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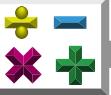
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The following pages are sample pages
taken *throughout* the Algebra 1
curriculum...

You'll see the page numbers
greatly jump as you browse.



Simplifying Expressions

Here's how to use the distributive property and the definition of subtraction to simplify the following expressions.

Example 1:

Simplify

$$\begin{aligned} -7a - 3a &= -7a + -3a \\ &= (-7 + -3)a \quad \leftarrow \text{use the distributive property} \\ &= -10a \end{aligned}$$

Example 2:

Simplify

$$\begin{aligned} 10c - c &= 10c - 1c \\ &= 10c + -1c \\ &= (10 + -1)c \quad \leftarrow \text{use the distributive property} \\ &= 9c \end{aligned}$$

The expressions $-7a - 3a$ and $-10a$ are called **equivalent expressions**. The expressions $10c - c$ and $9c$ are also called **equivalent expressions**. Equivalent expressions express the same number. An expression is in simplest form when it is replaced by an equivalent expression having no **like terms** and no parentheses.

Study these examples.

$$\begin{aligned} -5x + 4x &= (-5 + 4)x \\ &= -x \end{aligned}$$

$$\begin{aligned} 5y - 5y &= 5y + -5y \\ &= (5 + -5)y \\ &= 0y \quad \leftarrow \text{multiplicative property of zero} \\ &= 0 \end{aligned}$$

The multiplicative property of 0 says for any number a ,
 $a \cdot 0 = 0 \cdot a = 0$.



The following shortcut is frequently used to simplify expressions.

First

- rewrite each subtraction as adding the opposite
- then combine *like terms* (terms that have the same variable) by adding.

Simplify

$$\begin{aligned} 2a + 3 - 6a &= \boxed{\text{like terms}} \\ 2a + 3 - 6a &= 2a + 3 + -6a && \leftarrow \text{rewrite } -6a \text{ as } + -6a \\ &= -4a + 3 && \leftarrow \text{combine like terms by adding} \end{aligned}$$

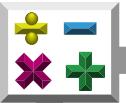
Simplify

$$\begin{aligned} 8b + 7 - b - 6 &= \boxed{\text{like terms}} \\ 8b + 7 - b - 6 &= 8b + 7 + -1b + -6 && \leftarrow \text{rewrite } -b \text{ as } + -1b \text{ and } -6 \text{ as } + -6 \\ &= 7b + 1 && \leftarrow \boxed{\text{like terms}} \quad \leftarrow \text{combine like terms by adding} \end{aligned}$$

Simplify

$$7x + 5 + 3x = 10x + 5 \quad \leftarrow \text{combine like terms}$$

like terms



Practice

Simplify by combining like terms. Show essential steps.

$$1. \ 5n + 3n$$

$$7. \ 4x + 11x$$

$$2. \ 6n - n$$

$$8. \ 4x - 11x$$

$$3. \ 8y - 8y$$

$$9. \ -4x - 11x$$

$$4. \ 7n + 3n - 6$$

$$10. \ 10y - 4y + 7$$

$$5. \ -7n - 3n - 6$$

$$11. \ 10y + 4y - 7$$

$$6. \ 6n - 3 + 7$$

$$12. \ 10y - 4 - 7$$



13. $8c - 12 - 6c$

20. $20n - 6n - 1 + 8$

14. $8c - 12c - 6$

21. $12c - 15 - 12c - 17$

15. $-10y - y - 15$

22. $12c - 15c - 12 - 18$

16. $-10y + y - 15$

17. $15x - 15x + 6$

18. $15x - 15 + 8x$

19. $20n - 6 - n + 8$



Linear Equations in Standard Form

- $ax + by = c$
- x and y are **variables**
- a , b , and c are **constants** for the given equation

You can graph a line fairly easily by using standard form.

Follow this example.

$$3x + 2y = 12$$

If we replace x with 0 we get the following.

$$\begin{aligned}3x + 2y &= 12 \\3(0) + 2y &= 12 \\0 + 2y &= 12 \\2y &= 12 \\y &= 6\end{aligned}$$

This tells us that the point $(0, 6)$ is on the graph of the line $3x + 2y = 12$. In fact $(0, 6)$ is called the **y -intercept** of the line. It is the point where the line crosses the y -axis.

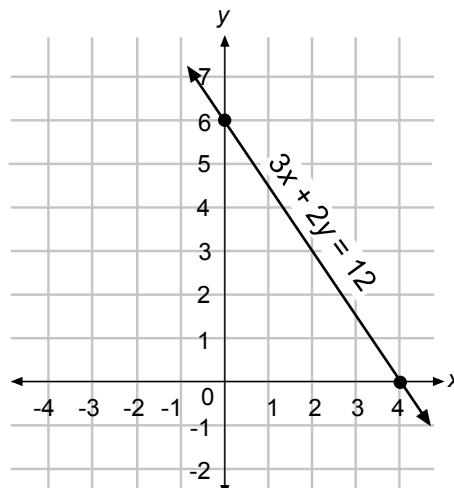
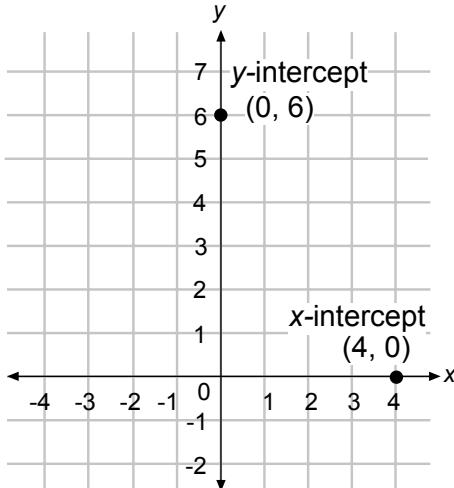
Remember that you must have two points to decide exactly where the line goes on the coordinate plane. So, we repeat the process, but this time replace y with 0.

$$\begin{aligned}3x + 2y &= 12 \\3x + 2(0) &= 12 \\3x + 0 &= 12 \\3x &= 12 \\x &= 4\end{aligned}$$

This tells us that the point $(4, 0)$ is also on the line. Did you guess that this is called the **x -intercept**?



So, if we plot the two points $(0, 6)$ and $(4, 0)$, we can draw a line connecting them.



Did you notice that we could find the slope of the line above either by using the slope formula with the x - and y -intercepts

$(m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 6}{4 - 0} = \frac{-6}{4} = \frac{-3}{2})$ or by counting rise and run from the graph?



Let's try another example.

$$5x - y = 15$$

If $x = 0$,

$$\begin{aligned}5x - y &= 15 \\5(0) - y &= 15 \\0 - y &= 15 \\-y &= 15 \\y &= -15\end{aligned}$$

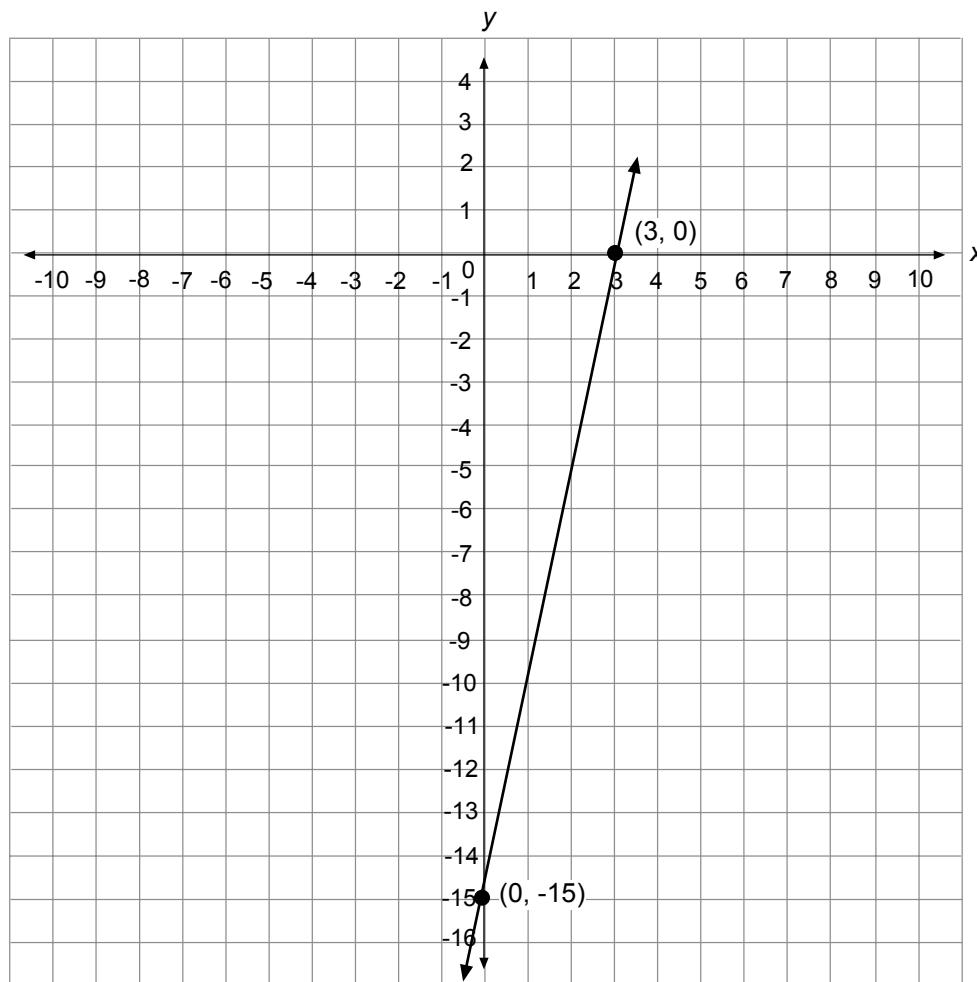
(0, -15) y -intercept

If $y = 0$,

$$\begin{aligned}5x - y &= 15 \\5x - y(0) &= 15 \\5x - 0 &= 15 \\5x &= 15 \\x &= 3\end{aligned}$$

(3, 0) x -intercept

Graph of $5x - y = 15$



Your turn.



Lesson Four Purpose

Reading Process Strand

Standard 6: Vocabulary Development

- LA.910.1.6.1
The student will use new vocabulary that is introduced and taught directly.
- LA.910.1.6.2
The student will listen to, read, and discuss familiar and conceptually challenging text.
- LA.910.1.6.5
The student will relate new vocabulary to familiar words.

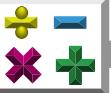
Algebra Body of Knowledge

Standard 1: Real and Complex Number Systems

- MA.912.A.1.8
Use the zero product property of real numbers in a variety of contexts to identify solutions to equations.

Standard 7: Quadratic Equations

- MA.912.A.7.1
Graph quadratic equations with and without graphing technology.
- MA.912.A.7.10
Use graphing technology to find approximate solutions of quadratic equations.



Graphing Quadratics

Any function whose equation is in the format $f(x) = ax^2 + bx + c$ (when $a \neq 0$) is called a **quadratic function**. The presence of the ax^2 term is a big hint that this is a quadratic expression. You'll also remember that the ax^2 term is a hint that **factoring** is involved for solving x .

Graphs of *quadratic functions* are called **parabolas** and have a shape that looks like an airplane wing.

Let's look at two examples.

Example 1

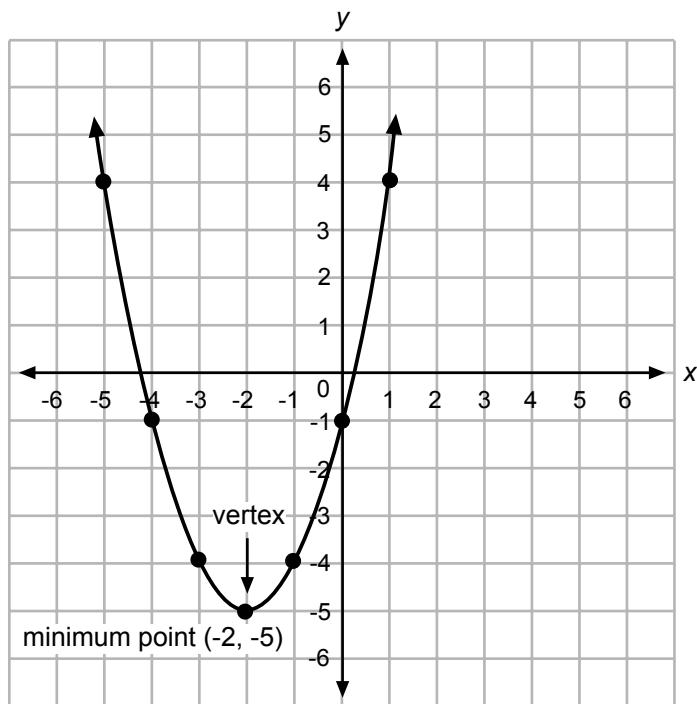
$$f(x) = x^2 + 4x - 1$$

We will use a table of values to graph this function.

Table of Values

$f(x) = x^2 + 4x - 1$	
x	$f(x)$
-5	4
-4	-1
-3	-4
-2	-5
-1	-4
0	-1
1	4

Graph of $f(x) = x^2 + 4x - 1$



We plot the points, and knowing that the graph will look like an airplane wing, we connect the dots with a smooth curve. A **coefficient** is the number part in front of an algebraic term. The *coefficient* in front of x^2 in the function $f(x) = x^2 + 4x - 1$ is understood to be a +1.



Because the x value of the coefficient is positive, the *parabola* will open upward and will have a *lowest point*, or **vertex**, called the **minimum** point.

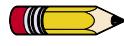
To tell exactly where that *minimum* point will be on our graph, we use information from the equation. Remembering that $f(x) = ax^2 + bx + c$, we use $x = \frac{-b}{2a}$ to tell us the x -value of the lowest point.

So from our function $f(x) = x^2 + 4x - 1$, where $a = 1$, $b = 4$, $c = -1$, we get the following.

$$\begin{aligned}x &= \frac{-b}{2a} \\x &= \frac{-4}{2(1)} \\x &= \frac{-4}{2} \\x &= -2\end{aligned}$$

So, the minimum point occurs when $x = -2$.

Using the function again,



Remember: $f(x) = ax^2 + bx + c$
 $f(x) = x^2 + 4x - 1$, where
 $a = 1, b = 4, c = -1$

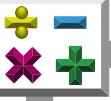
$$\begin{aligned}f(-2) &= (-2)^2 + 4(-2) - 1 \\f(-2) &= 4 + -8 - 1 \\f(-2) &= -5\end{aligned}$$

Therefore, the minimum point is $(-2, -5)$.

Another thing we can tell from the equation $x = -2$ in the box above is the **axis of symmetry**. Recall that the graph of $x = -2$ is a vertical line through -2 on the x -axis. This is the line that divides the parabola exactly in half. If you fold the graph along the *axis of symmetry*, each half of the parabola will match the other side exactly.

Note that the graph is a function because it passes the *vertical line test*. Any vertical line you draw will only **intersect** the graph (parabola) at one point.

Let's look at another example.



Example 2

$$f(x) = -x^2 + 2x - 3$$

Notice that the coefficient of x^2 is -1.

Because the value of the coefficient of x is negative, the parabola will open downward and have a highest point, or *vertex*, called a **maximum** point.

Find the axis of symmetry.

$$x = \frac{-b}{2a}$$

$$x = \frac{-2}{2}$$

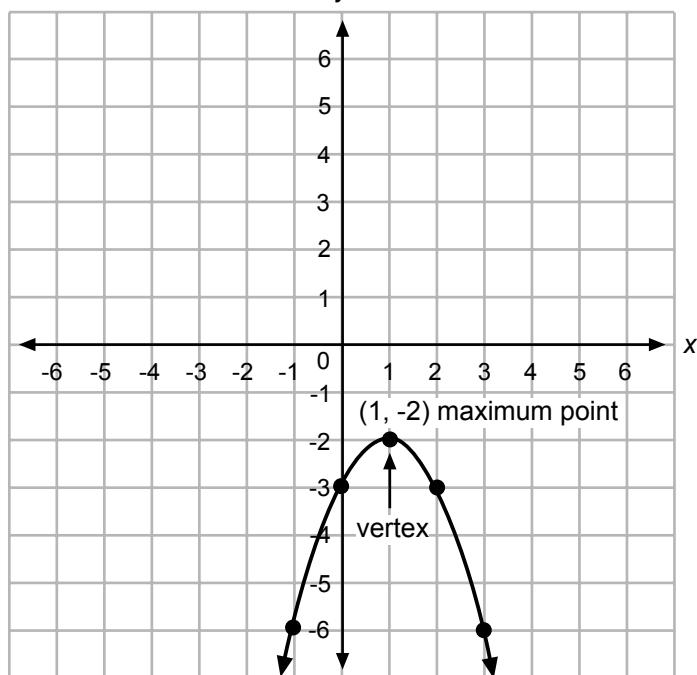
$$x = 1 \quad \text{← axis of symmetry}$$

Our *maximum* point occurs when $x = 1$. Let's make a table of values (be sure to include 1 as a value for x).

Table of Values

$f(x) = -x^2 + 2x - 3$	
x	$f(x)$
-1	-6
0	-3
1	-2
2	-3
3	-6

Graph of $f(x) = -x^2 + 2x - 3$



Graph the ordered pairs and connect them with a smooth curve. Note that the vertex of the parabola has a maximum point at $(1, -2)$ and the line of symmetry is at $x = 1$.

Refer to the examples above as you try the following.



Practice

For each **function** do the following.

- Find the equation for the axis of symmetry.
- Find the coordinates of the vertex of the graph.
- Tell whether the vertex is a maximum or minimum vertex.
- Graph the function.

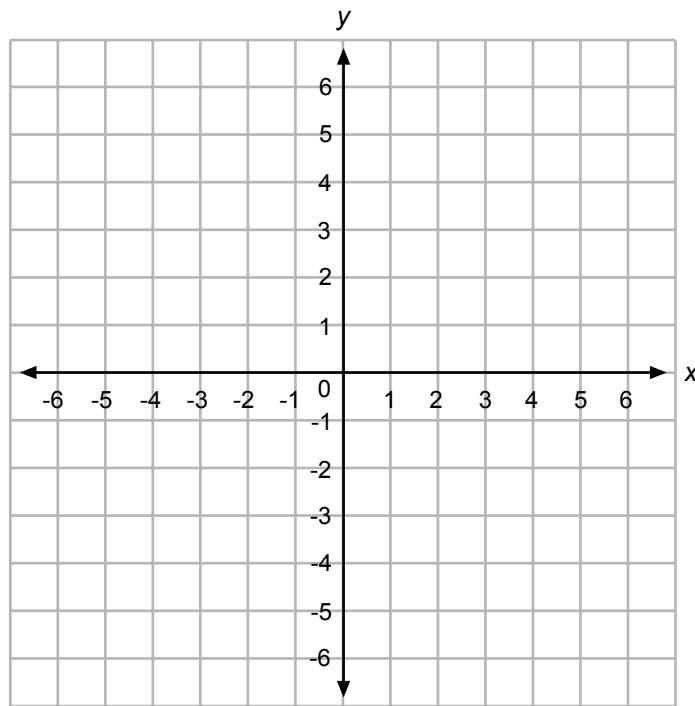
1. $f(x) = x^2 + 2x - 3$

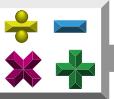
- axis of symmetry = _____
- coordinates of vertex = _____
- maximum or minimum = _____
- graph

Graph of $f(x) = x^2 + 2x - 3$

Table of Values

$f(x) = x^2 + 2x - 3$	
x	$f(x)$





2. $f(x) = x^2 - 2x - 3$

- a. axis of symmetry = _____
- b. coordinates of vertex = _____
- c. maximum or minimum = _____
- d. graph

Table of Values

$f(x) = x^2 - 2x - 3$	
x	$f(x)$

Graph of $f(x) = x^2 - 2x - 3$

