UNIT 1 OVERVIEW AND READINESS

Unit 1 Overview

Why Should I Care?

Do you know what a budget is? Have you ever used one? Watch the video to learn a bit about how City Manager Arthur Noriega uses linear equations to manage the budget for the city of Miami.

Access multimedia content (http://openstax.org/books/algebra-1/pages/1-unit-1-overview)
In this unit, you will learn about using variables, expressions, and equations to model relationships. You will learn that you can represent a constraint, or limit on what is possible in a situation, using expressions, equations, and inequalities. This will be helpful whether you want to know how soon you'll be able to save for a new bicycle, or if you can afford to go to a concert with your friends in two weeks.

You will also learn to transform one equation into an equivalent equation. Sometimes you want to write an equation in a different form so you can solve for a certain variable or so you can write the equation in a form that makes it easier to identify information about the relationship. You will learn how the form and parts of linear equations are related to the features of its graph. A graph can be helpful to model a relationship and to make sense of the constraints.

Building Character: Social Intelligence

As a city manager, Arthur Noriega must work with others to develop budgets. Similarly, in this course, you will need to work with your classmates to solve problems. Working well with others is a skill that will be useful to you in this course, as well as outside of the classroom. Most jobs require the ability to work well, or collaborate, with other people.

Throughout this unit, you will work on developing your **social intelligence**. Social intelligence is the ability to connect with other people. Having this ability allows you to interact in a more positive manner with others. Being empathetic, or sensitive to what others are feeling, shows that you care about others. In fact, empathetic people are less likely to experience anxiety, depression, and addictions later in life. They are also more likely to be hired, promoted, earn more money, and have happier marriages and better-adjusted children.

Think about your current sense of social intelligence. How many of the following statements are true for you?

- I have a lot of relationships that are mutually beneficial, enjoyable, and supportive.
- Most of the time, I can tell how other people feel and have a good idea about how to respond appropriately.
- My relationships make me feel good about myself.
- The people in my life help me be my best.

Don't worry if none of these statements are true for you. Developing this trait takes time. Your first step starts today!

Am I Ready to Learn This?

Getting Ready for Unit 1

To be ready for this unit, you need to be able to:

- Solve linear equations using a general strategy.
- Classify equations.
- Identify points on a graph.

Next, you will answer some questions that will help you see how ready you are for this unit. If you need help, some mini-lessons will help you brush up on anything you need to work on.

Solve Linear Equations: Mini-Lesson Review

? **MINI LESSON QUESTION**

Question #1: Solve Linear Equations

Solve: $2(m-6)+3=m-1$.

a. $m=-10$

b. $m=14$

c. $m = 8$
d. $m = 2$

Solving Linear Equations Using a General Strategy

A solution of an equation is a value of a variable that makes a true statement when substituted into the equation. For example, in $x + 2 = 3$, the value of the variable x is 1.

To find the solution to an equation in one variable, the goal is to isolate the variable on one side of the equation. For example,

$3x + 1 = 9 - x$

$+x + x$

$4x + 1 = 9$

$-1 - 1$

$4x = 8$

You can check the solution by substituting the value into the equation.

$3(2) + 1 = 9 - 2$

$6 + 1 = 7$

$7 = 7$

Equations may take several steps to solve, so it is helpful to have a clear and organized strategy. The following table shows a general strategy to solve any **linear equation** in one variable. You may not need to use every step.

General Strategy for Solving Linear Equations

Step 1

Simplify each side of the equation as much as possible.

Use the **Distributive Property** to remove any parentheses.

Combine like **terms** .

Step 2

Collect all the variable terms on one side of the equation.

Use the **Addition or Subtraction Property of Equality**.

Step 3

Collect all the constant terms on the other side of the equation.

Use the Addition or Subtraction Property of Equality.

Step 4

Make the **coefficient** of the variable term to equal to 1.

State the solution to the equation.

Step 5

Check the solution.

Substitute the solution into the original equation to make sure the result is a true statement.

TRY IT **Solving a Linear Equation Using a General Strategy**

Solve the following using a general strategy:

Solve $2(3x-8)=19-x$.

Check Your Understanding

Solve: $7(n-3)-8=-15$.

a. $n=-\frac{4}{7}$

b. $n=-2$

c. $n=2$

d. $n=-3\frac{5}{7}$

Videos: Solving Linear Equations

Khan Academy: Equations with Parentheses

Watch this video to see how to use the Distributive Property to solve an equation with parentheses.

Access multimedia content (http://openstax.org/books/algebra-1/pages/1-solve-linear-equations-mini-lesson-review)

Khan Academy: Equations with Variables on Both Sides: Fractions

Watch this video to see how to solve an equation with fractional coefficients and variables on both sides.

Access multimedia content (http://openstax.org/books/algebra-1/pages/1-solve-linear-equations-mini-lesson-review)

Classify Equations: Mini-Lesson Review

MINI LESSON QUESTION **Question #2: Classify Equations**

Which of the following correctly classifies the equation and the solution?

$6(2n-1)+3=2n-8+5(2n+1)$

a. contradiction; no solution

b. conditional equation; $1n=-\frac{1}{4}$

c. conditional equation; $n=0$

d. identity; all real numbers

Use Solutions to Classify Equations

An equation that is true for one or more values of the variable and false for all other values of the variable is a **conditional equation**.

Consider the equation $7x+8=-13$.

Subtract 8 to get the constants on one side.	$7x = -21$
Divide by 7 to make the coefficient of the variable 1.	$x = -3$

The solution is $x = -3$. This means the equation $7x + 8 = -13$ is true when we replace the variable, x, with the value -3, but it is not true when we replace x with any other value. Whether the equation $7x + 8 = -13$ is true depends on the value of the variable. The equation is a conditional equation.

An equation that is true for any value of the variable is called an **identity**. The solution of an identity is all real numbers.

Consider the equation $2y + 6 = 2(y + 3)$. Do you recognize that the left side and the right side are equivalent? Let's see what happens when we solve for y.

Distribute.	$2y + 6 = 2y + 6$
Subtract $2y$ to get the variables on one side.	$6 = 6$

But $6 = 6$ is true. This means the equation $2y + 6 = 2(y + 3)$ is true for any value of y. The equation is an identity, and we say the solution is all real numbers.

An equation that is false for all values of the variable is called a **contradiction**. A contradiction has no solution.

Consider the equation $5z = 5z - 1$.

Subtract $5z$ to get the variables on one side.	$0 \neq -1$

The table summarizes the types of equations and solutions.

Type of Equation	What happens when you solve it?	Solution
Conditional Equation	True for one or more values of the variables and false for all other values	One or more values
Identity	**True** for any value of the variable	All real numbers
Contradiction	**False** for all values of the variable	No solution

TRY IT **Use Solutions to Classify Equations**

Classify the following: $5m + 3(9 + 3m) = 2(7m - 11)$.

Check Your Understanding

Which of the following correctly classifies the equation and the solution?$4 + 9(3x - 7) = -42x - 13 + 23(3x - 2)$

a. identity; all real numbers

b. conditional equation; $x = 0$

c. conditional equation; $x = 2\frac{5}{27}$

d. contradiction; no solution

Video: Solving Linear Equations

Khan Academy: Number of Solutions to Linear Equations

Watch the video to see how a linear equation may have one solution, no solution, or infinite solutions.

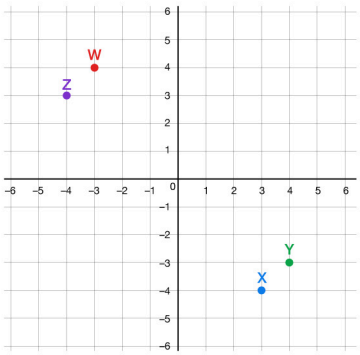
Access multimedia content (http://openstax.org/books/algebra-1/pages/1-classify-equations-mini-lesson-review)

Find Coordinates: Mini-Lesson Review

? **MINI LESSON QUESTION**

Question #3: Find Coordinates

Which point has coordinates $(3, -4)$?



a. Point Z

b. Point Y

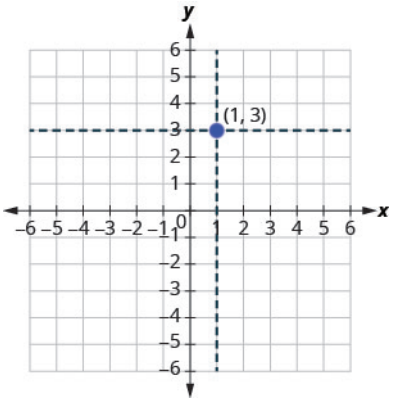
c. Point W

d. Point X

Identifying Coordinates of a Point on a Graph

In the rectangular coordinate system, every point is represented by an **ordered pair**. The first number in the ordered pair is the x**-coordinate** of the point, and the second number is the y**-coordinate** of the point. An ordered pair, (x, y), gives the coordinates of a point in a rectangular coordinate system. The first number is the x-coordinate. The second number is the y-coordinate. The phrase "ordered pair" means the order is important. What is the ordered pair of the point where the axes cross? At that point, both coordinates are zero, so its ordered pair is $(0, 0)$. The point $(0, 0)$ has a special name. It is called the origin.

We use the coordinates to locate a point on the xy-plane. Let's plot the point $(1, 3)$ as an example. First, locate 1 on the x-axis and lightly sketch a vertical line through $x = 1$. Then, locate 3 on the y-axis and sketch a horizontal line through $y = 3$. Now, find the point where these two lines meet—that is the point with coordinates $(1, 3)$.

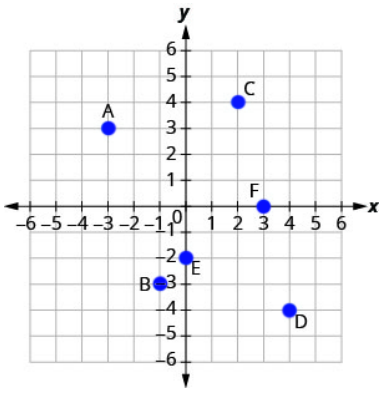


Notice that the vertical line through $x = 1$ and the horizontal line through $y = 3$ are not part of the graph. We just used them to help us locate the point $(1, 3)$.

In algebra, being able to identify the coordinates of a point shown on a graph is just as important as being able to plot points. To identify the x-coordinate of a point on a graph, read the number on the x-axis directly above or below the point. To identify the y-coordinate of a point, read the number on the y-axis directly to the left or right of the point. Remember, when you write the ordered pair, use the correct order, (x, y).

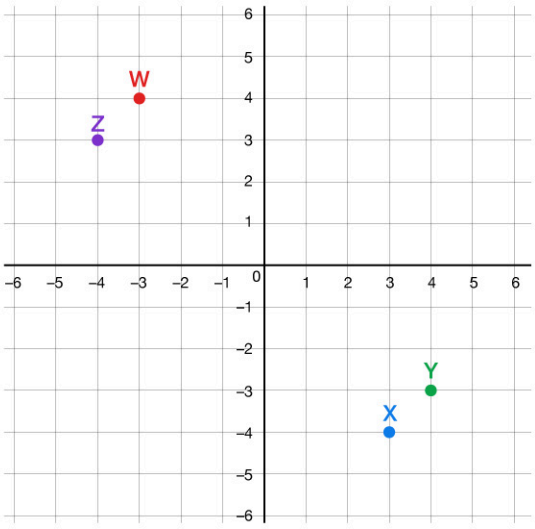
TRY IT **Identifying Coordinates of a Point on a Graph**

Name the ordered pair of each point shown in the rectangular coordinate system.



Check Your Understanding

Which point has coordinates $(-4, 3)$?



a. Point W

b. Point Z

c. Point X

d. Point Y

Video: Points on the Coordinate Plane

Khan Academy: Points on the Coordinate Plane

Watch this video to see how you can use a coordinate plane to plot points and to identify the coordinates of a point plotted on a coordinate plane.

Access multimedia content (http://openstax.org/books/algebra-1/pages/1-find-coordinates-mini-lesson-review)

Unit 1 Overview: Wrap Up

- Solve linear equations using a general strategy.
- Classify equations.
- Identify points on a graph.

If you are still struggling, be sure to reach out to your teacher for additional help. Nobody is good at problems like this on the first try. Keep at it, and it will get easier.