Multiple Representations of Equations & What We Know

California State Standards: 7 AF 1.1, 7 AF 3.3, 7 AF 3.4, Alg. 6.0, Alg. 7.0, Alg. 18.0

CCSS: 8.EE.6, 8.F.1, 8.F.2, 8.F.4

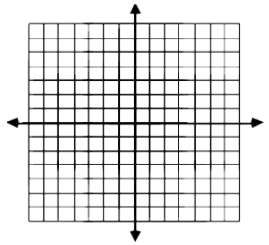
The idea of this lesson is to have students make connections between the multiple ways that an equation can be represented and what we know about these equations. This lesson will cover linear functions with positive and negative slopes and various vertical phase shifts. After filling out a chart with the students, we will have the students fill in their own charts beginning with a variety of different information. This process will be repeated so that students will have a chance to make connections between verbal descriptions, equations, tables of values, graphs and the information we know.

Note that the worked out "our turn" and "your turn" charts can also be used as a matching activity.

Also note that there are various ways students may fill out the verbal description column and convert from one form of an equation to another.

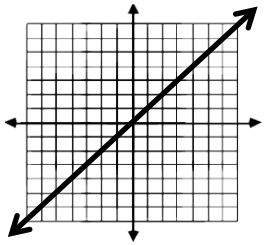
Our Turn!

Given Verbal Description

Verbal Description	Equation	Table of Values	Graph	Things We Know
A number y is a number x.	**Slope-Intercept Form** **Standard Form**	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ m = ? Is it a function? _____

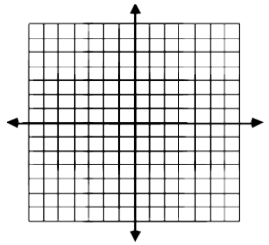
Our Turn! (worked out)

Given Verbal Description

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number y is a number x.</td>
<td>Slope-Intercept Form
$y = x$
$y - y = x - y$
$0 = x - y$
Standard Form
$x - y = 0$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = x$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = -2$</td><td>-2</td><td>$(-2, -2)$</td></tr>
<tr><td>-1</td><td>$y = -1$</td><td>-1</td><td>$(-1, -1)$</td></tr>
<tr><td>0</td><td>$y = 0$</td><td>0</td><td>(0,0)</td></tr>
<tr><td>1</td><td>$y = 1$</td><td>1</td><td>(1,1)</td></tr>
<tr><td>2</td><td>$y = 2$</td><td>2</td><td>(2,2)</td></tr>
</table>
</td>
<td>  </td>
<td>Linear Equation
x-intercept: (0,0)
y-intercept: (0,0)
positive slope
rate of change $= \frac{1}{1}$
It is a Function</td>
</tr>
</table>

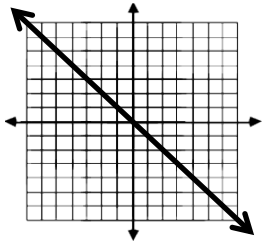
Your Turn!!

Given Slope-Intercept Form

Verbal Description	Equation	Table of Values	Graph	Things We Know
	Slope-Intercept Form $y = -x$ = = **Standard Form** =	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ rate of change = ? Is it a function? _____

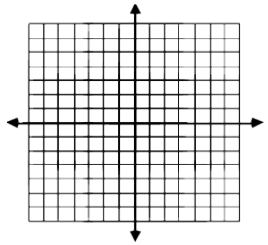
Your Turn!! (worked out)

Given Slope-Intercept Form

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number y is the opposite of a number x.</td>
<td>Slope-Intercept Form
$y = -x$
$y + x = -x + x$
$y + x = 0$
Standard Form
$x + y = 0$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = -x$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = 2$</td><td>2</td><td>$(-2,2)$</td></tr>
<tr><td>-1</td><td>$y = 1$</td><td>1</td><td>$(-1,1)$</td></tr>
<tr><td>0</td><td>$y = 0$</td><td>0</td><td>$(0,0)$</td></tr>
<tr><td>1</td><td>$y = -1$</td><td>-1</td><td>$(1,-1)$</td></tr>
<tr><td>2</td><td>$y = -2$</td><td>-2</td><td>$(2,-2)$</td></tr>
</table>
</td>
<td>  </td>
<td>Linear Equation
x-intercept: (0,0)
y-intercept: (0,0)
negative slope
rate of change $= \frac{-1}{1}$
It is a Function</td>
</tr>
</table>

Your Turn!!

Given Standard Form

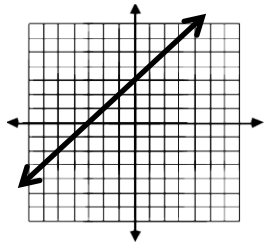
Verbal Description	Equation	Table of Values	Graph	Things We Know
	Standard Form $x - y = -3$ = = = = **Slope-Intercept Form** =	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ m = ? Is it a function? _____

Your Turn!! (worked out)

Given Standard Form

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number x subtracted by a number y is negative three.</td>
<td>Standard Form
$x - y = -3$

$x - y + y = -3 + y$
$x = -3 + y$
$x + 3 = -3 + 3 + y$
$x + 3 = y$

Slope-Intercept Form
$y = x + 3$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = x + 3$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = 1$</td><td>1</td><td>$(-2,1)$</td></tr>
<tr><td>-1</td><td>$y = 2$</td><td>2</td><td>$(-1,2)$</td></tr>
<tr><td>0</td><td>$y = 3$</td><td>3</td><td>$(0,3)$</td></tr>
<tr><td>1</td><td>$y = 4$</td><td>4</td><td>$(1,4)$</td></tr>
<tr><td>2</td><td>$y = 5$</td><td>5</td><td>$(2,5)$</td></tr>
</table>
</td>
<td>  </td>
<td>Linear Equation

x-intercept: $(-3,0)$

y-intercept: $(0,3)$

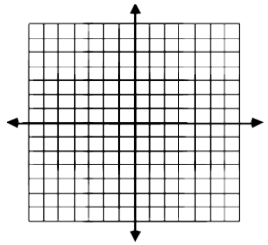
positive slope

m $= \frac{1}{1}$

It is a Function</td>
</tr>
</table>

Your Turn!!

Given Table of Values

Verbal Description	Equation	Table of Values	Graph	Things We Know
	Slope-Intercept Form = = = = = **Standard Form** =			Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ rate of change = ? Is it a function? _____

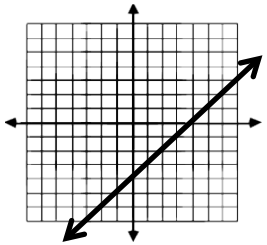
Input (x)	Equation	Output (y)	(Input, Output) (x, y)
-2	$y = -6$	-6	$(-2, -6)$
-1	$y = -5$	-5	$(-1, -5)$
0	$y = -4$	-4	$(0, -4)$
1	$y = -3$	-3	$(1, -3)$
2	$y = -2$	-2	$(2, -2)$

Your Turn!! (worked out)

Given Table of Values

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number x subtracted by a number y is four.</td>
<td>Slope-Intercept Form
$y = x - 4$

$y + 4 = x - 4 + 4$
$y - y + 4 = x - y$
$4 = x - y$

Standard Form
$x - y = 4$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = x - 4$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = -6$</td><td>-6</td><td>$(-2, -6)$</td></tr>
<tr><td>-1</td><td>$y = -5$</td><td>-5</td><td>$(-1, -5)$</td></tr>
<tr><td>0</td><td>$y = -4$</td><td>-4</td><td>$(0, -4)$</td></tr>
<tr><td>1</td><td>$y = -3$</td><td>-3</td><td>$(1, -3)$</td></tr>
<tr><td>2</td><td>$y = -2$</td><td>-2</td><td>$(2, -2)$</td></tr>
</table>
</td>
<td>  </td>
<td>Linear Equation

x-intercept: $(4,0)$

y-intercept: $(0, -4)$

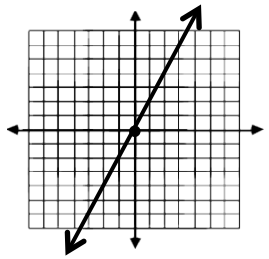
positive slope

rate of change $= \frac{1}{1}$

It is a Function</td>
</tr>
</table>

Our Turn!!

Given Graph

Verbal Description	Equation	Table of Values	Graph	Things We Know
	Slope-Intercept Form = = = = = **Standard Form** =	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ rate of change = ? Is it a function? _____

Our Turn!! (worked out)

Given Table of Values

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>Twice a number x is a number y.</td>
<td>Slope-Intercept Form
$y = 2x$

$y - y = 2x - y$
$0 = 2x - y$

Standard Form
$2x - y = 0$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = 2x$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = -4$</td><td>-4</td><td>$(-2, -4)$</td></tr>
<tr><td>-1</td><td>$y = -2$</td><td>-2</td><td>$(-1, -2)$</td></tr>
<tr><td>0</td><td>$y = 0$</td><td>0</td><td>(0,0)</td></tr>
<tr><td>1</td><td>$y = 2$</td><td>2</td><td>(1,2)</td></tr>
<tr><td>2</td><td>$y = 4$</td><td>4</td><td>(2,4)</td></tr>
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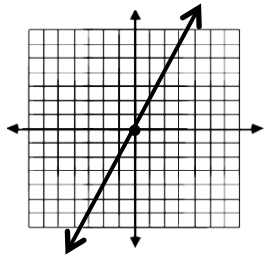
<td>  </td>
<td>Linear Equation

x-intercept:
(0,0)

y-intercept:
(0,0)

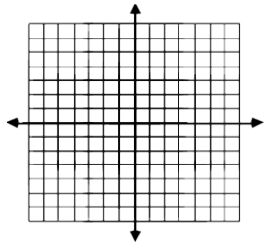
positive slope

rate of change $= \frac{2}{1}$

It is a Function</td>
</tr>
</table>

Your Turn!!

Given Slope and *y*-intercept

Verbal Description	Equation	Table of Values	Graph	Things We Know
	Slope-Intercept Form = = = = = **Standard Form** =	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ *x*-intercept: ____ *y*-intercept: (0,0) Positive, negative, zero or undefined slope? _____ $m = \frac{-3}{1}$ Is it a function? _____

Your Turn!! (worked out)

Given Slope and *y*-intercept

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number y is the product of negative three and a number x.</td>
<td>Slope-Intercept Form
$y = -3x$

$y + 3x = -3x + 3x$
$y + 3x = 0$

Standard Form
$3x + y = 0$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = -3x$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = 6$</td><td>6</td><td>$(-2,6)$</td></tr>
<tr><td>-1</td><td>$y = 3$</td><td>-3</td><td>$(-1,-3)$</td></tr>
<tr><td>0</td><td>$y = 0$</td><td>0</td><td>$(0,0)$</td></tr>
<tr><td>1</td><td>$y = -3$</td><td>-3</td><td>$(1,-3)$</td></tr>
<tr><td>2</td><td>$y = -6$</td><td>-6</td><td>$(2,-6)$</td></tr>
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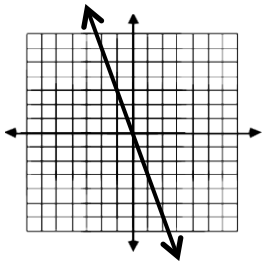
</td>
<td>  </td>
<td>Linear Equation

x-intercept:
(0,0)

y-intercept:
(0,0)

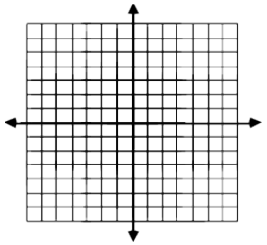
negative slope

m = $\frac{-3}{1}$

It is a Function</td>
</tr>
</table>

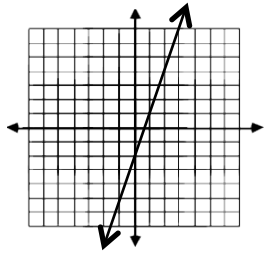
Your Turn!!

Given Slope-Intercept Form

Verbal Description	Equation	Table of Values	Graph	Things We Know
	Slope-Intercept Form $y = 3x - 2$ = = = = **Standard Form** =	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ rate of change = ? Is it a function? _____

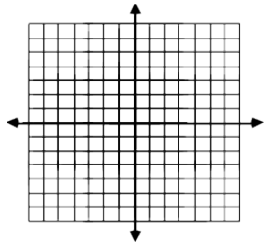
Your Turn!! (worked out)

Given Slope-Intercept Form

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number y is two less than the product of three and a number x.</td>
<td>
Slope-Intercept Form
$y = 3x - 2$
$y + 2 = 3x - 2 + 2$
$y + 2 = 3x$
$y - y + 2 = 3x - y$
$2 = 3x - y$
Standard Form
$3x - y = 2$
</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = 3x - 2$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = -8$</td><td>-8</td><td>$(-2, -8)$</td></tr>
<tr><td>-1</td><td>$y = -5$</td><td>-5</td><td>$(-1, -5)$</td></tr>
<tr><td>0</td><td>$y = -2$</td><td>-2</td><td>$(0, -2)$</td></tr>
<tr><td>1</td><td>$y = 1$</td><td>1</td><td>(1,1)</td></tr>
<tr><td>2</td><td>$y = 4$</td><td>4</td><td>(2,4)</td></tr>
</table>
</td>
<td>  </td>
<td>
Linear Equation
x-intercept: $(\frac{2}{3}, 0)$
y-intercept: $(0, -2)$
positive slope
rate of change $= \frac{3}{1}$
It is a Function
</td>
</tr>
</table>

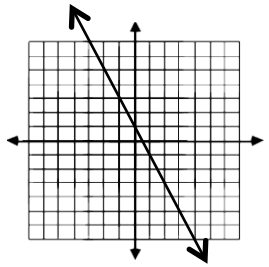
Your Turn!!

Given Verbal Description

Verbal Description	Equation	Table of Values	Graph	Things We Know
A number y is one more than the product of negative two and a number x.	**Slope-Intercept Form** = = = = = **Standard Form** =	Input (x) | Equation | Output (y) | (Input, Output) (x, y)		Linear, quadratic,…? _____ x-intercept: ____ y-intercept: ____ Positive, negative, zero or undefined slope? _____ m = ? Is it a function? _____

Your Turn!! (worked out)

Given Slope-Intercept Form

<table>
<tr><th>Verbal Description</th><th>Equation</th><th>Table of Values</th><th>Graph</th><th>Things We Know</th></tr>
<tr>
<td>A number y is one more than the product of negative two and a number x.</td>
<td>Slope-Intercept Form
$y = -2x + 1$
$y + 2x = -2x + 2x + 1$
$y + 2x = 1$
Standard Form
$2x + y = 1$</td>
<td>
<table>
<tr><th>Input (x)</th><th>Equation $y = -2x + 1$</th><th>Output (y)</th><th>(Input, Output) (x, y)</th></tr>
<tr><td>-2</td><td>$y = 5$</td><td>5</td><td>$(-2,5)$</td></tr>
<tr><td>-1</td><td>$y = 3$</td><td>3</td><td>$(-1,3)$</td></tr>
<tr><td>0</td><td>$y = 1$</td><td>1</td><td>$(0,1)$</td></tr>
<tr><td>1</td><td>$y = -1$</td><td>-1</td><td>$(1,-1)$</td></tr>
<tr><td>2</td><td>$y = -3$</td><td>-3</td><td>$(2,-3)$</td></tr>
</table>
</td>
<td>  </td>
<td>Linear Equation
x-intercept: $(\frac{1}{2}, 0)$
y-intercept: $(0,1)$
negative slope
m $= \frac{-2}{1}$
It is a Function</td>
</tr>
</table>