LESSON 3.2

Two Negatives

You will need:

graph paper

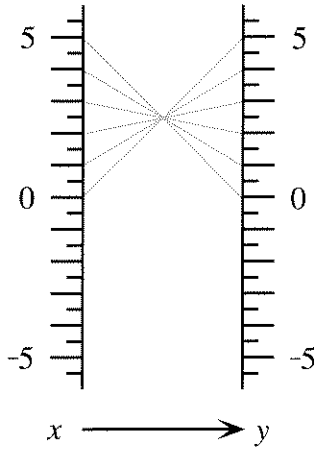
function diagram paper

1. **Exploration** Many people have heard the rule that *two negatives make a positive.* Investigate to decide whether this rule is always, sometimes, or never true when you *add* two negative numbers. Explain, giving examples. Then repeat your investigation for *subtracting, multiplying,* and *dividing* two negative numbers. Write a brief summary explaining your conclusions.

2. What does *not unilliterate* mean? What about *not uninteresting*? Look up *irregardless* in a dictionary.

SUBTRACTION

3. This function diagram represents a function of the type $y = b - x$. What is the value of b?



4. Make an in-out table for the in-out lines shown on the function diagram.

5. Copy the function diagram. Extend the table and the function diagram for negative values of x.

6. If you know the values of b and x, how can you calculate $b - x$ *by using addition?* Explain, using examples.

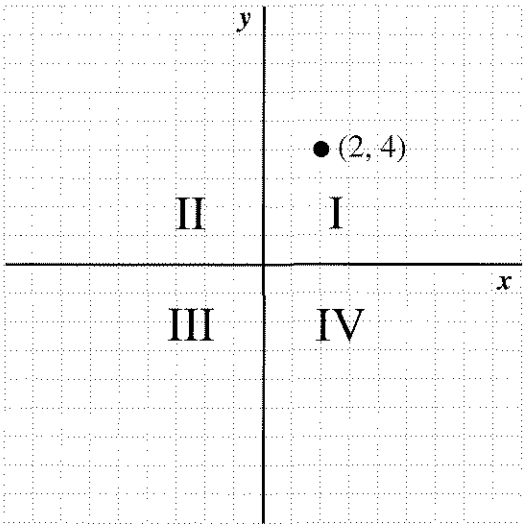
THE CARTESIAN COORDINATE SYSTEM

When you draw horizontal and vertical axes and plot points you are using a *Cartesian coordinate system.* It is named after the French mathematician and philosopher René Descartes. He is credited with bringing together algebra and geometry by using graphs to make geometric representations of algebraic equations.

An important skill in algebra is predicting what the graph will look like from the equation, or what the equation will be from the graph.

You should know the vocabulary of the Cartesian coordinate system.

- The horizontal number line is the *x-axis.*
- The vertical number line is the *y-axis.*
- The numbers (x, y) associated with a point are the *coordinates* of the point.
- The axes divide the coordinate system into four parts, called *quadrants.*
- The quadrants are numbered counterclockwise, as shown. In the first quadrant the coordinates of every point are both positive.
- The point where the axes cross is called the *origin.* The coordinates of the origin are (0, 0).



7. In which two quadrants does a graph lie if
   a. the second coordinate is always positive?
   b. the first coordinate is always positive?
   c. the two coordinates always have the same sign (both positive or both negative)?

8. What can you say about the signs of x and/or y if you know that (x, y) is in either
   a. the third or the fourth quadrant?
   b. the second or the fourth quadrant?
   c. the second or the third quadrant?

9. If a point is on the x-axis, what is its y-coordinate? If a point is on the y-axis, what is its x-coordinate?

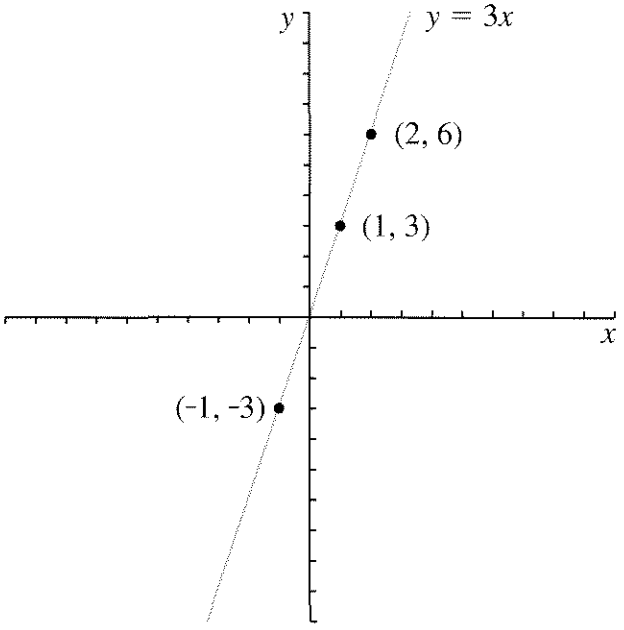
Important: Zero, 0, is neither positive nor negative.

10. Make a Cartesian graph for the function from problem 3, using the in-out table you made in problems 4 and 5.

11. Look at the part of the graph where the y-values are greater than 5. What are the x-values there? Explain what this says about *two negatives.*

MULTIPLICATION

The graph below shows the function $y = 3x$. The y-coordinate is always three times the x-coordinate. Three points are labeled.



12. a. List three more (x, y) pairs that would be on the graph above, including at least one negative and one fractional value for x.
    b. In which two quadrants does the graph lie?
    c. In each (x, y) pair, how are the signs of the x-coordinate and the y-coordinate related?

13. This problem is about the function $y = -3x$.
    a. Make a table of at least six (x, y) values for this function. Use negative numbers and fractions as well as positive whole numbers.
    b. Write the multiplication fact that is represented by each (x, y) pair in your table.
    c. Use your table to make a graph of the function $y = -3x$.

d. In which two quadrants does the graph lie?

e. In each (x, y) pair in your table, how are the signs of the x-coordinate and the y-coordinate related?

14. a. Make a function diagram for the function $y = -3x$.

b. On the diagram, see how the signs of x and $-3x$ are related. When x is negative, what can you say about $-3x$?

15. What is the sign of the answer (positive or negative) when you

a. multiply a negative number and a positive number?

b. multiply two negative numbers?

c. multiply three negative numbers?

16. What is the sign of the answer? (You do not need to find the answer.)

a. $(-5)(-4)(-3)(-2)(-1)(0)(1)(2)(3)(4)(5)$

b. $(-9)(-87)(-7.65)(-43210)$

c. $(-9)^9$ d. $(-99)^{99}$

MULTIPLYING BY -1

Match each function diagram 17-19 with one or more functions from this list.

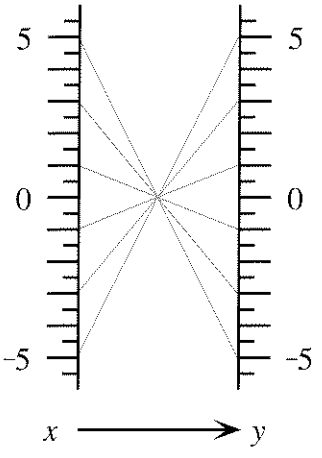
a. $y = 0$ b. $y = x$

c. $y = x + 0$ d. $y = 1 \cdot x$

e. $y = -x$ f. $y = -1 \cdot x$

g. $y = 0 \cdot x$ h. $y = 0 \cdot x^2$

17.



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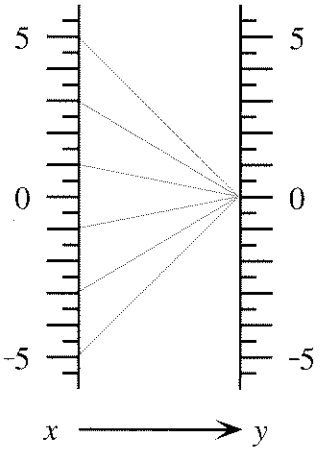

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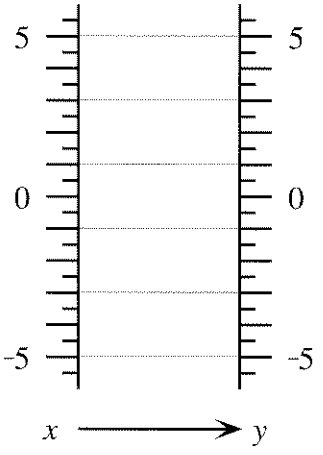

20. *Multiplying x by -1 is the same as takin the opposite of x.* Explain.

21. **Generalization** Explain each step of this calculation.

a. $(-x)(-y) = (-1)(x)(-1)(y)$

b. $= (-1)(-1)(x)(y)$

c. $= (1)(x)(y) = xy$

22. Simplify $(-a)(b)(-c)(-d)$ by the san method.

23. Find each product.

a. $-3 \cdot 5y(-x)$

b. $(-2y)(-3x)(-4)(12xy)$

c. $(-1.3x)(-7x^2)$

d. $(-3x)^2$

e. $(-3x)^3$