Section 3.1
Graphing Linear Equations in Two Variables

Throw me the BALL!

From the time the football leaves a quarterback's hand
until it is caught by the receiver,
it follows a predictable path.

The Exercise Set of this section of the textbook
will show how a graph can be used to analyze
the position of the football during its flight.

First Steps:

- ☐ **Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 3.1 of your textbook which begins on page 210.
- ☐ Complete the ***Concept and Vocabulary Check*** on page 220 of the textbook.

Guided Practice:

- ☐ Review each of the following ***Solved Problems*** and complete each ***Pencil Problem***.

Objective #1: Plot ordered pairs in the rectangular coordinate system.

✔ *Solved Problem #1*

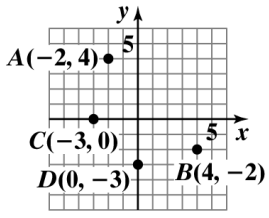
1. Plot the points:
$A(-2, 4)$, $B(4, -2)$, $C(-3, 0)$, and $D(0, -3)$.

From the origin, point A is left 2 units and up 4 units.

From the origin, point B is right 4 units and down 2 units.

From the origin, point C is left 3 units.

From the origin, point D is down 3 units.



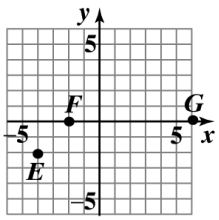
✎ *Pencil Problem #1* ✎

1. Plot the points:
$A(3, 5)$, $B(-5, 1)$, $C(-3, -1)$.

Objective #2: Find coordinates of points in the rectangular coordinate system.

✔ *Solved Problem #2*

2. Determine the coordinates of points E, F, and G.



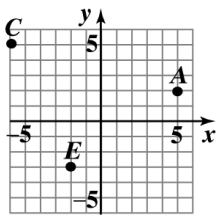
From the origin, point E is left 4 units and down 2 units.
Coordinates: $E(-4,-2)$

From the origin, point F is left 2 units.
Coordinates: $F(-2,0)$

From the origin, point G is right 6 units.
Coordinates: $G(6,0)$

✎ *Pencil Problem #2*

2. Determine the coordinates of points A, C, and E.



Objective #3: Determine whether an ordered pair is a solution of an equation.

✔ *Solved Problem #3*

3a. Determine whether the ordered pair $(3,-2)$ is a solution of the equation $x-3y=9$.

$$\begin{aligned} x-3y&=9\\ 3-3(-2)&=9\\ 3+6&=9\\ 9&=9,\ \text{true} \end{aligned}$$

$(3,-2)$ is a solution.

✎ *Pencil Problem #3*

3a. Determine whether the ordered pair $(0,6)$ is a solution of the equation $y=2x+6$.

3b. Determine whether the ordered pair $(-2,3)$ is a solution of the equation $x-3y=9$.

$$\begin{aligned} x-3y&=9\\ -2-3(3)&=9\\ -2-9&=9\\ -11&=9,\ \text{false} \end{aligned}$$

$(-2,3)$ is not a solution.

3b. Determine whether the ordered pair $(2,-2)$ is a solution of the equation $y=2x+6$.

Objective #4: Find solutions of an equation in two variables.

✔ *Solved Problem #4*

4. Find five solutions of $y = 3x + 2$.

Select integers for x, starting with -2 and ending with 2.

x	$y = 3x + 2$	(x, y)
-2	$y = 3(-2) + 2$ $= -6 + 2$ $= -4$	$(-2, -4)$
-1	$y = 3(-1) + 2$ $= -3 + 2$ $= -1$	$(-1, -1)$
0	$y = 3(0) + 2$ $= 0 + 2$ $= 2$	$(0, 2)$
1	$y = 3(1) + 2$ $= 3 + 2$ $= 5$	$(1, 5)$
2	$y = 3(2) + 2$ $= 6 + 2$ $= 8$	$(2, 8)$

✎ *Pencil Problem #4*

4. Find five solutions of $y = -3x + 7$.

Select integers for x, starting with -2 and ending with 2.

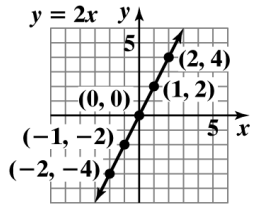
Objective #5: Use point plotting to graph linear equations.

✔ *Solved Problem #5*

5a. Graph the equation: $y = 2x$

First, make a table of values:

x	$y = 2x$	(x, y)
-2	$y = 2(-2) = -4$	$(-2, -4)$
-1	$y = 2(-1) = -2$	$(-1, -2)$
0	$y = 2(0) = 0$	$(0, 0)$
1	$y = 2(1) = 2$	$(1, 2)$
2	$y = 2(2) = 4$	$(2, 4)$



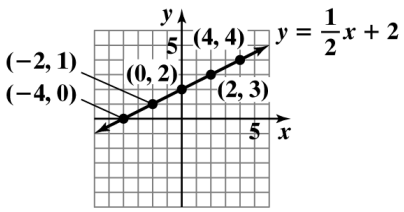
✎ *Pencil Problem #5*

5a. Graph the equation: $y = x$

5b. Graph the equation: $y = \frac{1}{2}x + 2$

First, make a table of values:

x	$y = \frac{1}{2}x + 2$	(x, y)
-4	$y = \frac{1}{2}(-4) + 2 = 0$	$(-4, 0)$
-2	$y = \frac{1}{2}(-2) + 2 = 1$	$(-2, 1)$
0	$y = \frac{1}{2}(0) + 2 = 2$	$(0, 2)$
2	$y = \frac{1}{2}(2) + 2 = 3$	$(2, 3)$
4	$y = \frac{1}{2}(4) + 2 = 4$	$(4, 4)$



5b. Graph the equation: $y = -\frac{3}{2}x + 1$

Objective #6: Use graphs of linear equations to solve problems.

✔ *Solved Problem #6*

6. The mathematical model $D = 1.4n + 1$ describes the percentage of consumers, D, who paid primarily with debit cards n years after 1995.

6a. Let n = 0, 5, 10, and 15. Make a table of values showing four solutions of the equation.

n	$D = 1.4n + 1$	(n, D)
0	$D = 1.4(0) + 1$ $= 0 + 1$ $= 1$	$(0,1)$
5	$D = 1.4(5) + 1$ $= 7 + 1$ $= 8$	$(5,8)$
10	$D = 1.4(10) + 1$ $= 14 + 1$ $= 15$	$(10,15)$
15	$D = 1.4(15) + 1$ $= 21 + 1$ $= 22$	$(15,22)$

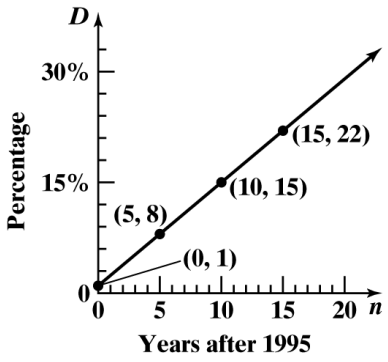
✎ *Pencil Problem #6*

6. For the period from 2000 through 2010, the percentage viewing a college education as essential for success increased on average by approximately 2.4 each year. These conditions can be described by the mathematical model $S = 2.4n + 31$, where S is the percentage of U.S. adults who viewed college as essential for success n years after 2000.

6a. Let n = 0, 5, 10, 15 and 20. Make a table of values showing five solutions of the equation.

6b. Graph the formula in a rectangular coordinate system.

Plot the points from the table of values. Then use a straightedge to draw the line though them.



6b. Graph the formula in a rectangular coordinate system.
Suggestion: Let each tick mark on the horizontal axis, labeled n, represent 5 units. Extend the horizontal axis to include $n = 25$. Let each tick mark on the vertical axis, labeled S, represent 10 units and extend the axis to include $S = 100$.

6c. Use your graph from part (b) to estimate the percentage of consumers who will pay primarily with debit cards in 2015.

According to the graph, about 29% of consumers will pay primarily with debit cards in 2015.

6c. Use your graph from part (b) to estimate the percentage of U.S. adults who will view college as essential for success in 2018.

6d. Use the formula to project the percentage of consumers who will pay primarily by debit cards in 2015.

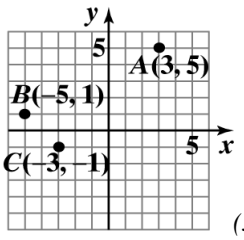
2015 is 20 years after 1995. Therefore, substitute 20 into the formula for n.

$$D = 1.4n + 1$$
$$D = 1.4(20) + 1$$
$$= 28 + 1$$
$$= 29$$

According to the formula, about 29% of consumers will pay primarily with debit cards in 2015.

6d. Use the formula to project the percentage of U.S. adults who will view college as essential for success in 2018.

Answers for Pencil Problems *(Textbook Exercise references in parentheses)*:

1. 

(3.1 #1, #3, and #5)

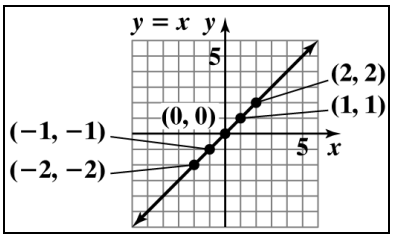
2. A (5,2), C (−6,5), E(−2,−3) *(3.1 #25, #27, and # 29)*

3a. (0,6) is a solution *(3.1 #41)* **3b.** (2,−2) is not a solution *(3.1 #41)*

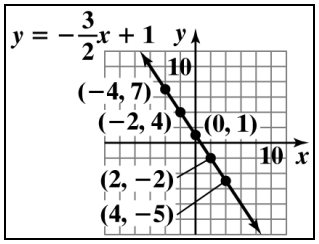
4.

x	$y=-3x+7$	(x,y)
−2	$y=-3(-2)+7=13$	$(-2,13)$
−1	$y=-3(-1)+7=10$	$(-1,10)$
0	$y=-3(0)+7=7$	$(0,7)$
1	$y=-3(1)+7=4$	$(1,4)$
2	$y=-3(2)+7=1$	$(2,1)$

(3.1 #55)

5a. 

(3.1 #57)

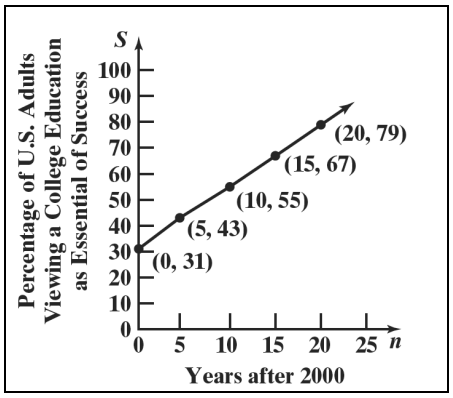
5b. 

(3.1 #73)

6a.

n	$S=2.4n+31$	(n,S)
0	$S=2.4(0)+31=31$	$(0,31)$
5	$S=2.4(5)+31=43$	$(5,43)$
10	$S=2.4(10)+31=55$	$(10,55)$
15	$S=2.4(15)+31=67$	$(15,67)$
20	$S=2.4(20)+31=79$	$(20,79)$

(3.1 #93a)

6b. 

(3.1 #93b)

6c. approximately 74% *(3.1 #93c)* **6d.** 74.2% *(3.1 #93d)*

Homework:

- ☐ **Review the Section 3.1 summary** on page 271 of the textbook.
- ☐ **Insert your homework** into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.