Lesson 4-5

Example 1 Identify Linear Equations

Determine whether each equation is a linear equation. If so, write the equation in standard form.

a. $\mathbf{4 - 2y = 6x}$

First rewrite the equation so that both variables are on the same side of the equation.

$4 - 2y = 6x$	Original equation
$\frac{4-2y}{2} = \frac{6x}{2}$	Divide each side by the GCF.
$2 - y = 3x$	Simplify.
$2 - y + y = 3x + y$	Add y to each side.
$2 = 3x + y$	Simplify.

The equation $2 = 3x + y$ can be written as $3x + y = 2$. The equation is now in standard form where $A = 3$, $B = 1$, and $C = 2$. This is a linear equation.

b. $\mathbf{y + 3 = x^2}$

Since the variable x is raised to the second power, this is not a linear equation.

c. $\mathbf{\frac{4}{5}x = -2}$

Rewrite the equation with integer coefficients by multiplying both sides by 5.

$\frac{4}{5}x = -2$	Original equation
$(5)\frac{4}{5}x = 5(-2)$	Multiply both sides by 5.
$4x = -10$	Simplify.
$\frac{4x}{2} = \frac{-10}{2}$	Divide each side by the GCF.
$2x = -5$	Simplify.

The equation $2x = -5$ can be written as $2x + 0y = -5$. Therefore, it is a linear equation in standard form where $A = 2$, $B = 0$, and $C = -5$.

d. $\mathbf{6y + x = 5y - 2}$

Combine like terms.

$6y + x = 5y - 2$	Original equation
$6y + x - 5y = 5y - 2 - 5y$	Subtract $5y$ from each side.
$y + x = -2$	Simplify

The equation $y + x = -2$ can be written as $x + y = -2$. The equation is now in standard form where $A = 1$, $B = 1$, and $C = -2$.

Example 2 Graph by Making a Table

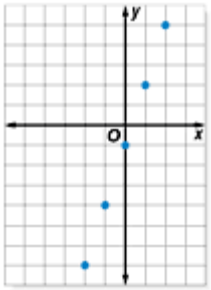
Graph $y - 3x = -1$.

In order to find values for y more easily, solve the equation for y.

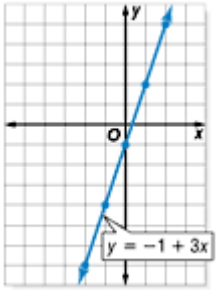
$y - 3x = -1$	Original equation
$y - 3x + 3x = -1 + 3x$	Add $3x$ to each side.
$y = -1 + 3x$	Simplify.

Select 5 values for the domain and make a table. Then graph the ordered pairs.

x	$-1x + 3$	y	(x, y)
-2	-1(-2) + 3	-7	(-2, -7)
-1	-1(-1) + 3	-4	(-1, -4)
0	-1(0) + 3	-1	(0, -1)
1	-1(1) + 3	2	(1, 2)
2	-1(2) + 3	5	(2, 5)



When you graph the ordered pairs, a pattern begins to form. The domain of $y = -1 + 3x$ is the set of all real numbers, so there are an infinite number of solutions of the equation. Draw a line through the points. This line represents all of the solutions for $y = -1 + 3x$.



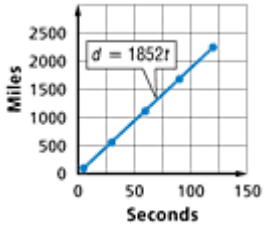
Example 3 Use the Graph of a Linear Equation

The speed of the earth around the sun is 18.52 miles per second. Therefore, the distance d the earth will travel in a time t is $d = 18.52t$.

a. Graph the equation $d = 18.52t$. Where d is represented in miles and t is represented in seconds.

Select 5 values for t and make a table. Graph the ordered pairs and connect them to draw a line.

t	$18.52t$	d	(t, d)
5	18.52(5)	92.6	(5, 92.6)
30	18.52(30)	555.6	(30, 555.6)
60	18.52(60)	1111.2	(60, 1111.2)
90	18.52(90)	1666.8	(90, 1666.8)
120	18.52(120)	2222.4	(120, 2222.4)



b. How long would it take to travel 200 miles?

Since any point on the line is a solution of the equation, use the graph to estimate the value of the x-coordinate in the ordered pair that contains 200 as the y-coordinate. The ordered pair (10.8, 200) appears to be on the line. So, it takes about 10.8 seconds to travel 200 miles. Check this solution algebraically by substituting (10.8, 200) into the original equation.

Example 4 Graph Using Intercepts

Determine the *x*-intercept and *y*-intercept of $5x - y = 8$. Then graph the equation.

To find the *x*-intercept, let $y = 0$.

$5x - y = 8$	Original equation
$5x - 0 = 8$	Replace y with 0.
$5x = 8$	Divide each side by 5.
$x = \frac{8}{5}$	

To find the *y*-intercept, let $x = 0$.

$5x - y = 8$	Original equation
$5(0) - y = 8$	Replace x with 0.
$-y = 8$	Multiply each side by –1.
$y = -8$	

The *x*-intercept is $\frac{8}{5}$, so the graph intersects the *x*-axis at $\left(\frac{8}{5}, 0\right)$. The *y*-intercept is –8, so the graph intersects the *y*-axis at (0, -8). Plot these points. Then draw a line that connects them.