9. Coordinate Graphs/ Equation of a Line/ Inequality Equations

Mathantics has a great intro video called "Graphing on the coordinate plane"

GRAPHING EQUATIONS

Becoming Familiar with a Coordinate Grid

A coordinate grid is formed by combining two number lines.

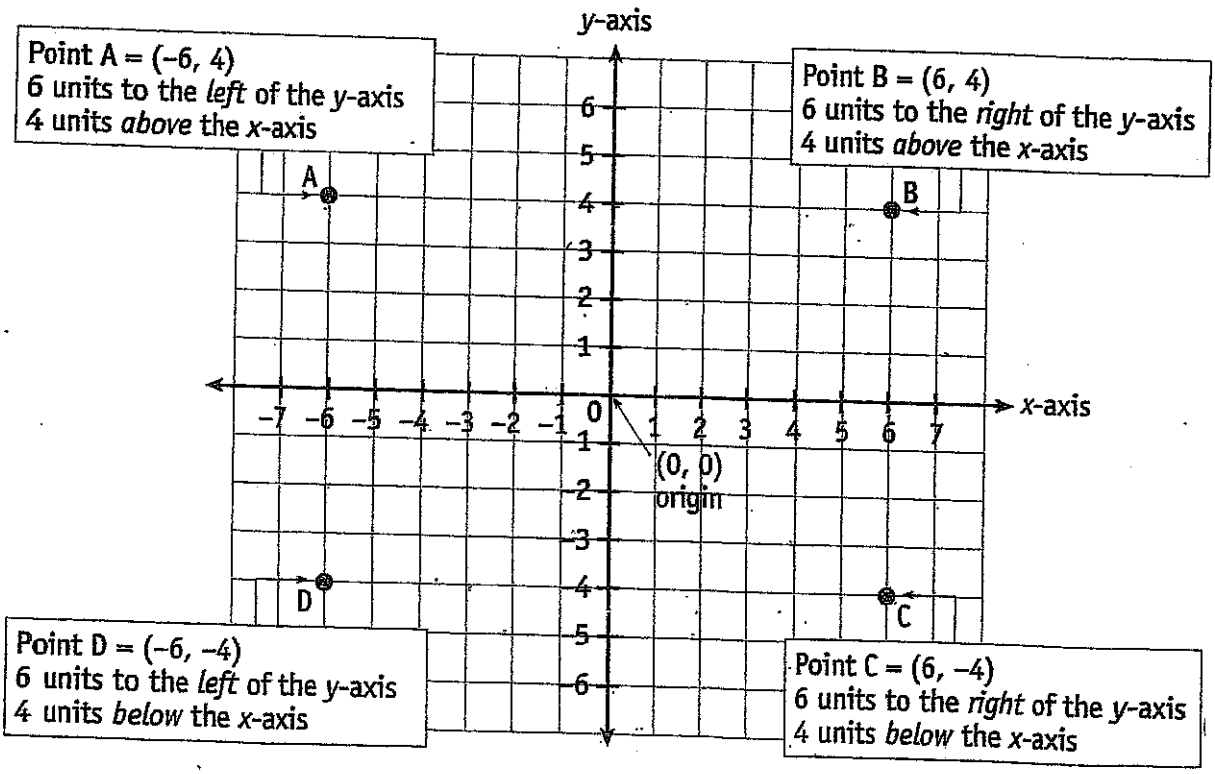
- The vertical number line is called the ***y*-axis.**
- The horizontal number line is called the ***x*-axis.**
- The point at which the two lines meet is called the **origin.**

Every point on a coordinate grid has coordinates, two numbers that tell its position.

- The ***x*-coordinate** tells how far the point is from the *y*-axis.
  Positive *x* indicates the point is to the right of the *y*-axis.
  Negative *x* indicates the point is to the left of the *y*-axis.
- The ***y*-coordinate** tells how far the point is from the *x*-axis.
  Positive *y* indicates the point is above the *x*-axis.
  Negative *y* indicates the point is below the *x*-axis.
- Coordinates are usually written as an **ordered pair,** two numbers within parentheses. The *x*-coordinate (*x* value) is written first, followed by the *y*-coordinate (*y* value).

EXAMPLE On the grid below, point A is (–6, 4).

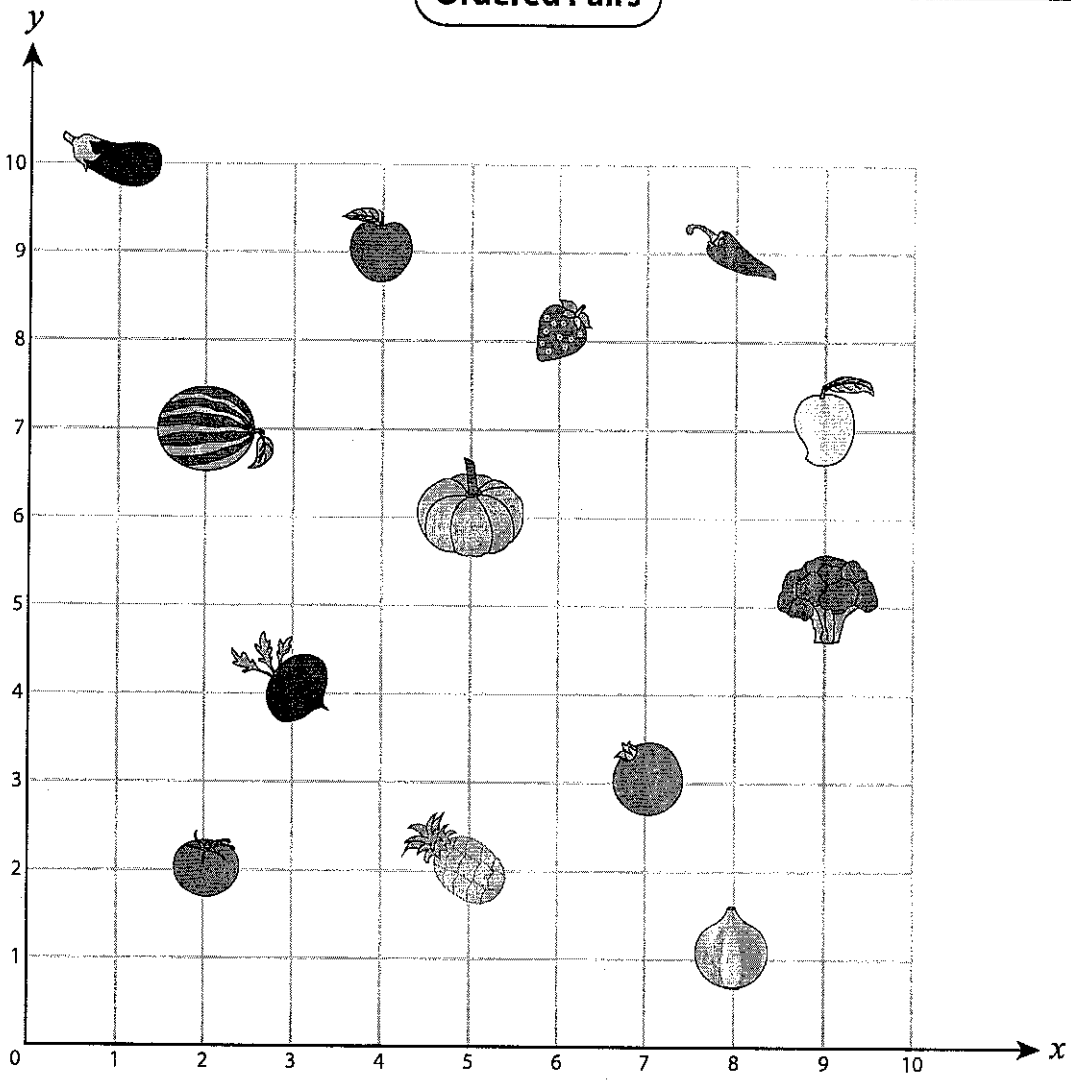
x-coordinate ↑ ↑ *y*-coordinate



Name : _____

Ordered Pairs

Positive: S1



A) Write the ordered pair for each item.

1)  _____

2)  _____

3)  _____

4)  _____

5)  _____

B) Write the item located at each ordered pair.

6) (2, 2) _____

7) (9, 7) _____

8) (2, 7) _____

9) (3, 4) _____

10) (7, 3) _____

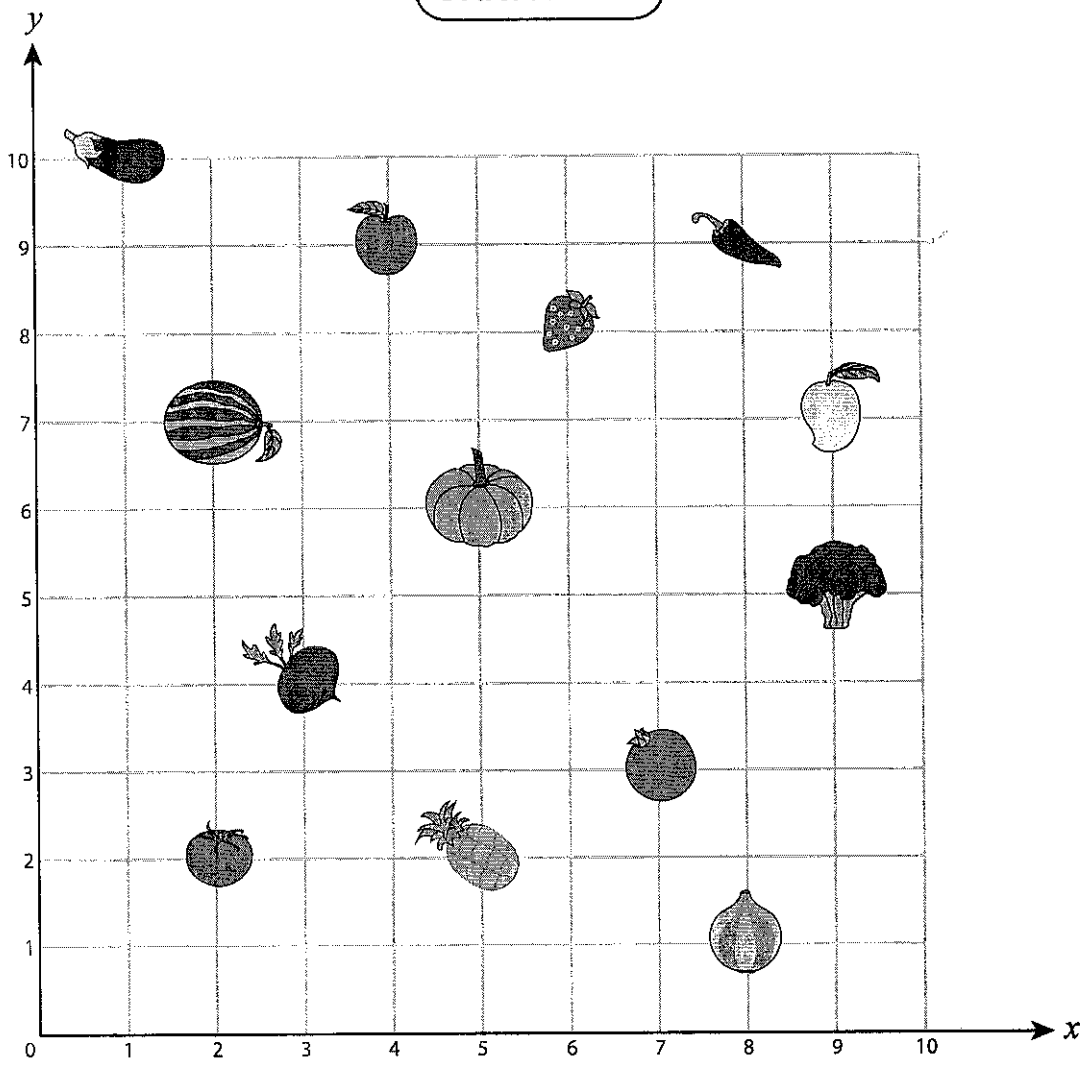
Name : _____

3

Answer Key

Ordered Pairs

Positive: S1



A) Write the ordered pair for each item.

1)  **(5, 2)**

2)  **(8, 1)**

3)  **(4, 9)**

4)  **(1, 10)**

5)  **(9, 5)**

B) Write the item located at each ordered pair.

6) (2, 2) **Tomato**

7) (9, 7) **Mango**

8) (2, 7) **Watermelon**

9) (3, 4) **Beet root**

10) (7, 3) **Pomegranate**

Plotting Points on a Grid

To plot a point on a coordinate grid, follow these steps.

STEP 1 Locate the x value on the x-axis.

STEP 2 From the x value, move directly up (for a positive y value) or directly down (for a negative y value).

STEP 3 Label this point.

EXAMPLE 1 Plot point A = (5, –4) on the grid at the right.

STEP 1 Find the value $x = 5$ on the x-axis.

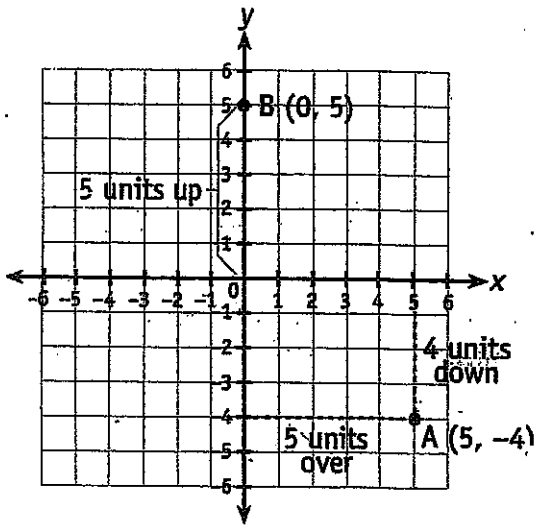
STEP 2 From the value 5 on the x-axis, move down to the y value –4.

STEP 3 Label point A.

EXAMPLE 2 Plot point B = (0, 5)

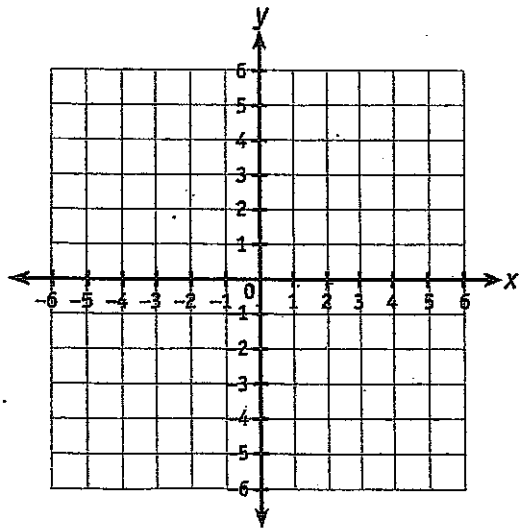
STEP 1 Begin at $x = 0$, the x value. Move up to the y value 5.

STEP 2 Label point B.



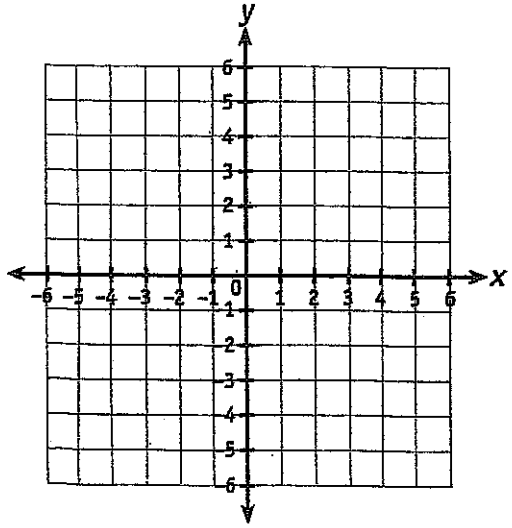
Plot and label each point.

1.



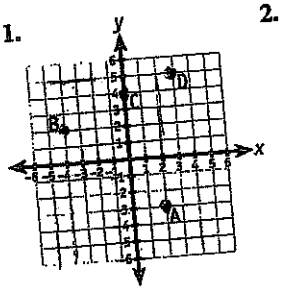
A = (2, –3)
B = (–4, 2)
C = (0, 4)
D = (3, 5)

2.

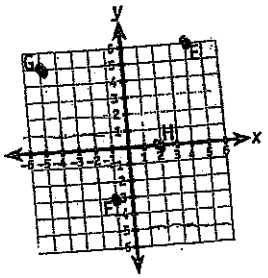


E = (4, 6)
F = (–1, –3)
G = (–5, 5)
H = (2, 0)

1.



2.



Slope-Intercept Form

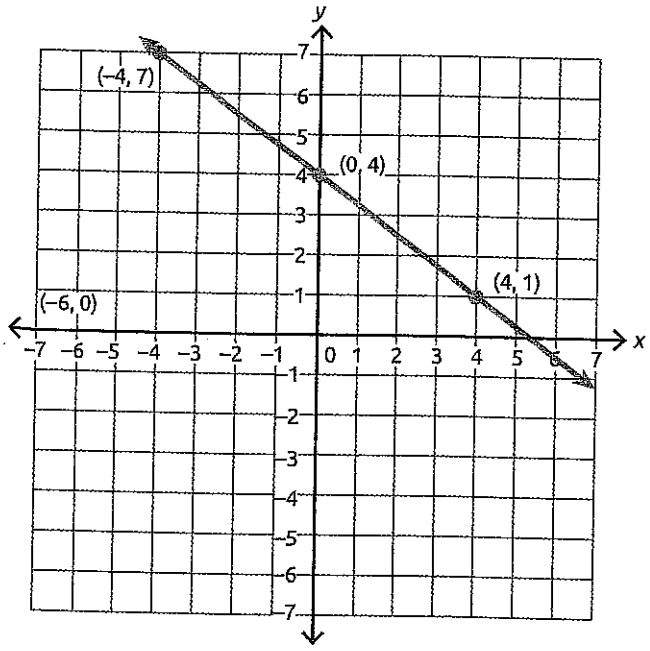
The **slope-intercept form** of the equation of a line is an equation in the form $y = mx + b$, where m is the slope, and b is the y-intercept of the line. The **slope of a line** measures the steepness of the line. It can be thought of as the $\frac{\text{rise}}{\text{run}}$ of the line. If the slope is positive, the line goes up from left to right. If the slope is negative, the line goes down from left to right.

To graph the equation of a line in this form, start by plotting the y-intercept, and then use the rise and run of the slope to graph one or two more points.

Use the slope and y-intercept to graph the line formed by this equation:

$$y = -\frac{3}{4}x + 4$$

ANSWER: Plot the y-intercept at (0, 4). Then, use the rise of −3 and the run of +4 or the rise of +3 and a run of −4 to plot two other points on the line.



SKILLS TIP

When the slope is negative, either the rise can be negative and the run can be positive, or the rise can be positive and the run can be negative. If the slope is positive, either both rise and run are positive or both rise and run are negative.

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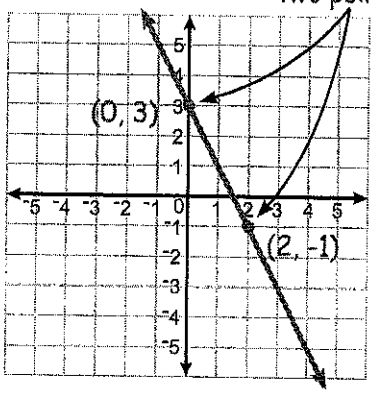
Graphing Linear Functions

BLF 1

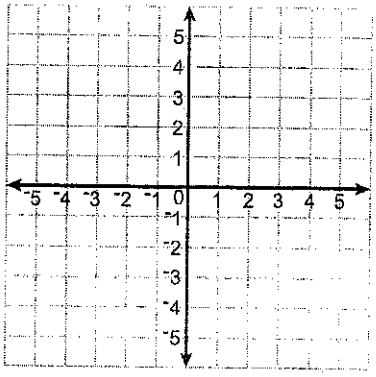
Instructions: Graph each linear function on the coordinate plane. (Hint: you only need to plot two points to graph the line. Then you can use a ruler to draw a straight line through those two points.)

1 $y = -2x + 3$

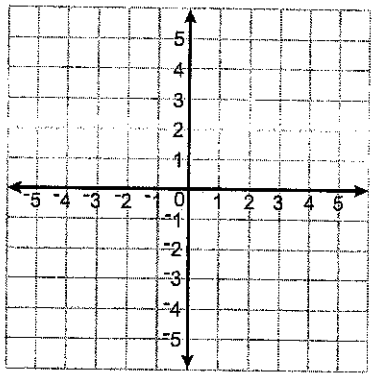
Plot any two points



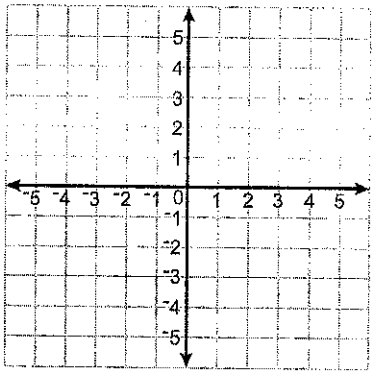
2 $y = 1x + 2$



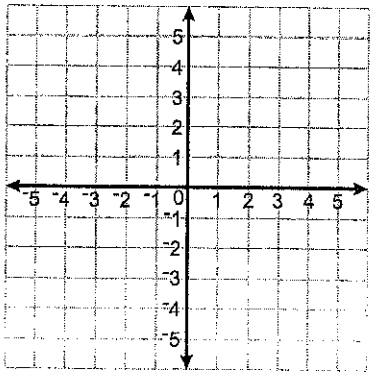
3 $y = -1x + 2$



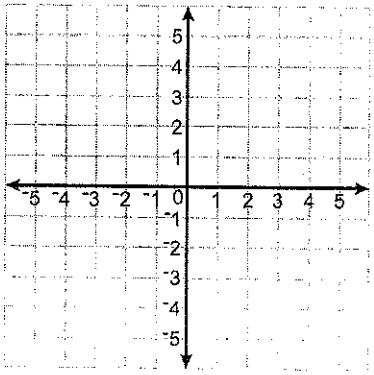
4 $y = -x - 2$



5 $y = 4x - 4$



6 $y = \frac{x}{2} + 3$



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Date: _____

Graphing Linear Functions

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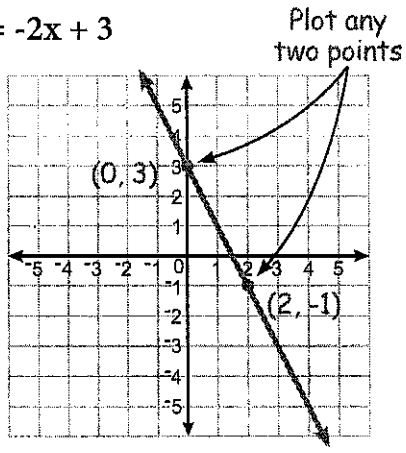
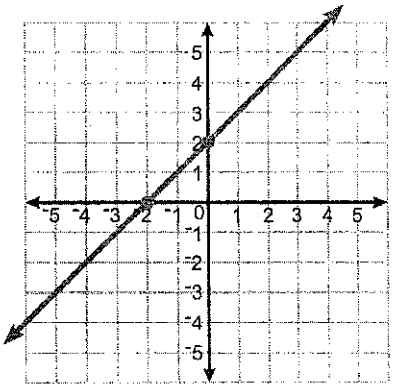
Instructions: Graph each linear function on the coordinate plane. (Hint: you only need to plot two points to graph the line. Then you can use a ruler to draw a straight line through those two points.)

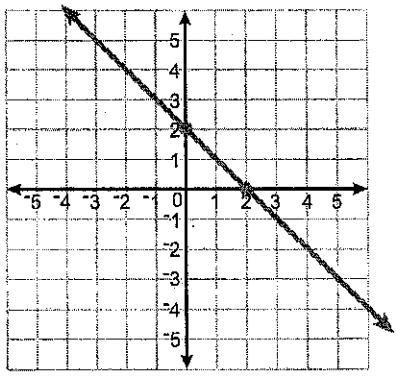
1 $y = -2x + 3$



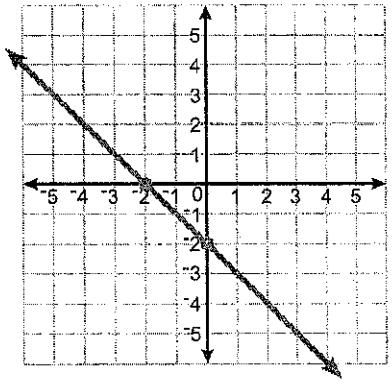
2 $y = 1x + 2$



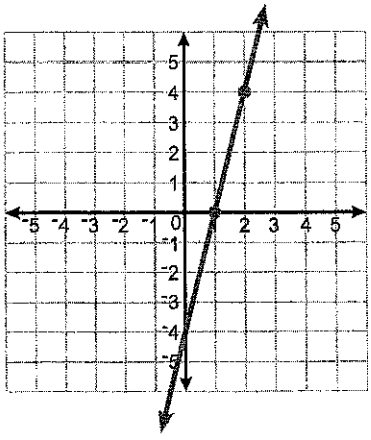
3 $y = -1x + 2$



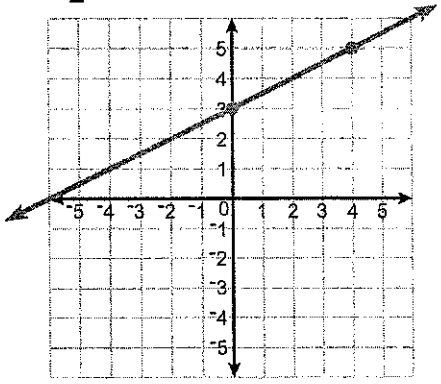
4 $y = -x - 2$



5 $y = 4x - 4$



6 $y = \frac{x}{2} + 3$



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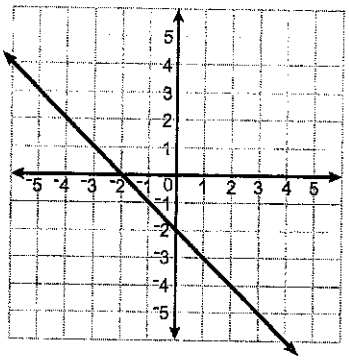
Slope & y-intercept (Graphs)

BLF 2

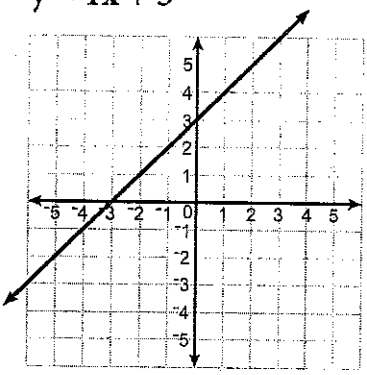
Instructions: Determine the slope and y-intercept of each linear function below.

1 $y = -x - 2$



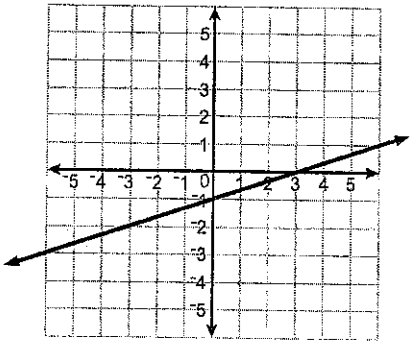
Slope: -1 y-intercept: -2

2 $y = 1x + 3$



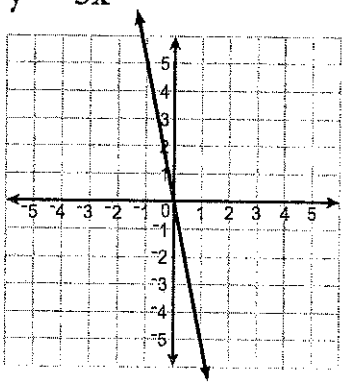
Slope: _____ y-intercept: _____

3 $y = \frac{x}{3} - 1$



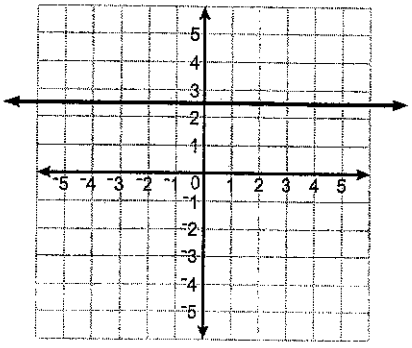
Slope: _____ y-intercept: _____

4 $y = -5x$



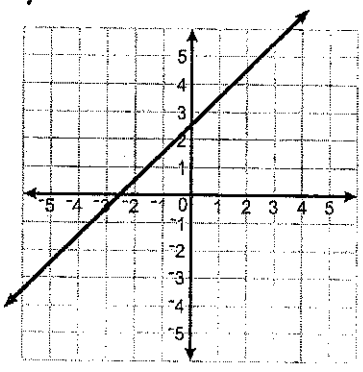
Slope: _____ y-intercept: _____

5 $y = 2.5$



Slope: _____ y-intercept: _____

6 $y = x + 2.5$



Slope: _____ y-intercept: _____

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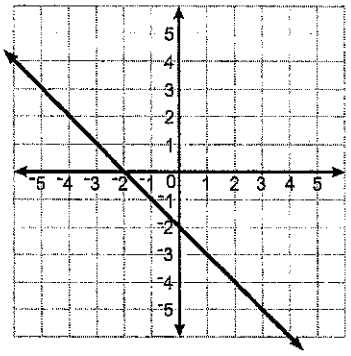
Date: _____

Slope & y-intercept (Graphs)

BLF 2

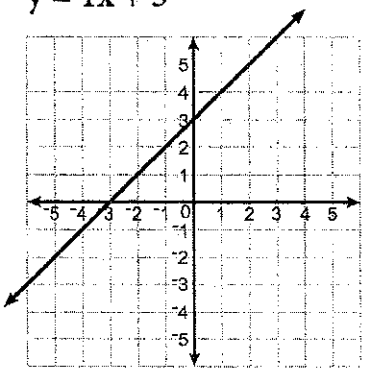
Instructions: Determine the slope and y-intercept of each linear function below.

1 $y = -x - 2$



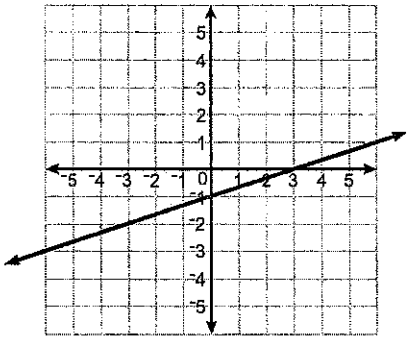
Slope: -1 y-intercept: -2

2 $y = 1x + 3$



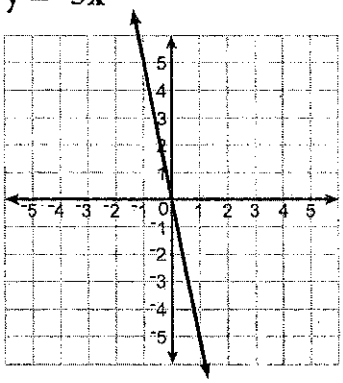
Slope: 1 y-intercept: 3

3 $y = \frac{x}{3} - 1$



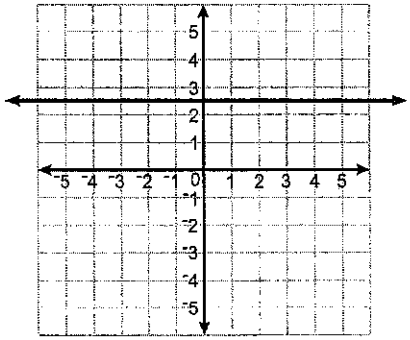
Slope: $\frac{1}{3}$ y-intercept: -1

4 $y = -5x$



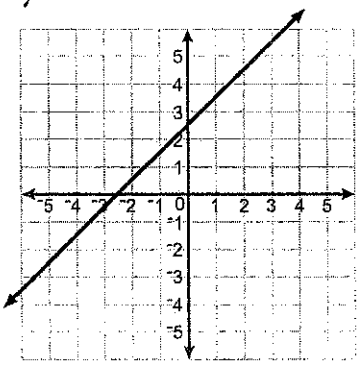
Slope: -5 y-intercept: 0

5 $y = 2.5$



Slope: 0 y-intercept: 2.5

6 $y = x + 2.5$



Slope: 1 y-intercept: 2.5

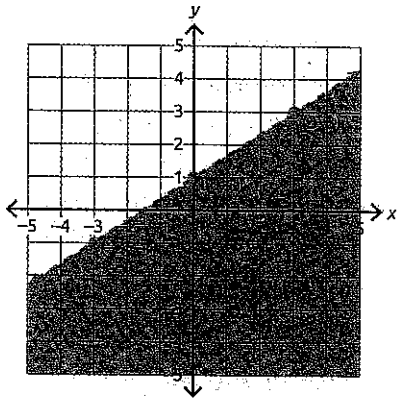
Graphing Linear Inequalities

A linear inequality can be graphed in a way that is similar to how a linear equation is graphed. Use the *y*-intercept and the slope to determine the location of the points that are on the line.

If the inequality symbol is $<$ or $>$, then use a dashed line because the line is not included in the solution. If the inequality symbol is $\leq$ or $\geq$, then use a solid line because the line is included in the solution. Then, shade the area either above or below the line. If the inequality begins with $y <$ or $y \leq$, shade below the line. If the inequality begins with $y >$ or $y \geq$, shade above the line.

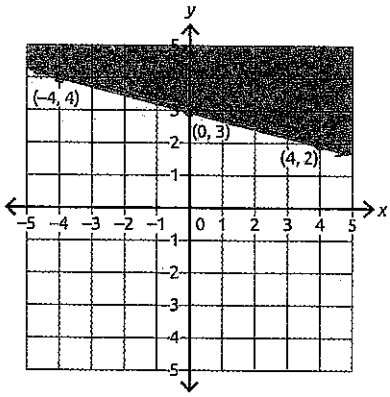
Graph the solution: $y < \frac{2}{3}x + 1$

ANSWER: Graph the line $y = \frac{2}{3}x + 1$ as a dashed line and shade the area below the line.



Graph the solution: $y \geq -\frac{1}{4}x + 3$

ANSWER: Graph the line $y = -\frac{1}{4}x + 3$ as a solid line and shade above the line.



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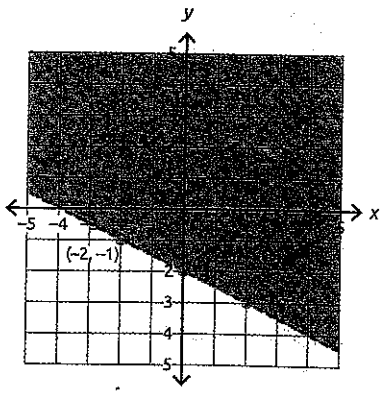
4. Which inequality is represented in the graph shown below?



this is a dotted line

A $y \geq -\frac{1}{2}x - 2$

B $y > -\frac{1}{2}x - 2$

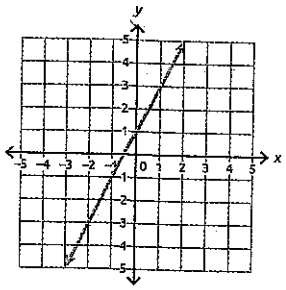
C $y \leq -\frac{1}{2}x - 2$

D $y < -\frac{1}{2}x - 2$

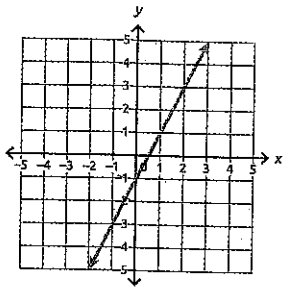
E $y > \frac{1}{2}x - 2$

5. Which of the following represents the graph of the line $y = -2x - 1$?

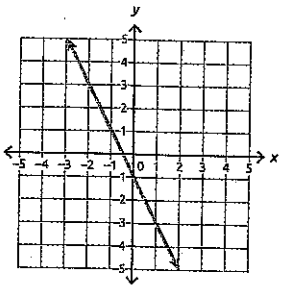
A



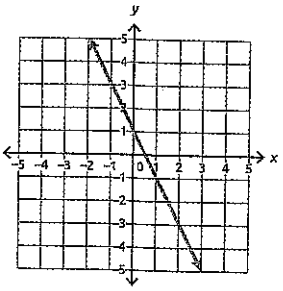
B



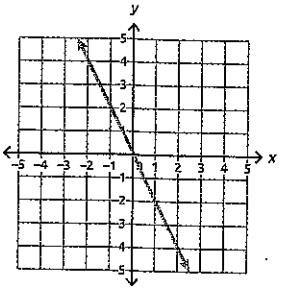
C



D



E



See page 90 for answers and help.

4. B. The dashed line and the shading above the dashed line indicate a > symbol. The slope is negative because the line is going down from the left to the right.

5. C.

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Systems of Equations

A **system of equations** is two or more linear equations in which the same variables work together simultaneously. To solve a system of linear equations, such as the one shown here, determine the ordered pair(s), (x, y), that make both equations true.

$$\begin{cases} 2x+3y=1 \\ x-2y=-3 \end{cases}$$

A linear system of equations can be solved in three ways: graphing, substitution, and elimination.

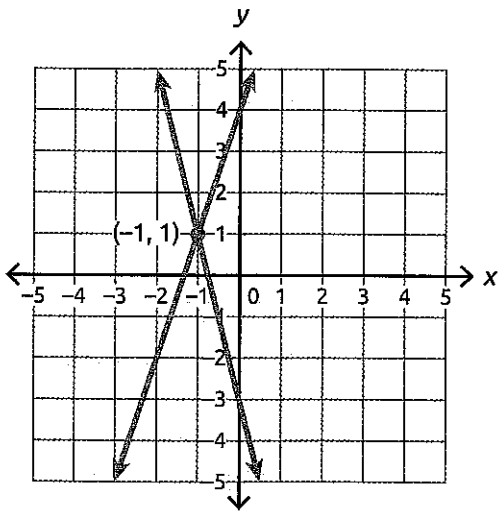
Solving Systems of Equations by Graphing

To solve a system of equations by graphing, graph both lines, and then find their point of intersection.

Solve the system of equations by graphing:

$$\begin{cases} 4x+y=-3 \\ -3x+y=4 \end{cases}$$

ANSWER: First, solve each equation for y. Then, use the slope and the y-intercept to graph each line, and then identify the point of intersection.



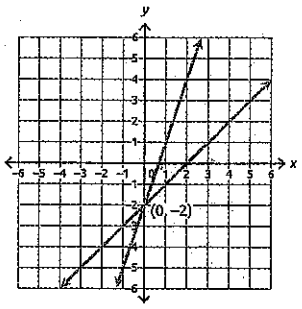
The point of intersection is at (−1, 1). This is the only solution that makes both equations true.

A system of linear equations has three possibilities for the number of solutions. Most systems, when graphed, intersect at exactly one point and, therefore, have exactly one solution. However, the two lines could be parallel and have the same slope. Since they never intersect, the system has no solution. If the lines are parallel, then there is no ordered pair that will make both equations true simultaneously. The two lines could also coincide, or they could be the same line. In this case, an infinite number of solutions could make both equations true.

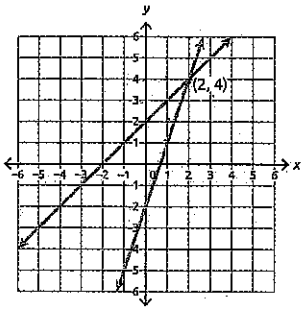
5. Which of the following graphs represents the solution to this system of linear equations?

$$\begin{cases} y = 3x - 2 \\ y = x + 2 \end{cases}$$

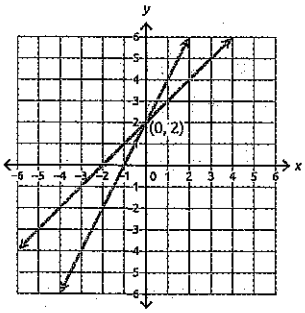
A



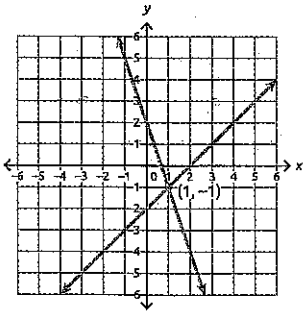
B



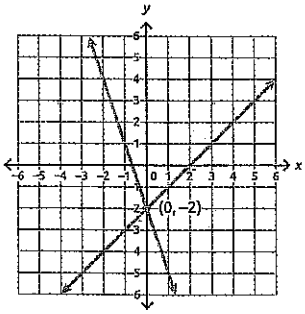
C



D

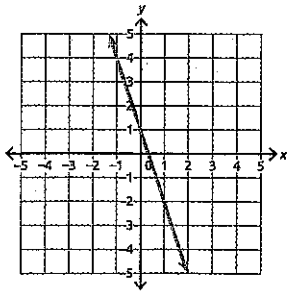


E

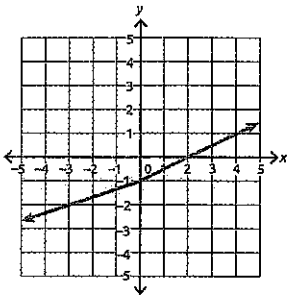


17. Which of the following graphs represents the graph of the line $y = -\frac{1}{3}x + 1$?

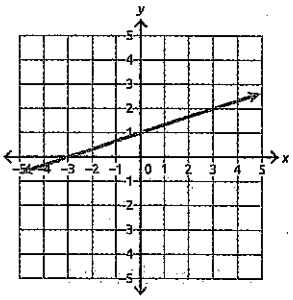
A



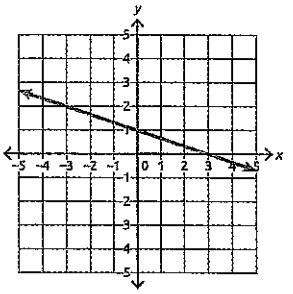
B



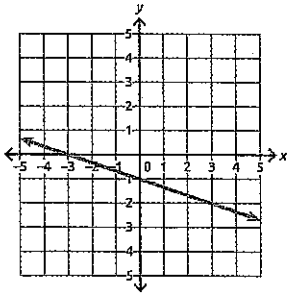
C



D



E



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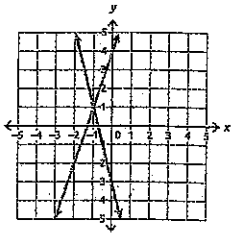
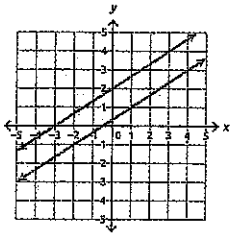
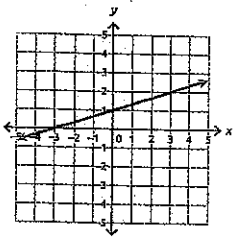
5. B

17. D

Solving Systems of Equations

SKILLS TIP

Most linear systems of two equations have exactly one solution: the ordered pair where the lines intersect. Still, it is important to remember that occasionally they have no solution or have many (infinite) solutions.

One Solution	No Solution	Infinite Solutions
Lines intersect at one point.	Lines are parallel.	Lines are the same.
Solution: (x, y)	Solution: Ø	Solutions: infinite
		

Frequently, the HISET exam asks a question like this:

The graph of which of these equations goes through point (3, -5) ?

a. $y = 2x + 4$
b. $y = -2x + 4$
c. $y = 4x - 2$
d. $y = -4x + 7$

How do you determine the answer? (Simply substitute 3 for x and -5 for y.)

d. $y = -4x + 7$

$-5 = -4 \cdot 3 + 7$

$-5 = -12 + 7$

$-5 = -5$