

Lesson 32: Graphing Linear Equations

LESSON 32: Graphing Linear Equations part 1

Weekly Focus: graphing lines
Weekly Skill: make a table, graph points, distance formula

Lesson Summary: For the warm-up, students will solve a problem about pet kennels. In Activity 1, they will learn how to graph lines by making a table and plotting points. In Activity 2, they will practice the distance formula. In Activity 3, they do problems in the student book. The Activity 4 application is graphing a word problem. There is an extra problem at the end also. Estimated time for the lesson is 2 hours.

Materials Needed for Lesson 32:

- Video (length 9:40) on the distance formula. The video is required for teachers and recommended for students.
- Notes worksheet 32A
- 2 worksheets (32.1 – attached, 32.2 – embedded link) with answers
- *Mathematical Reasoning Test Preparation for the 2014 GED Test Student Book (pages 72 – 73)*
- Graph paper

Objectives: Students will be able to:

- Solve word problems about points on a line
- Graph linear equations using points
- Find the distance between two points

ACES Skills Addressed: N, CT, LS

CCRS Mathematical Practices Addressed: Make Sense of Problems and Persevere in Solving Them, Model with Math

Levels of Knowing Math Addressed: Intuitive, Pictorial, Abstract, and Application

Notes:

You can add more examples if you feel students need them before they work. Any ideas that concretely relates to their lives make good examples.

For more practice as a class, feel free to choose some of the easier problems from the worksheets to do together. The “easier” problems are not necessarily at the beginning of each worksheet. Also, you may decide to have students complete only part of the worksheets in class and assign the rest as homework or extra practice.

The GED Math test is 115 minutes long and includes approximately 46 questions. The questions have a focus on quantitative problem solving (45%) and algebraic problem solving (55%).

Students must be able to understand math concepts and apply them to new situations, use logical reasoning to explain their answers, evaluate and further the reasoning of others, represent real world problems algebraically and visually, and manipulate and solve algebraic expressions.

This computer-based test includes questions that may be multiple-choice, fill-in-the-blank, choose from a drop-down menu, or drag-and-drop the response from one place to another.

The purpose of the GED test is to provide students with the skills necessary to either further their education or be ready for the demands of today's careers.

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Lesson 32 Warm-up: Solve the pet kennel question

Time: 5 Minutes

Write on the board: A kennel charges a fee of \$12 and \$8 a day for cats and \$12 a day for dogs.

Basic Questions:

- What is the cost to board a cat for a week? A dog?
 - $\$12 + \$8(7) = \$68$
 - $\$12 + \$12(7) = \$96$

Extension Questions:

- Write an expression for the cost of boarding a cat for a week
 - $\$12 + \$8d$
- Write an expression for the cost of boarding a dog for a week
 - $\$12 + \$12d$
- For how many dogs and how many cats is the price per day the same?
 - Since the ratio of the price is 2 to 3, the cost is the same for 2 dogs = 3 cats = \$24

Lesson 32 Activity 1: Graphing with Points

Time: 30 Minutes

1. Use **Notes 32A** to teach how to graph linear equations by making a table.
2. Do the examples from the notes on the board and have students take their own notes.
3. For each equation, make a table and then make a graph.
4. Practice with **Worksheet 32.1**. The worksheet does not have a table, but have the students add an x/y table for each problem.

Lesson 32 Activity 2: The Distance Formula

Time: 20-25 Minutes

1. Draw a coordinate plane on the board. Show two points such as (-2,3) and (2,3) for which it is easy to see how many units apart they are (4 in this case) because one of the coordinates is the same.
2. Do several examples of points that lie on either the same x or the same y.
3. The **distance formula** is used to find the distance between two points on a line that are not

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easy to count.

4. Explain how the distance formula is related to the Pythagorean Theorem (which you will study in a later lesson) of $a^2 + b^2 = c^2$.
5. Example: Find the distance between the points (8,5) and (4, -3). Show the points on the graph.

We can use the distance formula to determine the length of this line:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Plug in our numbers:

$$d = \sqrt{(4 - 8)^2 + \{(-3) - 5\}^2}$$

$$d = \sqrt{(4)^2 + (8)^2}$$

$$d = \sqrt{16 + 64}$$

$$d = \sqrt{80}$$

$$d = 8.9$$

So, the answer is 8.9



Note to teacher: The example should have $(-4)^2$ and $(-8)^2$. Results are the same.

6. Practice with [Worksheet 32.2](#). Do one together first.

Lesson 32 Activity 3: Practice Questions

Time: 15-20 Minutes

1. Have students work in the **student book pages 72-73**.
2. Do the example on page 72 on the board. Make a table to show how we choose x values and substitute them into the table to obtain the y value.
3. Explain again that when $x = 0$, it is the **x-intercept** because this is where the line crosses the x-axis. It is a good idea to graph $x = 0$.
4. Explain again that when $y = 0$, it is the **y-intercept**. It is a good idea to graph $y = 0$.
5. You should always graph at least 3 points to make sure you didn't make a mistake.

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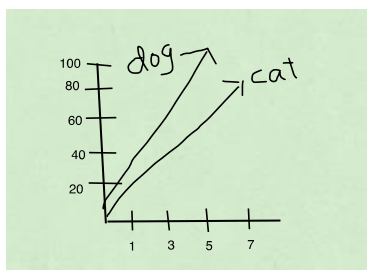
Lesson 32 Activity 4 Application: Graph the Kennel Problem

Time: 15-20 Minutes

1. Graph the word problem from the warm up activity about pet kennels.
2. Recall the equations: To kennel a cat, it's \$12 + \$8 a day. For the dog, it is \$12 + \$12 a day.
3. Make a table for each one and then graph each line by putting in a number of days and solving for y. The table below is an example. Students may write different numbers for x.
- 4.

Cat: $12 + 8x = y$			Dog: $12 + 12x = y$	
x = days	y = cost		x = days	y = cost
1	20		1	24
3	36		3	48
5	52		5	72
7	68		7	96

The graph should look similar to the one below (except lines should start at origin).



5. Follow up questions: Why do you think the line for the dog goes up faster? (more expensive)
6. What is that line called? (the slope). We will study the slope soon.

Lesson 32: Finish Early?

Time: 10 Minutes

1. Write an equation, make a table, and make a graph for how much pay you earn per week.
2. Hint: Your pay rate multiplied by your hours equals your pay.
3. Example: If you make \$12 an hour, then $12x = y$.

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Notes 32A: How to Graph a Linear Equation

GRAPHING Linear equations

Linear equations are named as such because if we were to plot ALL of the solutions to a linear equation (remember, there are an INFINITE number of solutions to a linear equation!), the points would form a **LINE**.

The graph of a Linear equation is a straight line.

example 1: Graph the equation
 $x + y = 3$

We start out by making a chart. We will choose any number for x and then find its corresponding y value.

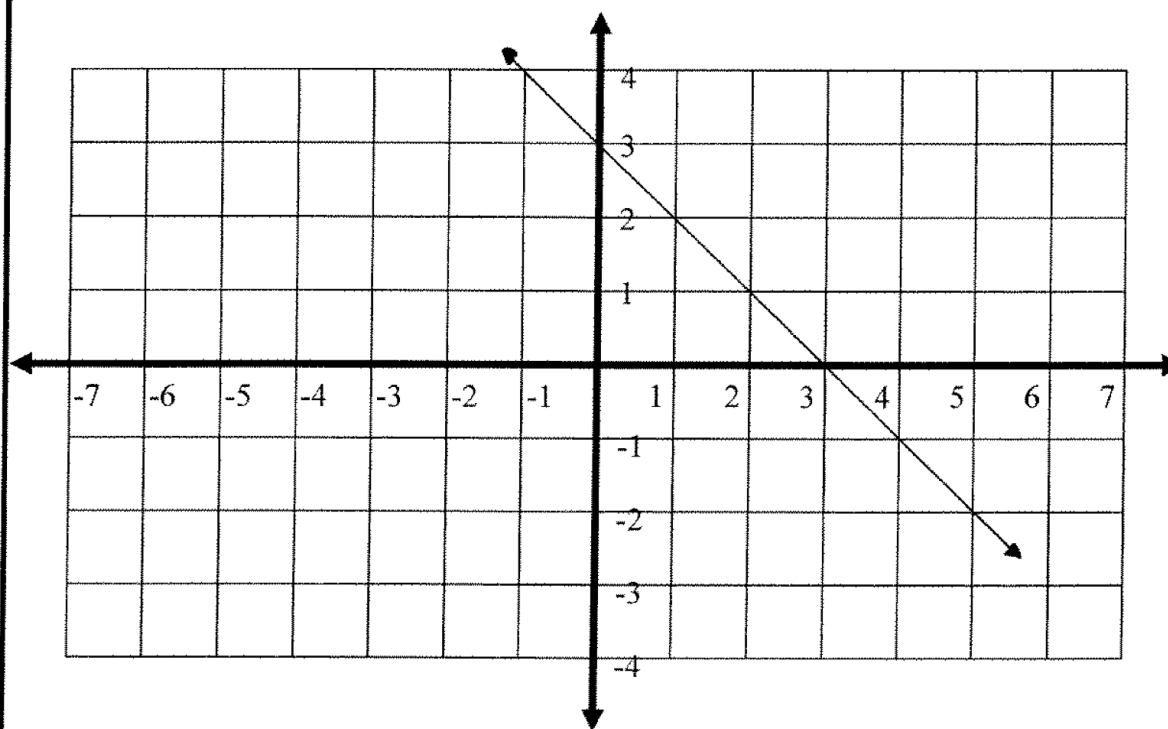
x	y
3	
0	
-3	
1	
2	

Note: Always find at least 3 points when graphing linear equations.

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NOW we plot these three points and connect the dots to form a line.

Every point that lies on this line is a solution to the equation $x + y = 3$.



Consider the line above. The point $(3, 0)$ is the **x-intercept** since that is the point where the line intersects the x axis. The point $(0, 3)$ is the **y-intercept** since that is the point where the line intersects the

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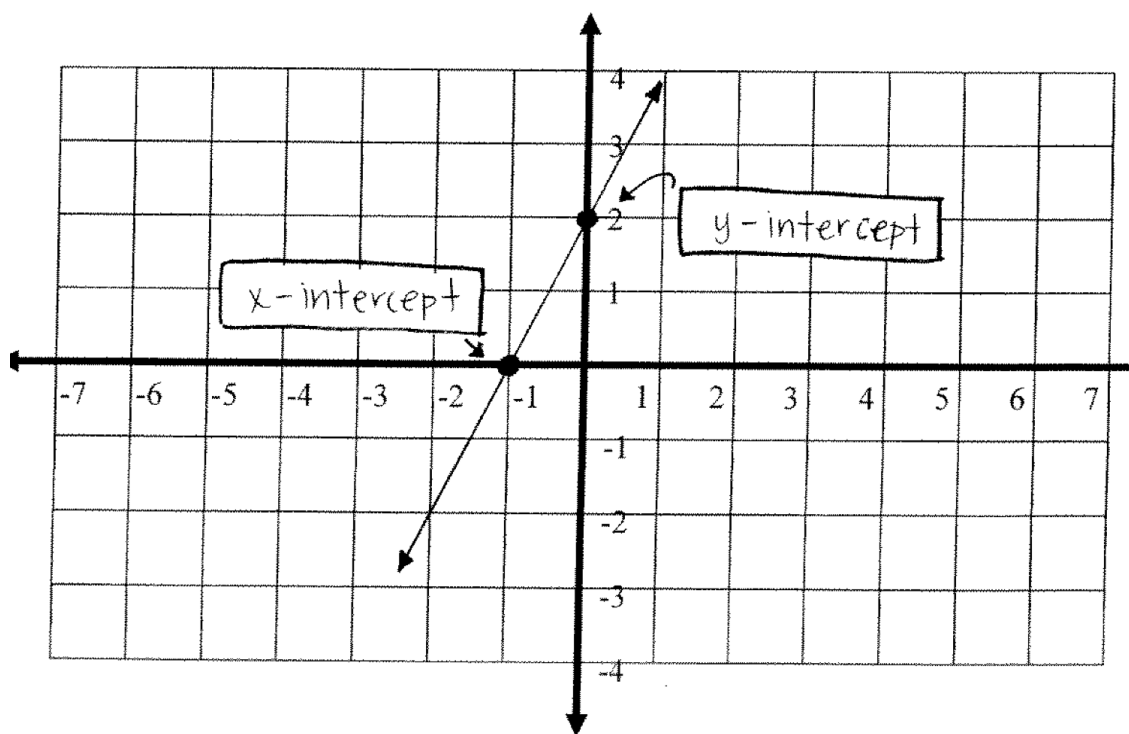
y axis.

One method of graphing linear equations is to find the x and y intercepts.

To find the x-intercept plug in zero for y and solve for x.

To find the y-intercept plug in zero for x and solve for y.

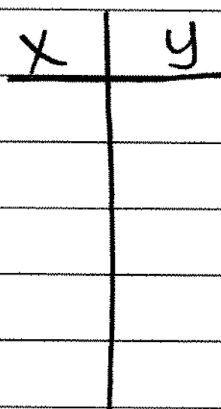
consider the graph of $-2x + y = 2$ below.



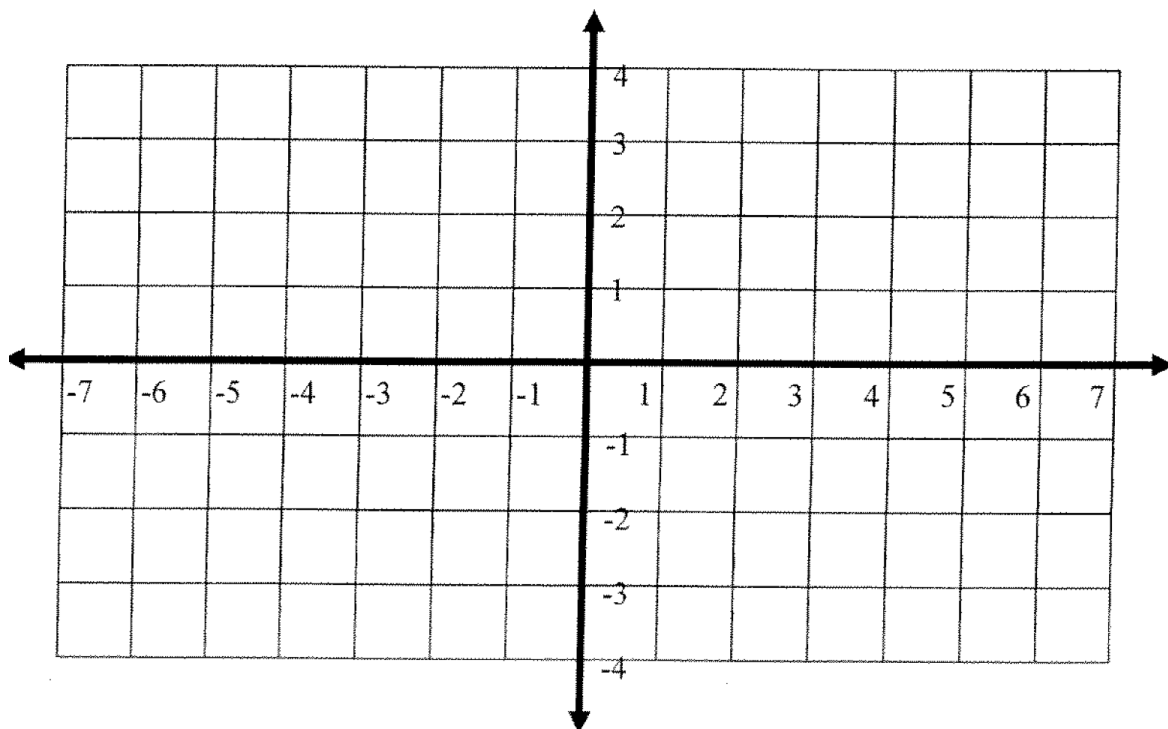
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example 2:

Graph the line $y=3$
on the grid below



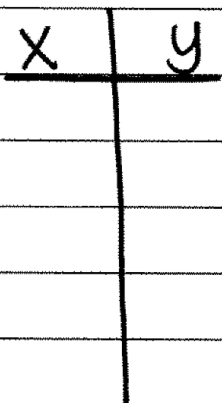
Note: $y=3$ means no matter what the
x-value, y always equals 3.



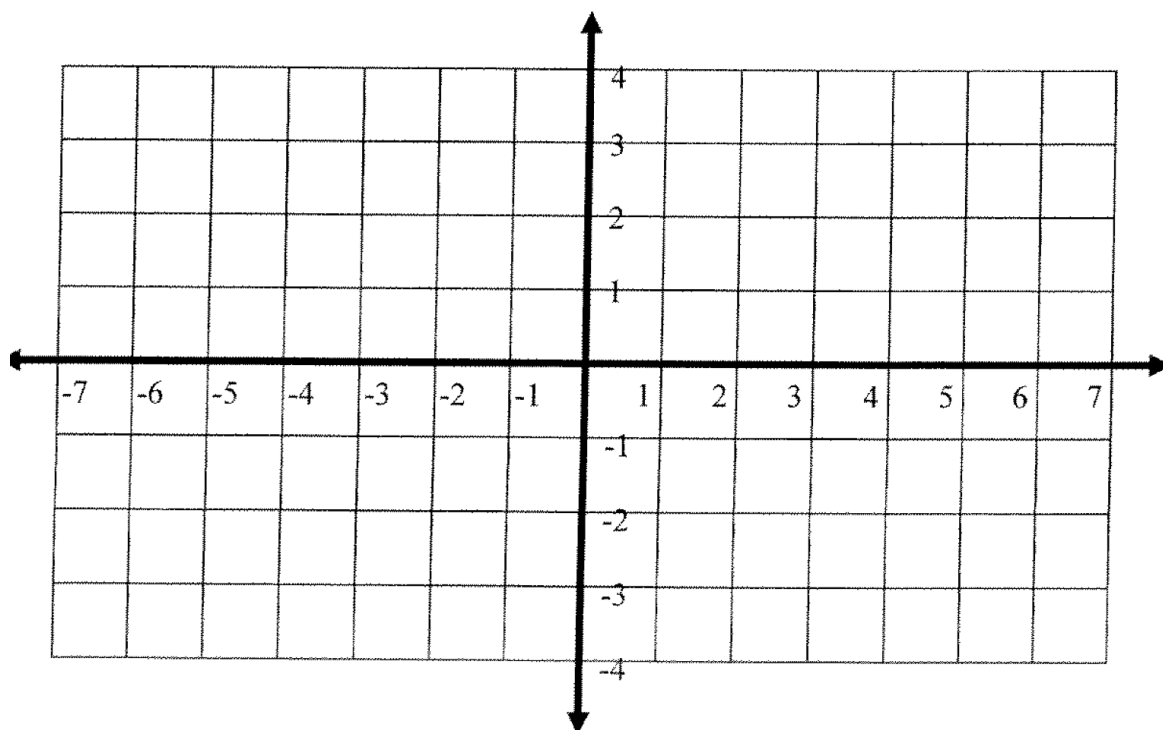
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example 3:

Graph the line $x = 2$ on
the grid below



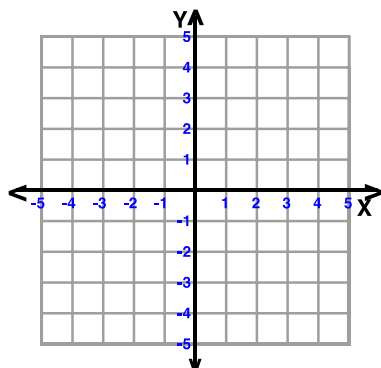
Note: $x = 2$ means no matter what
the y-value, x always
equals 2.



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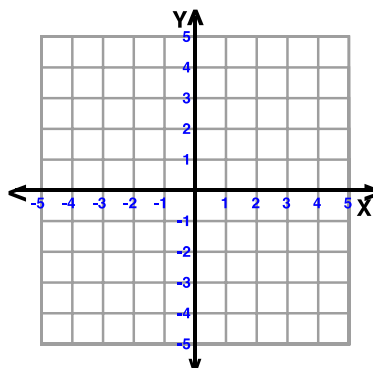
Worksheet 32.1 Graphing Lines

1)



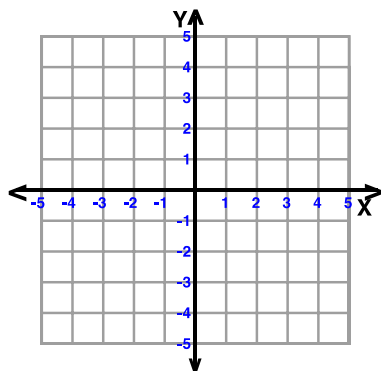
$$-5x + 2y = 6$$

2)



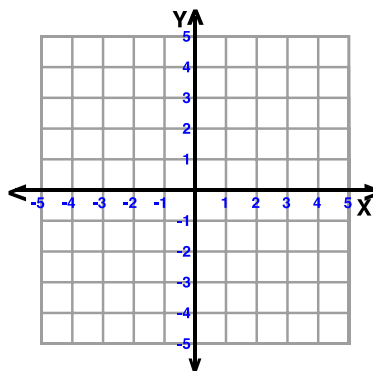
$$-2x + 3y = 9$$

3)



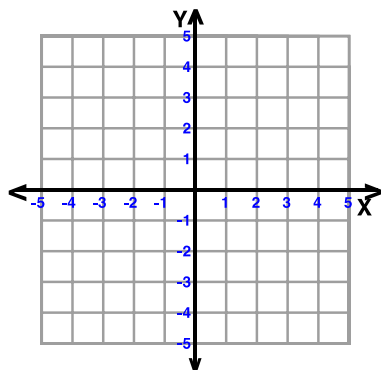
$$-6x + 4y = -12$$

4)



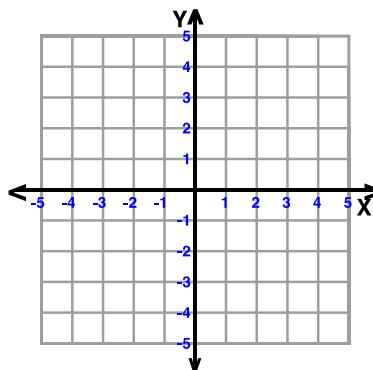
$$5x + 6y = -12$$

5)



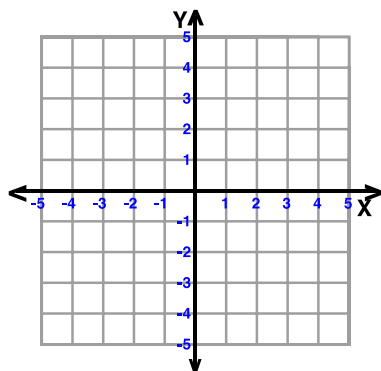
$$4x + 7y = -14$$

6)



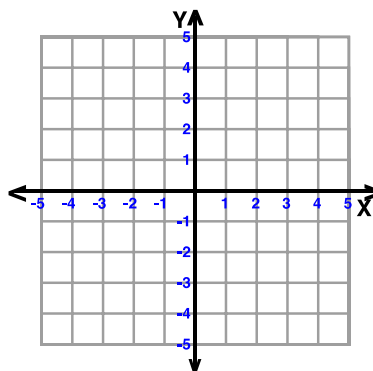
$$-4x - 3y = 12$$

7)



$$-7x + 2y = 8$$

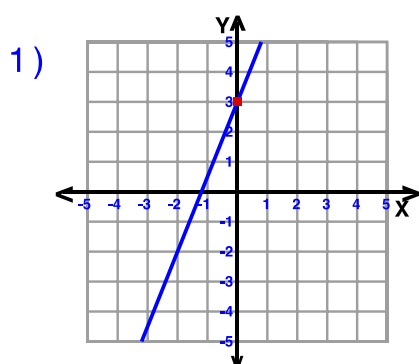
8)



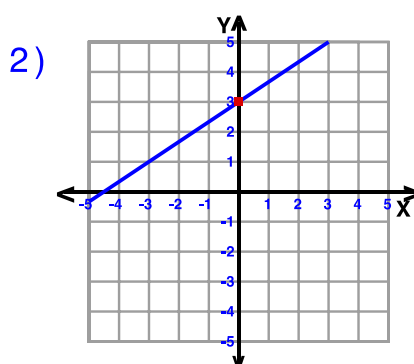
$$-x + 2y = -8$$

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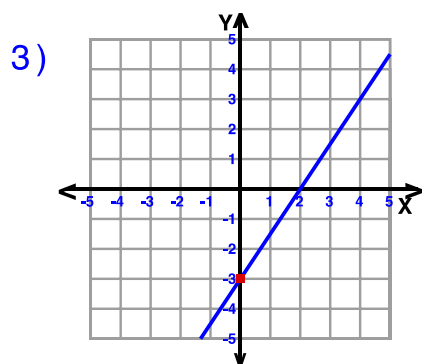
Worksheet 32.1 **Answers**



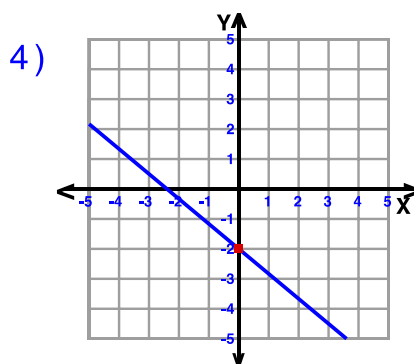
$$-5x + 2y = 6$$



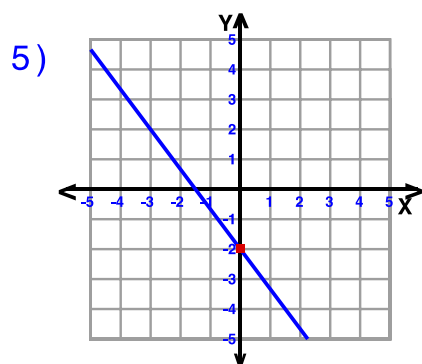
$$-2x + 3y = 9$$



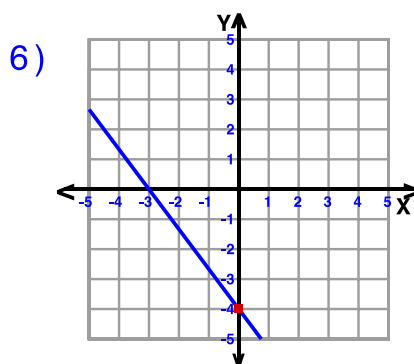
$$-6x + 4y = -12$$



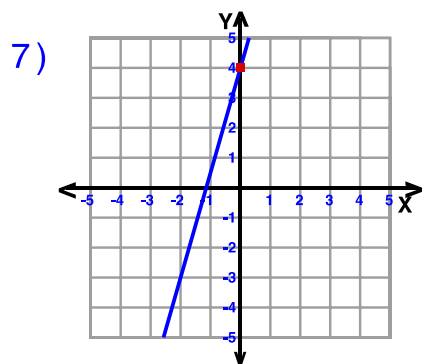
$$5x + 6y = -12$$



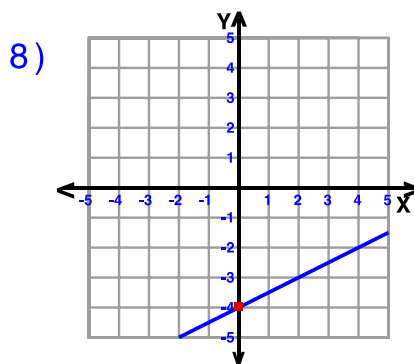
$$4x + 7y = -14$$



$$-4x - 3y = 12$$



$$-7x + 2y = 8$$



$$-x + 2y = -8$$