

Math: Algebra I

Linear Functions

Objectives

Students will be able to:

- Identify a linear equation.
 - Define a linear function.
 - Find the slope and y -intercept of a line.
 - Graph linear equations given a point and a slope or two points.
 - Write a linear equation in slope-intercept or point-slope form.
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Warm-Up

What is a linear function?

Have students share their ideas and thoughts.

What is the simplest linear function you can think of?

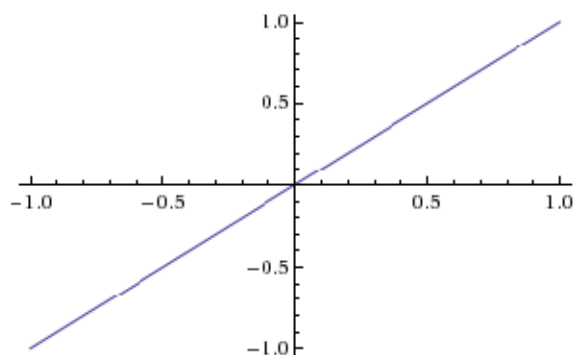


plot $y=x$

Input Interpretation:

plot $y = x$

Plot:



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Lesson

- Define a linear function.
 - Linear functions have a slope (m) and a y -intercept (b). Define these terms as well.
 - Investigate: What is the difference between slopes that are positive, negative, zero, or undefined?
- ◇ First, compare positive and negative slopes in W|A.



plot $y=3x+1$, $y=-5x+2$



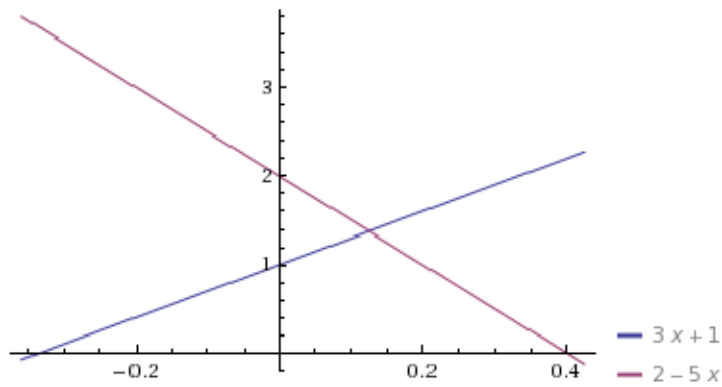
Input Interpretation:

plot

$$3x + 1$$

$$-5x + 2$$

Plot:





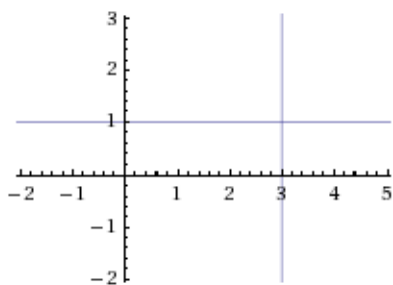
line y=1, line x=3

Assuming "line" is a geometric object | Use as a unit instead

Input interpretation:

line equation $y = 1$ | line equation $x = 3$

Visual representation:



Intersection:

(3, 1)

Properties:

	slope
line equation $y = 1$	0
line equation $x = 3$	∞

∞ is complex infinity »

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- Here are two different forms of a linear equation in x-y coordinates:

◆ Point-slope form: $y - y_1 = m(x - x_1)$,

where (x_1, y_1) is a point on the line and m is its slope.

◇ For example, the equation of the line through the point $(2, 7)$ with slope 4 is $y - 7 = 4(x - 2)$.

◆ Slope-intercept form: $y = mx + b$,

where m is the slope and b is the y -intercept, that is, the y value of the line where it crosses the y axis.

◇ For example, the equation of the line with slope -8 that intercepts the y axis at $y = -100$ is $y = -8x - 100$.

• Example problems:

◇ Find the linear equation with slope 4 and y -intercept 3.

Using $y = mx + b$, when $m = 4$ and $b = 3$, so the equation should be $y = 4x + 3$. Let us check using W|A.



slope of 4, y-intercept of 3



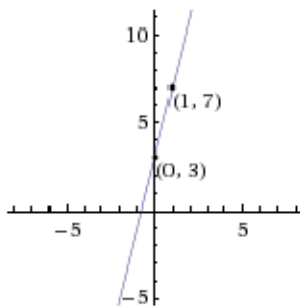
Input interpretation:

line

slope 4

y-intercept 3

Visual representation:



Equation:

$$y = 4x + 3$$

$$-4x + y - 3 = 0$$

Properties:

x-intercept

$$-\frac{3}{4} = -0.75$$

Distance:

from (0, 3) to (1, 7): $\sqrt{17} \approx 4.12311$

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Note: W|A also gives the x-intercept; explain what that means in terms of the graph of the function.

◇ Write the equation of the line through (2, 4) with slope 5.

Using point-slope form with $x_1 = 2$, $y_1 = 4$, and $m = 5$, you should get $y - 4 = 5(x - 2)$.



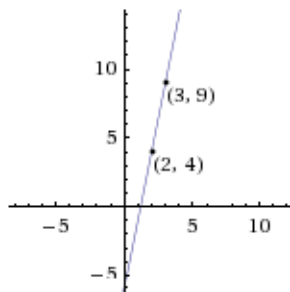
slope of 5, through (2,4)



Input interpretation:

line	slope 5
	(2, 4)

Visual representation:



Equation:

$$y = 5x - 6$$

$$-5x + y + 6 = 0$$

Properties:

x-intercept	$\frac{6}{5} = 1.2$
y-intercept	-6

Distance:

from (2, 4) to (3, 9): $\sqrt{26} \approx 5.09902$

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◇ Find an equation of the line through (2, -4) and (7, 11).

First find the slope and then use point-slope form. Go through the algebra and check with WJA.



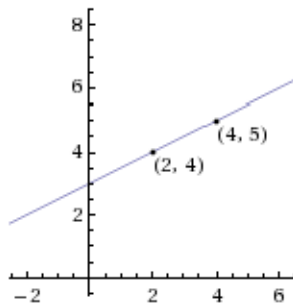
line through (2,4) and (4,5)



Input interpretation:

line	(2, 4)
	(4, 5)

Visual representation:



Equation:

$$y = \frac{x}{2} + 3$$

$$-x + 2y - 6 = 0$$

Properties:

x-intercept	-6
y-intercept	3
slope	$\frac{1}{2}$

Distance:

from (2, 4) to (4, 5): $\sqrt{5} \approx 2.23607$

Closing

Student activity: Choose any two linear functions and list their slope, y -intercept, and another point on the line. Plot these functions on a graph. You may use W|A as a resource.

Demonstrations

Slope and Equations of Lines through Points

Two Points Determine a Line

Lines : Point - Slope

Lines : Slope - Intercept

Equation of a Line Game