to think “opposite” when plotting left and right)

A number outside parenthesis shifts the graph’s starting point__________________________

A negative in front of the parenthesis means the graph ________________________________.

X-intercepts are where the graph crosses the ________________________________.

Y-intercepts are where the graph crosses the_______________________________________.

Cubic functions have one type of critical point:______________________________.
For each of the following:  

a. Graph (use pattern of points)  
b. Explain the translations (shifting)  
c. Find the x and y intercepts (give answers as coordinate points)  
d. Give the domain and range  
e. Give the type and find the location of the critical point  
f. Describe the behavior of the graph (increasing/decreasing)  
g. Find f(x) (give answer as a coordinate point) and show the point on the graph.

1. \( f(x) = (x + 1)^3 + 1 \)
   a. 
   b. ____________________________
   c. ____________________________
   d. ____________________________
   e. ____________________________
   f. ____________________________
   g. \( f(-3) = \)________________

2. \( f(x) = -(x - 6)^3 + 1 \)
   a. 
   b. ____________________________
   c. ____________________________
   d. ____________________________
   e. ____________________________
   f. ____________________________
   g. \( f(4) = \)________________

3. \( f(x) = -(x + 3)^3 + 8 \)
   a. 
   b. ____________________________
   c. ____________________________
   d. ____________________________
   e. ____________________________
   f. ____________________________
   g. \( f(-2) = \)________________
For each of the following: a. Graph (use pattern of points) b. Explain the translations (shifting) c. Find the x and y intercepts (give answers as coordinate points) d. Give the domain and range e. Give the type and find the location of the critical point f. Describe the behavior of the graph (increasing/decreasing) g. Find \( f(x) \) (give answer as a coordinate point) and show the point on the graph.

1. \( f(x) = -(x - 1)^3 + 8 \)
   - a. 
   - b. 
   - c. 
   - d. 
   - e. 
   - f. 
   - g. \( f(2) = \) 

2. \( f(x) = (x + 1)^3 \)
   - a. 
   - b. 
   - c. 
   - d. 
   - e. 
   - f. 
   - g. \( f(-3) = \) 

RHS Math Department  Algebra 1--Unit 1: Family of Functions 2008-2009
3. \( f(x) = (x - 3)^2 + 4 \)  

Type:_______________________

a. 

b.__________________________

c.__________________________

d.__________________________

e.__________________________

f.__________________________

g. \( f(1) = \) 

  
  g.__________

4. \( f(x) = -(x + 2)^3 + 1 \)  

Type:_______________________

a. 

b.__________________________

c.__________________________

d.__________________________

e.__________________________

f.__________________________

g. \( f(-3) = \) 

  
  g.__________

Write an equation for each translation.

5. A cubic function down eight and right ten.

6. A cubic function up three, flipped and right five.

7. A quadratic function flipped, left eleven and up seven.
Absolute Value Functions

Notes
Family of Functions
Algebra 1

\[ y = -|x - 1| + 6 \] is an absolute value function. Its graph looks like:

From the origin the graph’s starting point shifted right 1 and up 6, and the graph flipped. There are \( x \)-intercepts at \((-5,0)\) and \((7,0)\). There is a \( y \)-intercept at \((0,5)\). The domain of the function is \((-\infty, \infty)\), and the range of the function is \((-\infty, 6)\). There is an absolute maximum at \((1,6)\). The function is increasing from \((-\infty, 1)\) and decreasing from \((1, \infty)\).

The graph of the absolute value parent function has a starting point at the _______________.

Graphs of absolute value functions look like ________________________________________.

*A number inside the bars shifts the graph’s starting point ________________________________________.

(* remember to think “opposite” when plotting left and right)

A number outside the bars shifts the graph’s starting point _____________________________

____________________________________________________________________________.

A negative in front of the bars means the graph ________________________________________.

X-intercepts are where the graph crosses the ________________________________________.

Y-intercepts are where the graph crosses the ________________________________________.

Absolute value functions have two types of critical points: ____________________________.
For each of the following: a. Graph (use pattern of points) b. Explain the translations (shifting) c. Find the $x$ and $y$ intercepts (give answers as coordinate points) d. Give the domain and range e. Give the type and find the location of the critical point f. Describe the behavior of the graph (increasing/decreasing) g. Find $f(x)$ (give answer as a coordinate point) and show the point on the graph.

1. $f(x) = |x + 2| - 7$
   a. 
   b. _________________________
   c. _________________________
   d. _________________________
   e. _________________________
   f. _________________________
   g. $f(-10) =$

2. $f(x) = -|x + 4| + 3$
   a. 
   b. _________________________
   c. _________________________
   d. _________________________
   e. _________________________
   f. _________________________
   g. $f(5) =$

3. $f(x) = |x - 3| + 5$
   a. 
   b. _________________________
   c. _________________________
   d. _________________________
   e. _________________________
   f. _________________________
   g. $f(6) =$

RHS Math Department
Absolute Value Functions

For each of the following: a. Graph (use pattern of points) b. Explain the translations (shifting) c. Find the x and y intercepts (give answers as coordinate points) d. Give the domain and range e. Give the type and find the location of the critical point f. Describe the behavior of the graph (increasing/decreasing) g. Find f(x) (give answer as a coordinate point) and show the point on the graph.

1. \( f(x) = |x - 6| + 5 \)

- a.  
- b.  
- c.  
- d.  
- e.  
- f.  
- g. \( f(2) = \)

2. \( f(x) = -|x + 9| + 1 \)

- a.  
- b.  
- c.  
- d.  
- e.  
- f.  
- g. \( f(-3) = \)
3. \( f(x) = (x - 4)^3 \)

Type: _________________________

a. ________________

b. ________________

c. ________________

d. ________________

e. ________________

f. ________________

g. \( f(2) = \) ______

4. \( f(x) = |x + 3| - 5 \)

Type: _________________________

a. ________________

b. ________________

c. ________________

d. ________________

e. ________________

f. ________________

g. \( f(-6) = \) ______

Write an equation for each translation.

5. An absolute value function left six and down six.

6. A quadratic function flipped and down ten.

7. A linear function up twelve, right one and flipped.
For the following problems graph, describe the translations, find the intercepts, give the domain and range, state the type and location of the critical point and describe the behavior.

1. \( f(x) = -(x + 5) + 3 \)

2. \( f(x) = -(x - 2)^2 + 1 \)

3. \( f(x) = -|x - 6| - 7 \)

4. \( f(x) = (x - 1)^3 + 8 \)
INVERSE - the inverse of a relation is obtained by switching the x and y values in a coordinate point. Inverses are reflected over the y=x line. Not all inverses are functions. If the original graph and the inverse graph intersect, they will do so at the y=x line (see #1).

Example: {(-3,6), (-2,5), (-1,4), (0,3), (1,4), (2,5), (3,6)}

a. Domain? (all x values)
   (-3,-2,-1,0,1,2,3,)

b. Range? (all y values)
   (3,4,5,6)

c. Write the inverse. (switch x and y's)
   {(6,-3),(5,-2),(4,-1),(3,0),(4,1),(5,2),(6,3)}

d. Graph the function and its inverse.

e. Is the inverse a function?
   NO, b/c repeated x-values

f. Domain of the inverse?
   (3,4,5,6)

g. Range of the inverse?
   (-3,-2,-1,0,1,2,3,)

h. What do you notice about the domain and range of the original with the domain and range of the inverse?

1. f(x) = (x - 3)^2 - 7
   a. Graph the function and the y=x line.  
      (think shifting and pattern of points)

b. Domain?

c. Range?

d. Write coordinates of the inverse.

e. Graph the inverse. (label the graphs)

f. Is the inverse a function?

g. Domain of the inverse?      h. Range of the inverse?
2. A cubic function shifted up two and left one.
   a. Graph the function.

   b. Domain?

   c. Range?

   d. Write coordinates of the inverse.

   e. Graph the inverse. (label the graphs)

   f. Is the inverse a function?

   g. Domain of the inverse?

   h. Range of the inverse?

   i. Draw the y=x line. Do the two graphs intersect at y=x?

3. Using the picture at the right:
   a. Domain?

   b. Range?

   c. Write coordinates of the inverse.

   d. Graph the inverse. (label the graphs)

   e. Is the inverse a function?

   f. Domain of the inverse?

   g. Range of the inverse?

   h. Draw the y=x line. Do the two graphs intersect at y=x?
For each of the following state:

a. Domain
b. Range
c. Inverse
d. Is the inverse a function?
e. Domain of inverse
f. Range of inverse

*Tip: when drawing the graphs for #4 and #5, first write down some coordinate points of the original graph then switch your x and y values to get the coordinate points for the inverse. Plot those points and connect the dots to see the graph of the inverse.

1. \{(-2,-8),(-1,-2),(0,0),(1,-2),(2,-8)\}
   
   a. ____________________________ b. ____________________________
   
   c. ____________________________ d. ____________________________
   
   e. ____________________________ f. ____________________________

2. \{(2,-2),(3,5),(4,6),(5,7),(6,14)\}
   
   a. ____________________________ b. ____________________________
   
   c. ____________________________ d. ____________________________
   
   e. ____________________________ f. ____________________________

3. 

<table>
<thead>
<tr>
<th>X</th>
<th>-3</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>4</td>
<td>-2</td>
<td>-5</td>
<td>-2</td>
<td>4</td>
</tr>
</tbody>
</table>

a. ____________________________ b. ____________________________

<table>
<thead>
<tr>
<th>c. ____________________________ d. ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>e. ____________________________ f. ____________________________</td>
</tr>
</tbody>
</table>
1. Enter $y = (x - 1)^2 - 9$ into the calculator.

2. Which variable is the independent variable and which is the dependent variable?
   
   Independent Variable_____________________

   Dependent Variable_____________________

3. Graph the function.

4. State the domain and range of this function.

   Domain__________________________

   Range__________________________

5. Write the coordinates of this function.

6. Find the inverse of this function by writing down the new coordinates.
7. Graph the inverse.

8. State the domain and range of the inverse.

   Domain__________________
   Range___________________

9. Is the inverse a function? Why or why not?

10. a. Using a ruler, draw the x and y axis from one of the above graphs on your patty paper, and label the axes.
    b. Accurately graph both the function and the inverse on the patty paper. If possible, draw each graph in a different color.
    c. Draw a dotted $y=x$ line on the patty paper (use the grid and a ruler to be accurate). Does the function graph and the inverse graph intersect at the $y=x$ line? (they should)
    d. Now, fold your patty paper along the $y=x$ line. What do you notice when you fold your patty paper along the $y = x$ line?
Inverses
HW, Day 2
Family of Functions
Algebra 1

For each of the following state:

a. Domain
b. Range
c. Inverse
d. Is the inverse a function?
e. Domain of inverse
f. Range of inverse

*Tip: when drawing the graphs for #4 and #5, first write down some coordinate points of the original graph then switch your x and y values to get the coordinate points for the inverse. Plot those points and connect the dots to see the graph of the inverse.

1. \{(5,10),(-30,-2),(-1,1),(6,-4)\}
   a. __________________________________ b. ________________________________
   c. __________________________________ d. __________________________
   e. __________________________________ f. ________________________________

2. \{(9,8),(11,-7),(16,11),(-1,12),(-6,11)\}
   a. __________________________________ b. ________________________________
   c. __________________________________ d. __________________________
   e. __________________________________ f. ________________________________

3. 
<table>
<thead>
<tr>
<th>X</th>
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<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
   a. __________________________________ b. ________________________________
   c. __________________________________ d. __________________________
   e. __________________________________ f. ________________________________
1. Complete the table then graph \( f(x) = 10^x \)

<table>
<thead>
<tr>
<th>x</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Write the inverse of #1 in the table then graph it

<table>
<thead>
<tr>
<th>x</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

EXPONENTIAL FUNCTION - defined as \( y = 10^x \); as \( x \) increases \( y \) increases exponentially

LOGRITHMIC FUNCTION - defined as \( y = \log x \); inverse of exponential functions

3. Explain how each of the following functions will shift from the parent function:

   a. \( f(x) = 10^x + 2 \)  
      Since 2 is added, the function shifts up 2.

   b. \( f(x) = 10^x - 4 \)  

   c. \( f(x) = 10^{x+5} \)  
      Since 5 is added to \( x \) in the exponent, the function shifts left 5.

   d. \( f(x) = 10^{x-8} \)  

   e. \( f(x) = \log(x) - 6 \)  
      Since 6 is subtracted, the function shifts down 6.

   f. \( f(x) = \log(x) + 7 \)

   g. \( f(x) = \log(x - 1) \)  
      Since 1 is subtracted from \( x \) within parentheses, the function shifts right 1.

   h. \( f(x) = \log(x + 9) \)
4. Match each equation with its inverse. Write the number of the correct equation next to the letter answer blank below.

5. Match each equation with its inverse. Write the number of the correct equation next to the letter answer blank below:

6. Given the equation of each function described.
   a. Exponential shifted left 8.
      \[ y = 10^{x+8} \]
   b. Logarithmic shifted up 4.
   c. Exponential shifted right 4 and down 2.
   d. Logarithmic shifted down 5 and left 3.
      \[ y = \log(x + 3) - 5 \]
Exponential is often used for story problems that involve money, bacteria, population.

7. Certain bacterium doubles every 20 minutes. The bacteria colony starts with 5 cells.
   a. Complete the table

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Time Periods</th>
<th>Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>40</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>60</td>
<td>3</td>
<td>40</td>
</tr>
</tbody>
</table>

   b. How many will you have in 1 hour?

   c. 7 hours?

   d. Graph the function and its inverse. Be sure to label.

   e. What type of function is each?

   f. In which case would you use each?
1. Match each equation with its inverse. Write the number of the correct equation next to the letter answer blank below:
   a. \( y = 10^{x + 3} + 6 \) 
   b. \( y = 10^{x - 6} - 3 \) 
   c. \( y = 10^{x + 6} - 3 \) 
   d. \( y = 10^{x - 3} + 6 \)

   \( \circ \) \( y = \log(x - 3) - 6 \) \( \circ \) \( y = \log(x - 6) - 3 \) \( \circ \) \( y = \log(x - 3) + 6 \) \( \circ \) \( y = \log(x - 6) + 3 \) 

2. Match each equation with its inverse. Write the number of the correct equation next to the letter answer blank below:
   a. \( y = \log(x + 4) + 2 \) 
   b. \( y = \log(x - 4) + 2 \) 
   c. \( y = \log(x - 2) - 4 \) 
   d. \( y = \log(x + 2) - 4 \)

   \( \circ \) \( y = 10^{x + 2} + 4 \) \( \circ \) \( y = 10^{x + 2} - 4 \) \( \circ \) \( y = 10^{x - 2} + 4 \) \( \circ \) \( y = 10^{x - 2} - 4 \) 

   \( \circ \) \( y = 10^{x - 4} + 2 \) \( \circ \) \( y = 10^{x - 4} - 2 \) \( \circ \) \( y = 10^{x + 4} + 2 \) \( \circ \) \( y = 10^{x + 4} - 2 \) 

3. Give the equation of the function described.
   a. Exponential shifted left nine.
   b. Logarithmic shifted down two.
   c. Exponential shifted right six and down one.
   d. Logarithmic shifted down three and left five.
   e. Exponential shifted right seven and up six.
4. Romeo High School's office has a system to let people know when there is a snow day. Ms. Cathy calls three people who work in the office. Then those three people each call three other people, and so on until the whole office staff is notified. If it takes nine minutes for a person to call three people.

a. Complete the table

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Time Periods</th>
<th>People Notified</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

b. If all calls are completed in 36 minutes, how many people will be notified in the last round?

c. Create a graph where the domain is time and the range is people notified in that round. Graph the inverse.

d. What type of function is each?

e. How many people does Ms. Cathy work with in the office?
5. An amoeba divides into two amoebas once every half-hour.
   a. Complete the table

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Time Periods</th>
<th>Amoeba Count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

   b. How many amoeba are there after 6 hours?

   c. Create a graph where the domain is time and the range is amoeba count. Graph the inverse.

   d. What type of function is each?
State the type of function, the intercepts, domain, range, critical points, and end behavior of each graph.

6. [Graph]

Type of function __________________________

Zero(s) ______________  y-intercept _________

Domain ______________  Range ____________

Critical point(s) __________________________

Behavior ________________________________

7. [Graph]

Type of function __________________________

Zero(s) ______________  y-intercept _________

Domain ______________  Range ____________

Critical point(s) __________________________

Behavior ________________________________

8. [Graph]

Type of function __________________________

Zero(s) ______________  y-intercept _________

Domain ______________  Range ____________

Critical point(s) __________________________

Behavior ________________________________
Inverses, Exp./Log Review

Family of Functions

Algebra 1

1. \{(-6,-6),(0,2),(4,11),(-5,-6)\}

   Domain:_______________________________ Range:________________________________

   Inverse:_______________________________________________ Inverse a function?_______

   Domain of Inverse:_____________________ Range of Inverse:_________________________

2. Inverses are reflected over which line?___________________________________________

3. Inverse:

   Domain:_______________________________

   Range:_______________________________

   Is the inverse a function?______________

   Domain of Inverse:_____________________ Range of Inverse:_______________________

   Explain how each of the following functions will shift from the parent function:

4. \(y = 10^{x+2} - 6\)  

5. \(y = \log(x + 3) + 7\)

6. \(y = 10^{x-4} + 8\)  

7. \(y = \log(x) - 8\)

Given the equation of each function described.

8. logarithmic, shifted 3 right and 8 up  

9. exponential, shifted 2 left and 5 down
Write the *inverse* of each equation.

10. \( y = 10^{x+3} - 1 \)

11. \( y = \log(x+8) - 1 \)

12. \( y = 10^x - 8 - 3 \)

13. \( y = \log(x - 4) + 6 \)

14. Certain bacterium doubles every 30 minutes. The bacteria colony starts with 4 cells.

   a. Complete the table

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Time Periods</th>
<th>Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

   b. How many will you have in 1 \( \frac{1}{2} \) hours?

   c. How many will you have in 6 hours?

   d. Graph the function and its inverse. Be sure to label.

   e. What type of function is each?

   f. In which case would you use each?
Speedy-Fast Delivery Service charges for delivering packages by the weight of the package. If the package weighs less than 1 pound, the cost of delivery is $2. If the package weights at least 1 pound but less than 2 pounds, the cost is $3.50. For each additional pound the cost of delivery increases $1.50. Complete the table and graph the function.

<table>
<thead>
<tr>
<th>X</th>
<th>Weight</th>
<th>.25</th>
<th>.5</th>
<th>1</th>
<th>1.25</th>
<th>1.75</th>
<th>2</th>
<th>2.5</th>
<th>2.75</th>
<th>3</th>
<th>3.25</th>
<th>3.5</th>
<th>4</th>
<th>4.25</th>
<th>4.75</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Cost</td>
<td>2</td>
<td>2</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>9.5</td>
</tr>
</tbody>
</table>

The domain of the function is: $0 < x < \infty$

The range of the function is: $\{2, 3.5, 5, 6.5, \ldots\}$

The beginning circle is *not filled* in when ________________________________.

Key words to look for ____________________________________________________.

The beginning circle is filled in when ________________________________.

Key words to look for ____________________________________________________.
Practice problem:

Homelink Online, a computer networking service, charges a fee of $15 per month which includes a customer’s first 5 hours of use. Additional time is billed at a rate of $10 per hour.

a. Create a table of values.

<table>
<thead>
<tr>
<th>X</th>
<th>Hours</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Graph the function. Be sure to label your graph!

c. How much does Homelink charge for 3.6 hours?_________ 7.2 hours?____________

d. How many hours were used if Homelink charged $65?________ $125? _____________

e. What is the domain of the function?______________________________

f. What is the range of the function?______________________________
1. Sam is a 7 year old who loves music. Sam’s mom will give Sam allowance for each chore completed around the house that Sam can apply towards purchasing iTunes. Each iTunes costs $0.99.

   a. Create a table with allowance ($) as the independent variable and the number of iTunes as the dependent variable.

   b. Create a graph of the function. Be sure to label your graph!

   c. How many iTunes will Sam purchase after earning $8?

   d. How much allowance would earn Sam 100 iTunes?

   e. State the domain of the function.

   f. State the range of the function.
2. You sign a contract for a cell phone. Your contract states that you pay $40.00 per month for the first 400 minutes and then you pay $0.15 per minute for all minutes after 400.

a. How much would your monthly bill be if you talk for 353 minutes?__________________

b. How much would your monthly bill be if you talk for 428 minutes?__________________

c. How much would your monthly bill be if you talk for 0 minutes?___________________

d. Sketch a graph of the contract for minutes ranging from 0 to 410 minutes. Be sure to label your graph!

\[
F(x) = \begin{cases} 
\text{______________} & \text{for } 0 \leq x \leq 400 \\
\text{______________} & \text{for } x > 400 
\end{cases}
\]

e. What is the domain for the function?_________________________________________

f. What is the range for the function?___________________________________________

g. Write a piecewise rule for this situation.
3. State the type of function, the intercepts, domain, range, critical points, and the behavior of the following graph:

Type of function______________________________
Zero(s)_________________y-intercept____________
Domain_______________Range_________________
Critical Point_________________________________
Behavior____________________________________

4. Use the table to answer the following questions:

<table>
<thead>
<tr>
<th>x</th>
<th>-4</th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>11</td>
<td>-1</td>
<td>-5</td>
<td>-1</td>
<td>11</td>
</tr>
</tbody>
</table>

a. Is the relationship a function?___________________________________

b. What is the domain?______________________________________________

c. What is the range?_______________________________________________

d. What is the inverse?____________________________________________

e. What is the domain of the inverse?________________________________

f. What is the range of the inverse?__________________________________

g. Is the inverse a function?________________________________________
Evaluate each expression. Indicate the property used in each step.

1. \[25 \div 5^2\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]

2. \[3 + 4(17 - 4^2) - 8\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]

3. \[6(-3 + 4) + 7(8 - 4(2))\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]
   \[= \quad \text{____________________} \quad \text{____________________}\]

Simplify each expression.

4. \[4x^2 + 2x - x^2 + 7 + 6x\]
5. \[9 + 2x - 3x + 5x^2 + 2 - 4x^2\]

6. \[2(4x - 5) + 4(x + 7)\]
7. \[(x+5)y + 2y\]

8. \[2(5 + 2r) + 6r - 9\]
9. \[4(2a + b) + 2(a + 2b)\]
A ball is dropped from a 800 foot tower. Its height, in feet, after t seconds is given by the equation \( h(t) = 800 - 16t^2 \).

10. Enter the equation into \( Y_1 \). Create and complete a table below using TABLE on your calculator.

11. Use the information you find to create a graph of the flight of the ball. Don't forget to label!

12. What was the height of the ball at time 0?

13. When does the ball hit the ground?

14. What is the domain and range?

   Domain: 
   Range:

15. Find the time, rounded to the nearest hundredth, when the ball will be 200 ft in the air.
For #16 & 17:
   a. Determine whether each is a function.
   b. State the domain.
   c. State the range.

16.  

   1a. _______________

   1b. _______________

   1c. _______________

17.  

   2a. _______________

   2b. _______________

   2c. _______________

For #18 & 19:
   a. State the zero(s).
   b. State the y-intercept.

18.  

   18a. _______________

   18b. _______________

19.  

   19a. _______________

   19b. _______________

Given $f(x) = (2x + 3)^2 - 5$, find each of the following.

20.  $f(-3)$  

21.  $f(2)$
For each of the following a. Graph (use pattern of points), b. Name the type of function, c. Explain the translations (shifting), d. Find the x- and y-intercepts (give answers as coordinate points), e. Give the domain and range, f. Name any critical points, g. Describe the behavior of the graph.

22. \( f(x) = (x - 2)^2 - 4 \)

23. \( f(x) = -(x + 3) - 5 \)

24. \( f(x) = (x - 2)^3 + 1 \)

25. \( f(x) = |x + 1| - 3 \)
26. \((-2, -3), (-1, -2), (0, -1), (1, -2), (2, -3)\)
   a. State the domain.
b. State the range.
c. Write the inverse.
d. Graph the function and it's inverse.
e. Is the inverse a function?
f. Domain of the inverse?
g. Range of the inverse?

27. \(f(x) = -(x - 5)^2 + 9\)
   a. Graph the function.
b. State the domain.
c. State the range.
d. Write the coordinates of the inverse.
e. Graph the inverse.
f. Is the inverse a function?
g. Domain of the inverse?
h. Range of the inverse?

Write the inverse of each function.

28. \(y = 10^{x^2} + 3\)  
29. \(y = \log (x+4) + 5\)  
30. \(y = 10^{x+5} - 4\)  
31. \(y = \log (x) - 7\)
Give the equation of each function described.

32. exponential, shifted 3 right and 2 down
33. logarithmic, shifted 4 right and 3 up

34. quadratic, shifted 2 left and 5 up
35. cubic, shifted 5 right and 1 down

36. absolute value, flipped, shifted 5 right and 3 down

37. Right-to-You Delivery Service charges for delivering packages by the weight of the package. If the package weighs less than 1 pound, the cost of delivery is $3.00. If the package weighs at least 1 pound but less than 2 pounds, the cost is $4.00. For each additional pound the cost of delivery increases $1.00.

a. Graph the function. Be sure to label.

b. How much does Right-to-You charge for a 0.75 pound package?____ 3.5 pounds?_____

c. If you were charged $9.00, how much could the package weigh?________________________

d. What is the domain of the function?___________________ Range?___________________
For the following problems graph, describe the translations, find the intercepts, give the domain and range, state the type and location of the critical point and describe the behavior.

1. [Graph]

2. [Graph]

3. [Graph]

4. [Graph]