Graphing Linear Equations and Inequalities: The Slope-Intercept Form of a Line*

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Abstract

This module is from Elementary Algebra by Denny Burzynski and Wade Ellis, Jr. In this chapter the student is shown how graphs provide information that is not always evident from the equation alone. The chapter begins by establishing the relationship between the variables in an equation, the number of coordinate axes necessary to construct its graph, and the spatial dimension of both the coordinate system and the graph. Interpretation of graphs is also emphasized throughout the chapter, beginning with the plotting of points. The slope formula is fully developed, progressing from verbal phrases to mathematical expressions. The expressions are then formed into an equation by explicitly stating that a ratio is a comparison of two quantities of the same type (e.g., distance, weight, or money). This approach benefits students who take future courses that use graphs to display information. The student is shown how to graph lines using the intercept method, the table method, and the slope-intercept method, as well as how to distinguish, by inspection, oblique and horizontal/vertical lines. Objectives of this module: be more familiar with the general form of a line, be able to recognize the slope-intercept form of a line, be able to interpret the slope and intercept of a line, be able to use the slope formula to find the slope of a line.

1 Overview

- The General Form of a Line
- The Slope-Intercept Form of a Line
- Slope and Intercept
- The Formula for the Slope of a Line

2 The General Form of a Line

We have seen that the general form of a linear equation in two variables is $ax + by = c$ (Section here[1]). When this equation is solved for y, the resulting form is called the slope-intercept form. Let's generate this new form.

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[1]"Graphing Linear Equations and Inequalities: Graphing Linear Equations in Two Variables" <http://cnx.org/content/m21995/latest/>

$$\begin{aligned} ax + by &= c && \text{Subtract } ax \text{ from both sides.} \\ by &= -ax + c && \text{Divide } both \text{ sides by } b \\ \frac{by}{b} &= \frac{-ax}{b} + \frac{c}{b} \\ \frac{\not{b}y}{\not{b}} &= \frac{-ax}{b} + \frac{c}{b} \\ y &= \frac{-ax}{b} + \frac{c}{b} \\ y &= \frac{-ax}{b} + \frac{c}{b} \end{aligned}$$

This equation is of the form $y = mx + b$ if we replace $\frac{-a}{b}$ with m and constant $\frac{c}{b}$ with b. (**Note:** The fact that we let $b = \frac{c}{b}$ is unfortunate and occurs beacuse of the letters we have chosen to use in the general form. The letter b occurs on both sides of the equal sign and may not represent the same value at all. This problem is one of the historical convention and, fortunately, does not occur very often.)

The following examples illustrate this procedure.

Example 1

Solve $3x + 2y = 6$ for y.

$$\begin{aligned} 3x + 2y &= 6 && \text{Subtract } 3x \text{ from both sides.} \\ 2y &= -3x + 6 && \text{Divide both sides by 2.} \\ y &= -\frac{3}{2}x + 3 \end{aligned}$$

This equation is of the form $y = mx + b$. In this case, $m = -\frac{3}{2}$ and $b = 3$.

Example 2

Solve $-15x + 5y = 20$ for y.

$$\begin{aligned} -15x + 5y &= 20 \\ 5y &= 15x + 20 \\ y &= 3x + 4 \end{aligned}$$

This equation is of the form $y = mx + b$. In this case, $m = 3$ and $b = 4$.

Example 3

Solve $4x - y = 0$ for y.

$$\begin{aligned} 4x - y &= 0 \\ -y &= -4x \\ y &= 4x \end{aligned}$$

This equation is of the form $y = mx + b$. In this case, $m = 4$ and $b = 0$. Notice that we can write $y = 4x$ as $y = 4x + 0$.

3 The Slope-Intercept Form of a Line

The Slope-Intercept Form of a Line $y = mx + b$

A linear equation in two variables written in the form $y = mx + b$ is said to be in **slope-intercept form.**

4 Sample Set A

The following equations **are** in slope-intercept form:

Example 4

$y = 6x - 7$. In this case $m = 6$ and $b = -7$.

Example 5

$y = -2x + 9.$ In this case $m = -2$ and $b = 9$.

Example 6

$y = \frac{1}{5}x + 4.8$ In this case $m = \frac{1}{5}$ and $b = 4.8$.

Example 7

$y = 7x.$ In this case $m = 7$ and $b = 0$ since we can write $y = 7x$ as $y = 7x + 0$.

The following equations **are not** in slope-intercept form:

Example 8

$2y = 4x - 1.$ The coefficient of y is 2. To be in slope-intercept form, the coefficient of y must be 1.

Example 9

$y + 4x = 5.$ The equation is not solved for y. The x and y appear on the same side of the equal sign.

Example 10

$y + 1 = 2x.$ The equation is not solved for y.

5 Practice Set A

The following equation are in slope-intercept form. In each case, specify the slope and y-intercept.

Exercise 1 ***(Solution on p. 19.)***

$y = 2x + 7; \quad m = \qquad b =$

Exercise 2 ***(Solution on p. 19.)***

$y = -4x + 2; \quad m = \qquad b =$

Exercise 3 ***(Solution on p. 19.)***

$y = -5x - 1; \quad m = \qquad b =$

Exercise 4 ***(Solution on p. 19.)***

$y = \frac{2}{3}x - 10; \quad m = \qquad b =$

Exercise 5 ***(Solution on p. 19.)***

$y = \frac{-5}{8}x + \frac{1}{2}; \quad m = \qquad b =$

Exercise 6 ***(Solution on p. 19.)***

$y = -3x; \quad m = \qquad b =$

6 Slope and Intercept

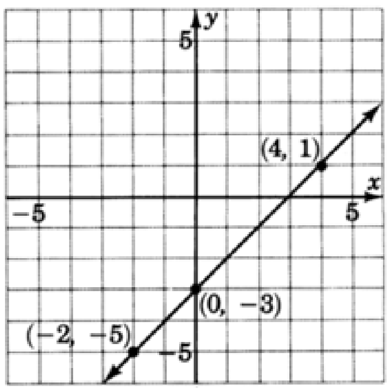
When the equation of a line is written in slope-intercept form, two important properties of the line can be seen: the **slope** and the **intercept**. Let's look at these two properties by graphing several lines and observing them carefully.

7 Sample Set B

Example 11
Graph the line $y = x - 3$.

x	y	$(x,\ y)$
0	-3	$(0,\ -3)$
4	1	$(4,\ 1)$
-2	-5	$(-2,\ -5)$

Table 1



Looking carefully at this line, answer the following two questions.

Problem 1
At what number does this line cross the y-axis? Do you see this number in the equation?

Solution
The line crosses the y-axis at -3.

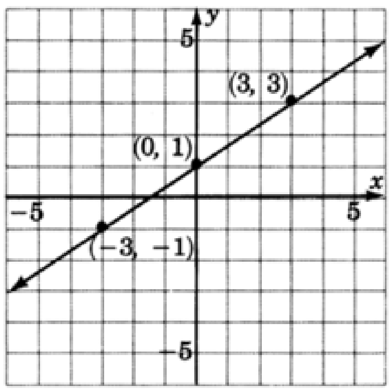
Problem 2
Place your pencil at any point on the line. Move your pencil exactly **one** unit horizontally to the right. Now, how many units straight up or down must you move your pencil to get back on the line? Do you see this number in the equation?

Solution
After moving horizontally one unit to the right, we must move exactly one vertical unit up. This number is the coefficient of x.

Example 12
Graph the line $y = \frac{2}{3}x + 1$.

x	y	$(x,\ y)$
0	1	$(0,\ 1)$
3	3	$(3,\ 3)$
-3	-1	$(-3,\ -1)$

Table 2



Looking carefully at this line, answer the following two questions.

Problem 1
At what number does this line cross the y-axis? Do you see this number in the equation?

Solution
The line crosses the y-axis at $+1$.

Problem 2
Place your pencil at any point on the line. Move your pencil exactly **one** unit horizontally to the right. Now, how many units straight up or down must you move your pencil to get back on the line? Do you see this number in the equation?

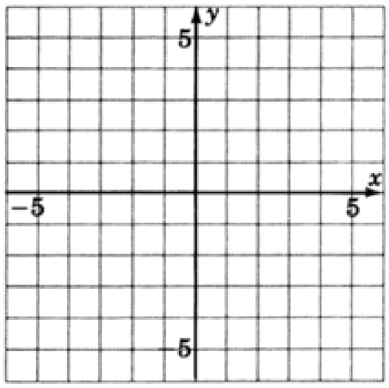
Solution
After moving horizontally one unit to the right, we must move exactly $\frac{2}{3}$ unit upward. This number is the coefficient of x.

8 Practice Set B

Example 13
Graph the line $y = -3x + 4$.

x	y	(x, y)
0		
3		
2		

Table 3



Looking carefully at this line, answer the following two questions.

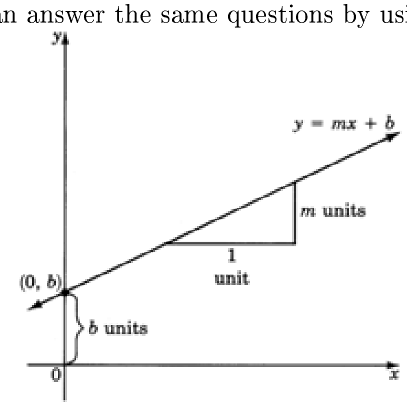
Exercise 11 ***(Solution on p. 19.)***

At what number does the line cross the y-axis? Do you see this number in the equation?

Exercise 12 ***(Solution on p. 19.)***

Place your pencil at any point on the line. Move your pencil exactly **one** unit horizontally to the right. Now, how many units straight up or down must you move your pencil to get back on the line? Do you see this number in the equation?

In the graphs constructed in Sample Set B and Practice Set B, each equation had the form $y = mx + b$. We can answer the same questions by using this form of the equation (shown in the diagram).



y-Intercept

Exercise 13

At what number does the line cross the y-axis? Do you see this number in the equation?

Solution

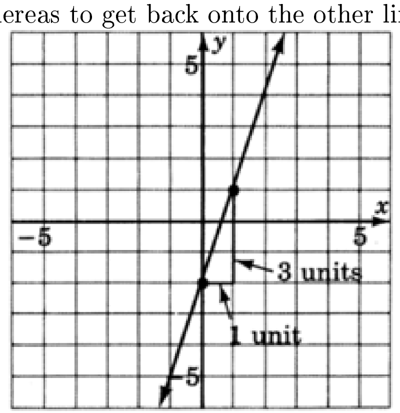
In each case, the line crosses the y-axis at the constant b. The number b is the number at which the line crosses the y-axis, and it is called the y-intercept. The ordered pair corresponding to the y-intercept is $(0, b)$.

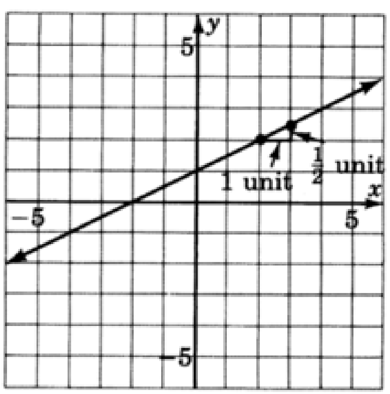
Exercise 14

Place your pencil at any point on the line. Move your pencil exactly **one** unit horizontally to the right. Now, how many units straight up or down must you move your pencil to get back on the line? Do you see this number in the equation?

Solution
To get back on the line, we must move our pencil exactly m vertical units.

Slope
The number m is the coefficient of the variable x. The number m is called the **slope** of the line and it is the number of units that y changes when x is increased by 1 unit. Thus, if x changes by 1 unit, y changes by m units.
Since the equation $y = mx + b$ contains both the slope of the line and the y-intercept, we call the form $y = mx + b$ the **slope-intercept** form.
The Slope-Intercept Form of the Equation of a Line
The slope-intercept form of a straight line is
$y = mx + b$
The slope of the line is m, and the y-intercept is the point $(0\,,\,b)$.
The Slope is a Measure of the Steepness of a Line
The word **slope** is really quite appropriate. It gives us a measure of the steepness of the line. Consider two lines, one with slope $\frac{1}{2}$ and the other with slope 3. The line with slope 3 is steeper than is the line with slope $\frac{1}{2}$. Imagine your pencil being placed at any point on the lines. We make a 1-unit increase in the x-value by moving the pencil **one** unit to the right. To get back to one line we need only move vertically $\frac{1}{2}$ unit, whereas to get back onto the other line we need to move vertically 3 units.





9 Sample Set C

Find the slope and the y-intercept of the following lines.

Example 14
$y = 2x + 7.$

The line is in the slope-intercept form $y = mx + b$. The slope is m, the coefficient of x. Therefore, $m = 2$. The y-intercept is the point $(0, b)$. Since $b = 7$, the y-intercept is $(0, 7)$.

Slope : 2

y-intercept : $(0, 7)$

Example 15
$y = -4x + 1.$

The line is in slope-intercept form $y = mx + b$. The slope is m, the coefficient of x. So, $m = -4$. The y-intercept is the point $(0, b)$. Since $b = 1$, the y-intercept is $(0, 1)$.

Slope : -4

y-intercept : $(0, 1)$

Example 16
$3x + 2y = 5.$

The equation is written in general form. We can put the equation in slope-intercept form by solving for y.

$$\begin{aligned} 3x + 2y &= 5 \\ 2y &= -3x + 5 \\ y &= -\frac{3}{2}x + \frac{5}{2} \end{aligned}$$

Now the equation is in slope-intercept form.

Slope: $-\frac{3}{2}$

y-intercept: $\left(0, \frac{5}{2}\right)$

10 Practice Set C

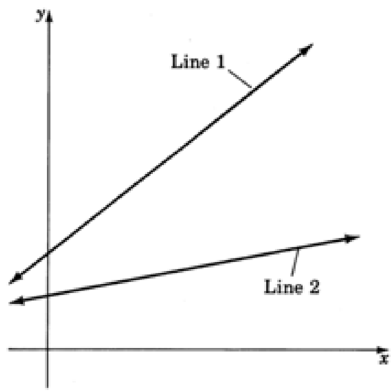
Exercise 15 ***(Solution on p. 19.)***
Find the slope and y-intercept of the line $2x + 5y = 15$.

11 The Formula for the Slope of a Line

We have observed that the slope is a measure of the steepness of a line. We wish to develop a formula for measuring this steepness.

It seems reasonable to develop a slope formula that produces the following results:

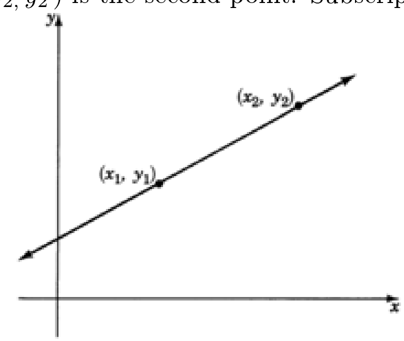
Steepness of line 1 > steepness of line 2.



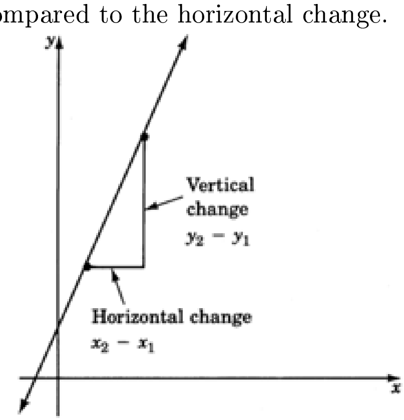
Consider a line on which we select any two points. We'll denote these points with the ordered pairs (x_1, y_1) and (x_2, y_2). The subscripts help us to identify the points.

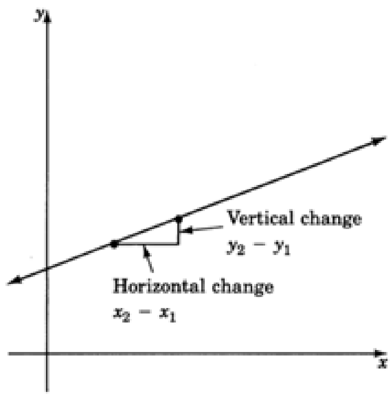
(x_1, y_1) is the first point. Subscript 1 indicates the first point.

(x_2, y_2) is the second point. Subscript 2 indicates the second point.



The difference in x values $(x_2 - x_1)$ gives us the horizontal change, and the difference in y values $(y_2 - y_1)$ gives us the vertical change. If the line is very steep, then when going from the first point to the second point, we would expect a large vertical change compared to the horizontal change. If the line is not very steep, then when going from the first point to the second point, we would expect a small vertical change compared to the horizontal change.





We are comparing changes. We see that we are comparing

The vertical change	to	the horizontal change
The change in y	to	the change in x
$y_2 - y_1$	to	$x_2 - x_1$

This is a comparison and is therefore a **ratio**. Ratios can be expressed as fractions. Thus, a measure of the steepness of a line can be expressed as a ratio.

The slope of a line is defined as the ratio

$$\text{Slope} = \frac{\text{change in } y}{\text{change in } x}$$

Mathematically, we can write these changes as

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

Finding the Slope of a Line
The slope of a nonvertical line passing through the points (x_1, y_1) and (x_2, y_2) is found by the formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

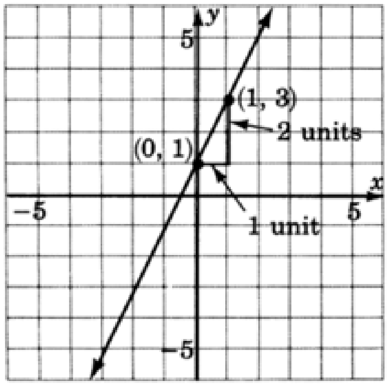
12 Sample Set D

For the two given points, find the slope of the line that passes through them.

Example 17
$(0,1)$ and $(1,3)$.

Looking left to right on the line we can choose (x_1, y_1) to be $(0,1)$, and (x_2, y_2) to be $(1,3)$ .Then,

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-1}{1-0} = \frac{2}{1} = 2$$



This line has slope 2. It appears fairly steep. When the slope is written in fraction form, $2 = \frac{2}{1}$, we can see, by recalling the slope formula, that as x changes 1 unit to the right (because of the +1) y changes 2 units upward (because of the +2).

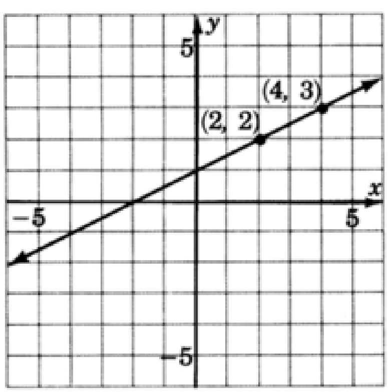
$$m = \frac{\text{change in } y}{\text{change in } x} = \frac{2}{1}$$

Notice that as we look left to right, the line rises.

Example 18
$(2,2)$ and $(4,3)$.

Looking left to right on the line we can choose (x_1, y_1) to be $(2,2)$ and (x_2, y_2) to be $(4,3)$. Then,

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-2}{4-2} = \frac{1}{2}$$



This line has slope $\frac{1}{2}$. Thus, as x changes 2 units to the right (because of the +2), y changes 1 unit upward (because of the +1).

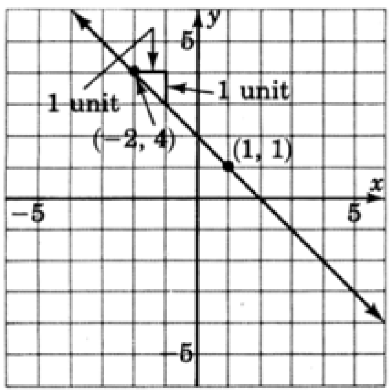
$$m = \frac{\text{change in } y}{\text{change in } x} = \frac{1}{2}$$

Notice that in examples 1 and 2, both lines have positive slopes, +2 and $+\frac{1}{2}$, and both lines **rise** as we look left to right.

Example 19
(−2, 4) and (1, 1).

Looking left to right on the line we can choose (x_1, y_1) to be (−2, 4) and (x_2, y_2) to be (1, 1). Then,

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-4}{1-(-2)} = \frac{-3}{1+2} = \frac{-3}{3} = -1$$

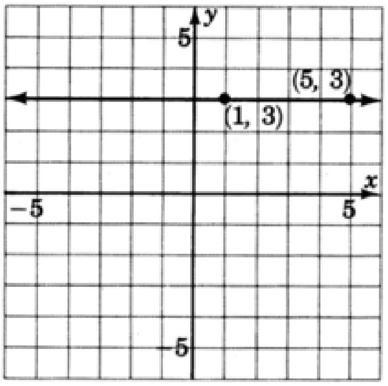


This line has slope −1.

When the slope is written in fraction form, $m = -1 = \frac{-1}{+1}$, we can see that as x changes 1 unit to the right (because of the +1), y changes 1 unit downward (because of the −1).
Notice also that this line has a negative slope and declines as we look left to right.

Example 20
$(1,3)$ and $(5,3)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-3}{5-1} = \frac{0}{4} = 0$$

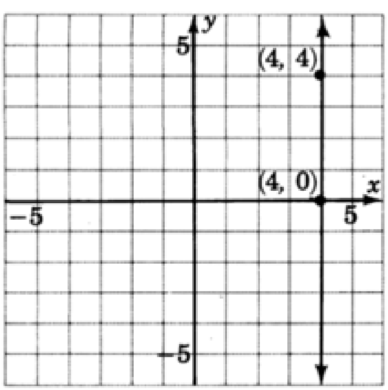


This line has 0 slope. This means it has **no** rise and, therefore, is a horizontal line. This does not mean that the line has no slope, however.

Example 21
$(4,4)$ and $(4,0)$.

This problem shows why the slope formula is valid only for nonvertical lines.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-4}{4-4} = \frac{-4}{0}$$

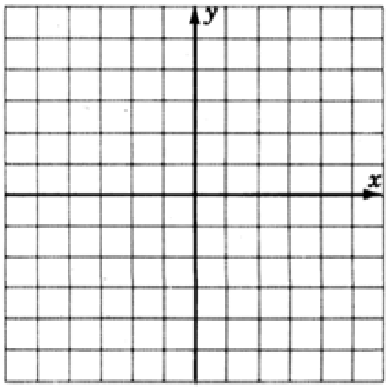


Since division by 0 is undefined, we say that vertical lines have undefined slope. Since there is no real number to represent the slope of this line, we sometimes say that vertical lines have **undefined slope**, or **no slope**.

13 Practice Set D

Exercise 16 ***(Solution on p. 19.)***
Find the slope of the line passing through $(2,1)$ and $(6,3)$. Graph this line on the graph of problem 2 below.

Exercise 17 ***(Solution on p. 19.)***
Find the slope of the line passing through $(3,4)$ and $(5,5)$. Graph this line.



Exercise 18 *(Solution on p. 19.)*

Compare the lines of the following problems. Do the lines appear to cross? What is it called when lines do not meet (parallel or intersecting)? Compare their slopes. Make a statement about the condition of these lines and their slopes.

Before trying some problems, let's summarize what we have observed.

Exercise 19

The equation $y = mx + b$ is called the slope-intercept form of the equation of a line. The number m is the slope of the line and the point $(0, b)$ is the y-intercept.

Exercise 20

The slope, m, of a line is defined as the steepness of the line, and it is the number of units that y changes when x changes 1 unit.

Exercise 21

The formula for finding the slope of a line through any two given points (x_1, y_1) and $(x_2, y_2)$is

$m = \frac{y_2 - y_1}{x_2 - x_1}$

Exercise 22

The fraction $\frac{y_2 - y_1}{x_2 - x_1}$ represents the $\frac{\text{Change in } y}{\text{Change in } x}$.

Exercise 23

As we look at a graph from left to right, lines with positive slope rise and lines with negative slope decline.

Exercise 24

Parallel lines have the same slope.

Exercise 25

Horizontal lines have 0 slope.

Exercise 26

Vertical lines have undefined slope (or no slope).

14 Exercises

For the following problems, determine the slope and y-intercept of the lines.

Exercise 27 *(Solution on p. 20.)*

$y = 3x + 4$

Exercise 28

$y = 2x + 9$

Exercise 29 *(Solution on p. 20.)*
$y = 9x + 1$

Exercise 30
$y = 7x + 10$

Exercise 31 *(Solution on p. 20.)*
$y = -4x + 5$

Exercise 32
$y = -2x + 8$

Exercise 33 *(Solution on p. 20.)*
$y = -6x - 1$

Exercise 34
$y = -x - 6$

Exercise 35 *(Solution on p. 20.)*
$y = -x + 2$

Exercise 36
$2y = 4x + 8$

Exercise 37 *(Solution on p. 20.)*
$4y = 16x + 20$

Exercise 38
$-5y = 15x + 55$

Exercise 39 *(Solution on p. 20.)*
$-3y = 12x - 27$

Exercise 40
$y = \frac{3}{5}x - 8$

Exercise 41 *(Solution on p. 20.)*
$y = \frac{2}{7}x - 12$

Exercise 42
$y = \frac{-1}{8}x + \frac{2}{3}$

Exercise 43 *(Solution on p. 20.)*
$y = \frac{-4}{5}x - \frac{4}{7}$

Exercise 44
$-3y = 5x + 8$

Exercise 45 *(Solution on p. 20.)*
$-10y = -12x + 1$

Exercise 46
$-y = x + 1$

Exercise 47 *(Solution on p. 20.)*
$-y = -x + 3$

Exercise 48
$3x - y = 7$

Exercise 49 *(Solution on p. 20.)*
$5x + 3y = 6$

Exercise 50
$-6x - 7y = -12$

Exercise 51 *(Solution on p. 20.)*

$-x + 4y = -1$

For the following problems, find the slope of the line through the pairs of points.

Exercise 52

$(1,\ 6)\ ,\ (4, 9)$

Exercise 53 *(Solution on p. 20.)*

$(1,\ 3)\ ,\ (4, 7)$

Exercise 54

$(3,\ 5)\ ,\ (4, 7)$

Exercise 55 *(Solution on p. 20.)*

$(6,\ 1)\ ,\ (2, 8)$

Exercise 56

$(0,\ 5)\ ,\ (2, -6)$

Exercise 57 *(Solution on p. 20.)*

$(-2,\ 1)\ ,\ (0, 5)$

Exercise 58

$(3,\ -9)\ ,\ (5, 1)$

Exercise 59 *(Solution on p. 20.)*

$(4,\ -6)\ ,\ (-2, 1)$

Exercise 60

$(-5,\ 4)\ ,\ (-1, 0)$

Exercise 61 *(Solution on p. 20.)*

$(-3,\ 2)\ ,\ (-4, 6)$

Exercise 62

$(9,\ 12)\ ,\ (6, 0)$

Exercise 63 *(Solution on p. 20.)*

$(0,\ 0)\ ,\ (6, 6)$

Exercise 64

$(-2,\ -6)\ ,\ (-4, -1)$

Exercise 65 *(Solution on p. 20.)*

$(-1,\ -7)\ ,\ (-2, -9)$

Exercise 66

$(-6,\ -6)\ ,\ (-5, -4)$

Exercise 67 *(Solution on p. 21.)*

$(-1,\ 0)\ ,\ (-2, -2)$

Exercise 68

$(-4,\ -2)\ ,\ (0, 0)$

Exercise 69 *(Solution on p. 21.)*

$(2,\ 3)\ ,\ (10, 3)$

Exercise 70

$(4,\ -2)\ ,\ (4, 7)$

Exercise 71 *(Solution on p. 21.)*

$(8,\ -1)\ ,\ (8, 3)$

Exercise 72

$(4,\ 2)\ ,\ (6, 2)$

Exercise 73 *(Solution on p. 21.)*

$(5, -6), (9, -6)$

Exercise 74

Do lines with a positive slope rise or decline as we look left to right?

Exercise 75 *(Solution on p. 21.)*

Do lines with a negative slope rise or decline as we look left to right?

Exercise 76

Make a statement about the slopes of parallel lines.

14.1 Calculator Problems

For the following problems, determine the slope and y-intercept of the lines. Round to two decimal places.

Exercise 77 *(Solution on p. 21.)*

$3.8x + 12.1y = 4.26$

Exercise 78

$8.09x + 5.57y = -1.42$

Exercise 79 *(Solution on p. 21.)*

$10.813x - 17.0y = -45.99$

Exercise 80

$-6.003x - 92.388y = 0.008$

For the following problems, find the slope of the line through the pairs of points. Round to two decimal places.

Exercise 81 *(Solution on p. 21.)*

$(5.56, 9.37), (2.16, 4.90)$

Exercise 82

$(33.1, 8.9), (42.7, -1.06)$

Exercise 83 *(Solution on p. 21.)*

$(155.89, 227.61), (157.04, 227.61)$

Exercise 84

$(0.00426, -0.00404), (-0.00191, -0.00404)$

Exercise 85 *(Solution on p. 21.)*

$(88.81, -23.19), (88.81, -26.87)$

Exercise 86

$(-0.0000567, -0.0000567), (-0.00765, 0.00764)$

15 Exercises for Review

Exercise 87 *(Solution on p. 21.)*

(**here**[2]) Simplify $\left(x^2y^3w^4\right)^0$.

Exercise 88

(**here**[3]) Solve the equation $3x - 4(2 - x) - 3(x - 2) + 4 = 0$.

Exercise 89 *(Solution on p. 21.)*

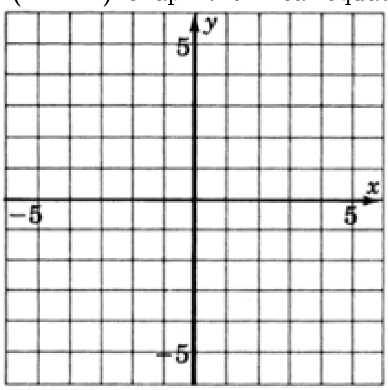
(**here**[4]) When four times a number is divided by five, and that result is decreased by eight, the result is zero. What is the original number?

Exercise 90

(**here**[5]) Solve $-3y + 10 = x + 2$ if $x = -4$.

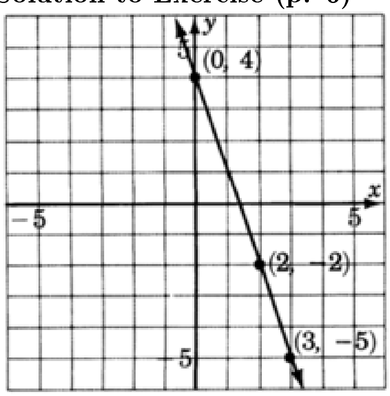
Exercise 91 *(Solution on p. 21.)*

(**here**[6]) Graph the linear equation $x + y = 3$.

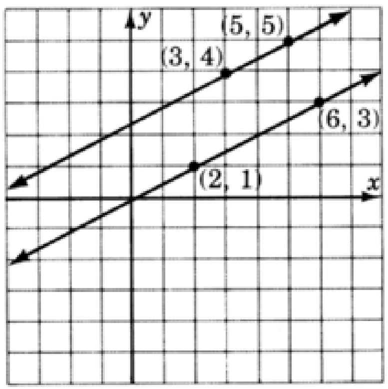


[2]"Basic Properties of Real Numbers: The Power Rules for Exponents" <http://cnx.org/content/m21897/latest/>
[3]"Solving Linear Equations and Inequalities: Further Techniques in Equation Solving" <http://cnx.org/content/m21992/latest/>
[4]"Solving Linear Equations and Inequalities: Application II - Solving Problems" <http://cnx.org/content/m21980/latest/>
[5]"Solving Linear Equations and Inequalities: Linear Equations in Two Variables" <http://cnx.org/content/m21982/latest/>
[6]"Graphing Linear Equations and Inequalities: Graphing Linear Equations in Two Variables" <http://cnx.org/content/m21995/latest/>

Solutions to Exercises in this Module

Solution to Exercise (p. 3)
$m = 2$, $b = 7$
Solution to Exercise (p. 3)
$m = -4, b = 2$
Solution to Exercise (p. 3)
$m = -5, b = -1$
Solution to Exercise (p. 3)
$m = \frac{2}{3}$, $b = \ -10$
Solution to Exercise (p. 3)
$m = \frac{-5}{8},\ b = \frac{1}{2}$
Solution to Exercise (p. 3)
$m = -3$, $b = 0$
Solution to Exercise (p. 6)
The line crosses the y-axis at $+4$. After moving horizontally 1 unit to the right, we must move exactly 3 units downward.
Solution to Exercise (p. 6)


Solution to Exercise (p. 8)
Solving for y we get $y = \frac{-2}{5}x + 3$. Now, $m = \frac{-2}{5}$ and $b = 3$.
Solution to Exercise (p. 13)
$m = \frac{3-1}{6-2} = \frac{2}{4} = \frac{1}{2}$.
Solution to Exercise (p. 13)
The line has slope $\frac{1}{2}$.
Solution to Exercise (p. 14)
The lines appear to be parallel. Parallel lines have the same slope, and lines that have the same slope are parallel.



Solution to Exercise (p. 14)
slope $= 3$; y-intercept $= (0, 4)$
Solution to Exercise (p. 14)
slope $= 9$; y-intercept $= (0, 1)$
Solution to Exercise (p. 15)
slope $= -4$; y-intercept $= (0, 5)$
Solution to Exercise (p. 15)
slope $= -6$; y-intercept $= (0, -1)$
Solution to Exercise (p. 15)
slope $= -1$; y-intercept $= (0, 2)$
Solution to Exercise (p. 15)
slope $= 4$; y-intercept $= (0, 5)$
Solution to Exercise (p. 15)
slope $= -4$; y-intercept $= (0, 9)$
Solution to Exercise (p. 15)
slope $= \frac{2}{7}$; y-intercept $= (0, -12)$
Solution to Exercise (p. 15)
slope $= -\frac{4}{5}$; y-intercept $= \left(0, -\frac{4}{7}\right)$
Solution to Exercise (p. 15)
slope $= \frac{6}{5}$; y-intercept $= \left(0, -\frac{1}{10}\right)$
Solution to Exercise (p. 15)
slope $= 1$; y-intercept $= (0, -3)$
Solution to Exercise (p. 15)
slope $= -\frac{5}{3}$; y-intercept $= (0, 2)$
Solution to Exercise (p. 15)
slope $= \frac{1}{4}$; y-intercept $= \left(0, -\frac{1}{4}\right)$
Solution to Exercise (p. 16)
$m = \frac{4}{3}$
Solution to Exercise (p. 16)
$m = -\frac{7}{4}$
Solution to Exercise (p. 16)
$m = 2$
Solution to Exercise (p. 16)
$m = -\frac{7}{6}$
Solution to Exercise (p. 16)
$m = -4$
Solution to Exercise (p. 16)
$m = 1$

Solution to Exercise (p. 16)
$m = 2$
Solution to Exercise (p. 16)
$m = 2$
Solution to Exercise (p. 16)
$m = 0\ (\text{horizontal line } y = 3)$
Solution to Exercise (p. 16)
$\text{No slope }(\text{vertical line at } x = 8)$
Solution to Exercise (p. 16)
$m = 0\ (\text{horizontal line at } y = -6)$
Solution to Exercise (p. 17)
decline
Solution to Exercise (p. 17)

$$\text{slope} = -0.31$$

$$y - \text{intercept} = (0, 0.35)$$

Solution to Exercise (p. 17)

$$\text{slope} = 0.64$$

$$y - \text{intercept} = (0, 2.71)$$

Solution to Exercise (p. 17)
$m = 1.31$
Solution to Exercise (p. 17)
$m = 0\ (\text{horizontal line at } y = 227.61)$
Solution to Exercise (p. 17)
$\text{No slope }(\text{vertical line } x = 88.81)$
Solution to Exercise (p. 18)
$1 \text{ if } xyw \neq 0$
Solution to Exercise (p. 18)
10
Solution to Exercise (p. 18)