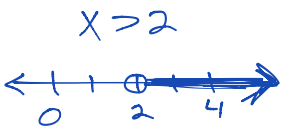
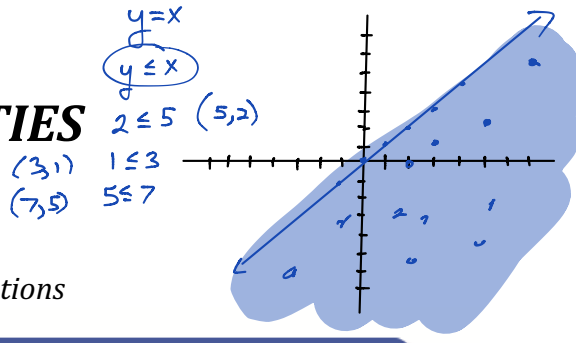


6-5: LINEAR INEQUALITIES



Lesson Objectives:

- *Graph linear inequalities*
- *Write and use linear inequalities when modeling real-world situations*

1 Graphing Linear Inequalities

A **linear inequality** describes a region of the coordinate plane that has a boundary line. The **solutions of an inequality** are the coordinates of the points that make the inequality true.

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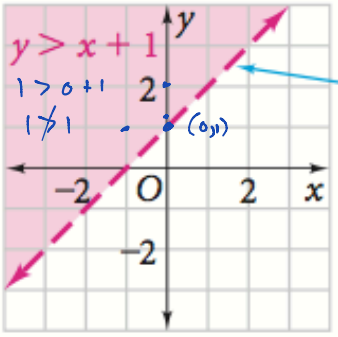
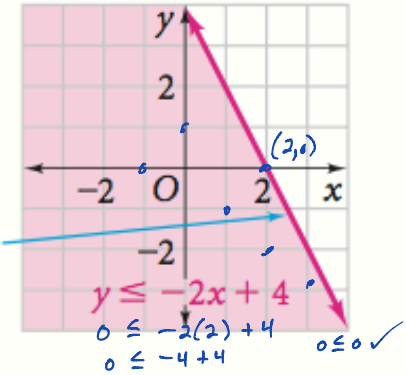


Each point on a *dashed* boundary line is not a solution.

Each point on a *solid* boundary line is a solution.



As you can see in the graphs above, you can tell from an inequality whether to shade above or below the boundary line. For an inequality written in the form of $y <$ or $y \leq$, shade below the boundary line. For an inequality written in the form of $y >$ or $y \geq$, shade above the boundary line.

EXAMPLE 1: GRAPHING AN INEQUALITY

1. Graph $y < 2x + 3$.

1. Use $y = 2x + 3$ to find the boundary line.

   $b = 3$

   $m = 2/1$ ↑ →

2. What kind of boundary line?

   $<$ or $>$: dashed

   $\leq$ or $\geq$: solid

3. Where to shade?

   Test a point (usually (0,0))

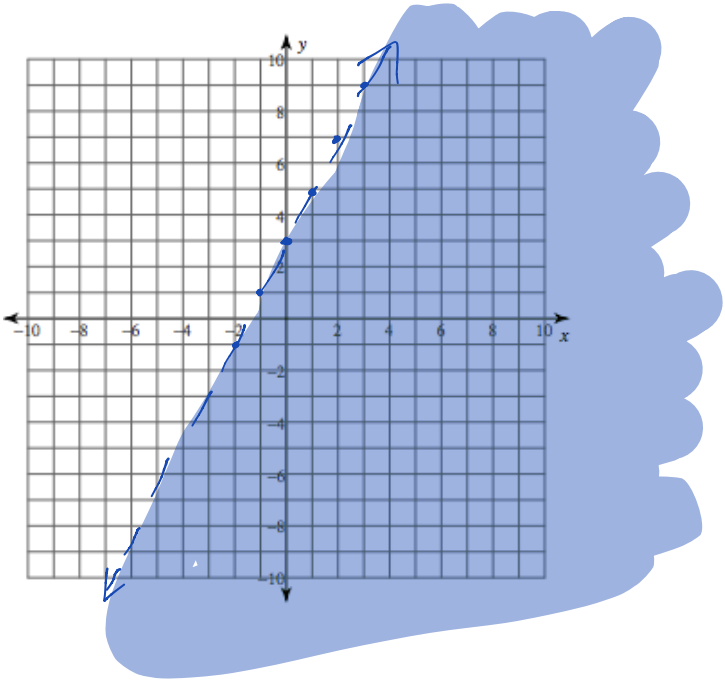
   $y < 2x + 3$

   $0 < 2(0) + 3$?

   $0 < 0 + 3$?

   $0 < 3$? yes

   - Yes : shade where the point is
   - No : Shade on the side where the point isn't



Graph.

2. $y \geq 3x - 1$

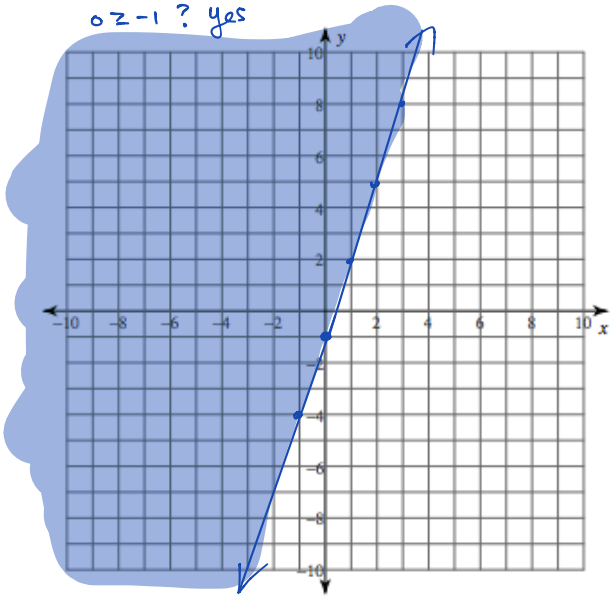
$b = -1$

$m = 3/1$ ↑ →

$0 \geq 3(0) - 1$?

$0 \geq 0 - 1$

$0 \geq -1$? yes



3. $y \leq -\frac{1}{4}x - 3$

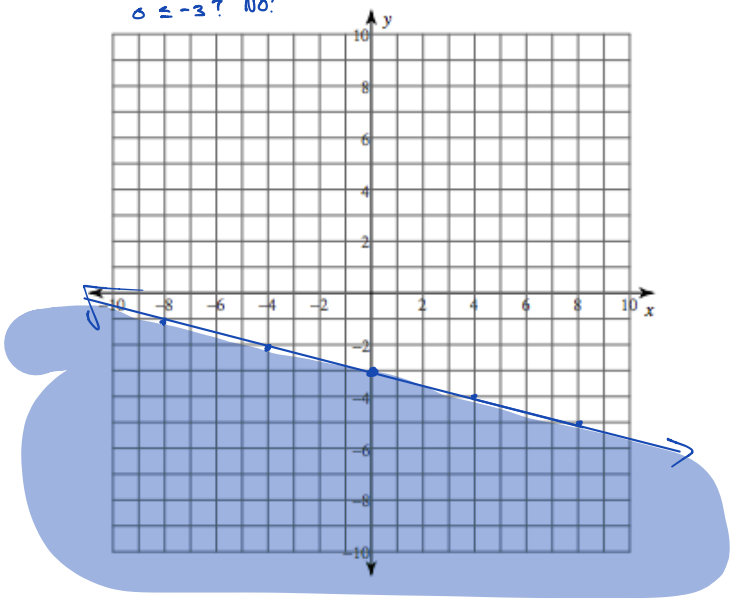
$m = -\frac{1}{4}$ ↓ →

$b = -3$

$0 \leq -\frac{1}{4}(0) - 3$?

$0 \leq 0 - 3$

$0 \leq -3$? NO!



EXAMPLE 2: REWRITING TO GRAPH AN INEQUALITY

4. Graph $3x - 5y < 10$

x	y
0	−2
3⅓	0

$\frac{-5y}{-5} = \frac{10}{-5}$ $\quad y = -2$

$\frac{3x}{3} = \frac{10}{3}$ $\quad x = 3\frac{1}{3}$

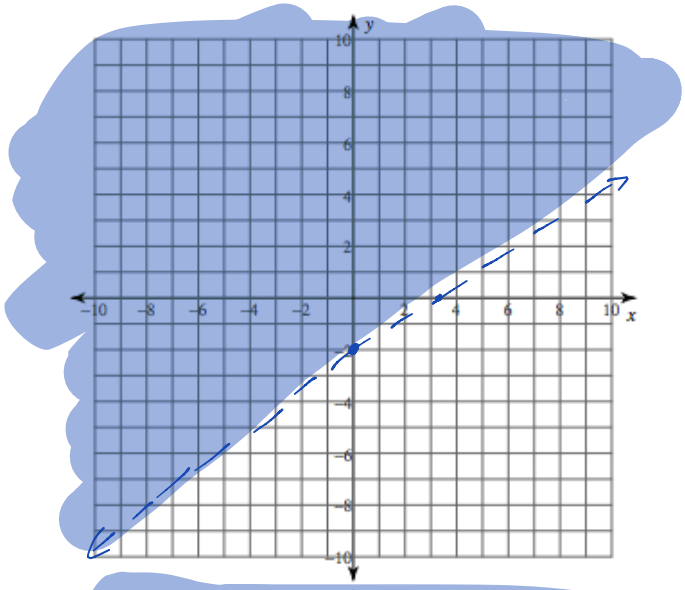
$0 < 10$? yes

$3x - 5y < 10$

$-3x \quad -3x$

$\frac{-5y}{-5} < \frac{-3x + 10}{-5}$

$y > \frac{3}{5}x - 2$



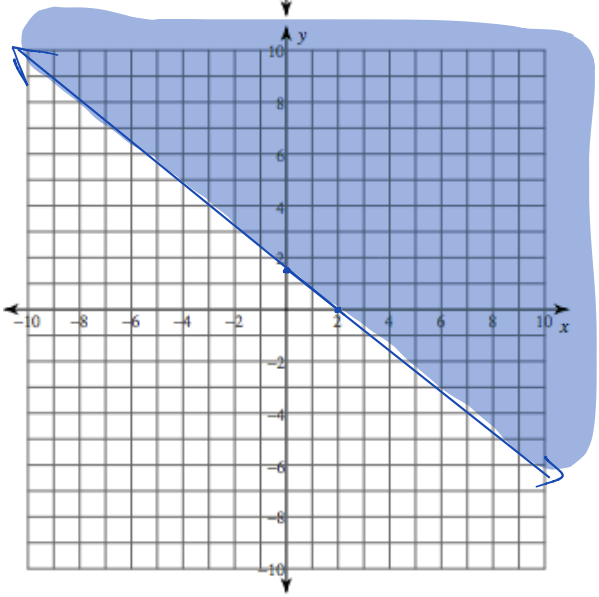
5. Graph $6x + 8y \geq 12$

x	y
0	1½
2	0

$\frac{8y}{8} = \frac{12}{8}$ $\quad y = 1\frac{1}{2}$

$\frac{6x}{6} = \frac{12}{6}$ $\quad x = 2$

$0 \geq 12$? NO



x	y
0	4
$-2\frac{2}{3}$	0

$\frac{-4y}{-4} = \frac{-16}{-4}$ $\quad y = 4$ $\qquad \frac{6x}{6} = \frac{16}{6}$ $\quad x = -2\frac{2}{3}$

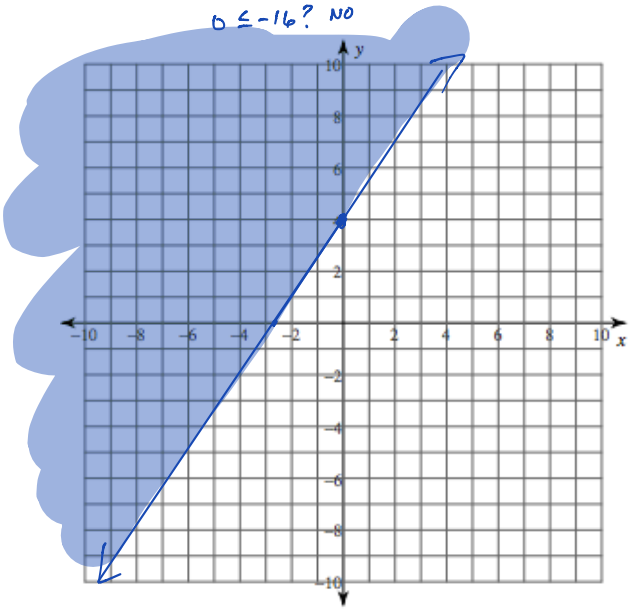
x	y
0	7
$-4\frac{2}{3}$	0

$\frac{8y}{8} = \frac{56}{8}$ $\quad y = 7$ $\qquad \frac{-12x}{-12} = \frac{56}{-12}$ $\quad x = -4\frac{2}{3}$

Graph.

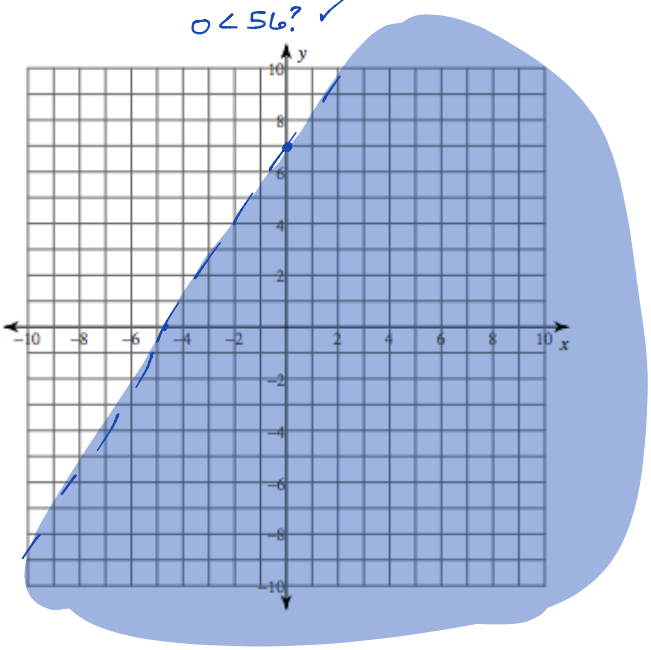
6. $6x - 4y \leq -16$

$0 \leq -16$? NO



7. $-12x + 8y < 56$

$0 < 56$? ✓



2 Modeling Real-World Situations

Many situations are modeled by inequalities that have a boundary line of the form $Ax + By = C$. You can use the intercepts to graph the boundary line of the inequality. Choose a test point not on the boundary line to determine whether the solutions are above or below the boundary line.

EXAMPLE 3: REAL-WORLD PROBLEM SOLVING

8. Suppose your budget for a party allows you to spend no more than \$12 on peanuts and cashews. Peanuts cost \$2 per pound and cashews cost \$4 per pound. Find three possible combinations of peanuts and cashews you can buy.

Let x = lbs of peanuts

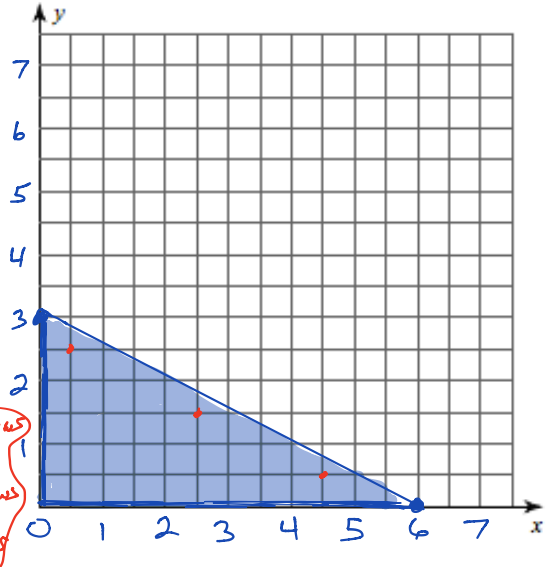
y = lbs of cashews

$2x + 4y \leq 12$ $\qquad y \geq 1$

x	y
0	3
6	0

$\frac{4y}{4} = \frac{12}{4}$ $\quad y = 3$ $\qquad \frac{2x}{2} = \frac{12}{2}$ $\quad x = 6$

$0 \leq 12$? ✓



$\frac{1}{2}$ lb peanuts, $2\frac{1}{2}$ lbs cashews

$2\frac{1}{2}$ lbs peanuts, $1\frac{1}{2}$ lbs cashews

$4\frac{1}{2}$ lbs peanuts, $\frac{1}{2}$ lb cashews

9. Suppose your class is raising money for the Red Cross. You make $5 on each basket of fruit and $3 on each box of cheese that you sell. How many items of each type must you sell to raise more than $150?

Let x = baskets of fruit

y = boxes of cheese

$5x + 3y > 150$

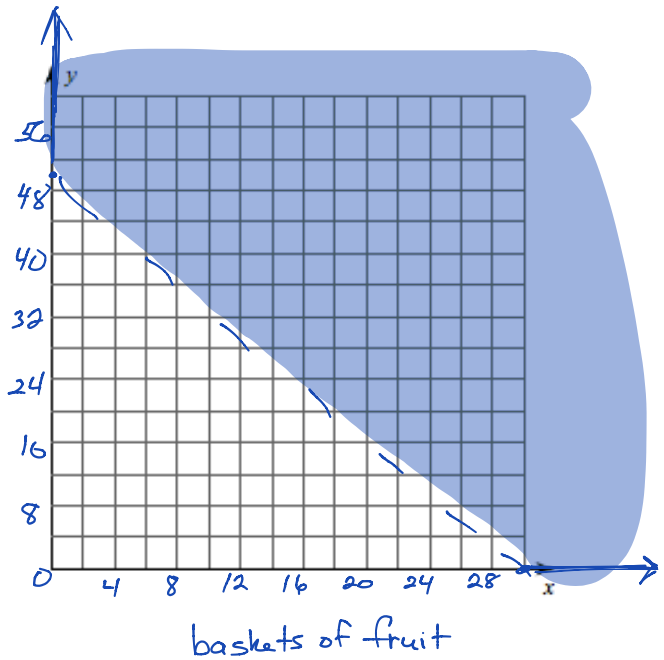
x	y
0	50
30	0

$\frac{3y}{3} = \frac{150}{3}$ $\quad y = 50$

$\frac{5x}{5} = \frac{150}{5}$ $\quad x = 30$

$0 > 150$?

NO



10. Suppose you intend to spend no more than $60 buying books. Hardback books cost $12 and paperbacks cost $5. How many books of each type can you buy?

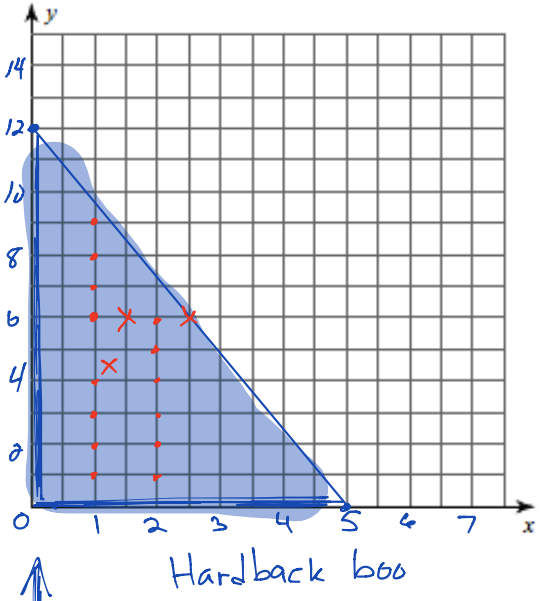
Let x = hardback books

y = paperback books

$12x + 5y \leq 60$

x	y
0	12
5	0

$0 \leq 60$? ✓



11. Suppose that for your exercise program, you either walk 5 miles/day or ride your bicycle 10 miles/day. How many days will it take you to cover a distance of at least 150 miles?

Let x = days walking

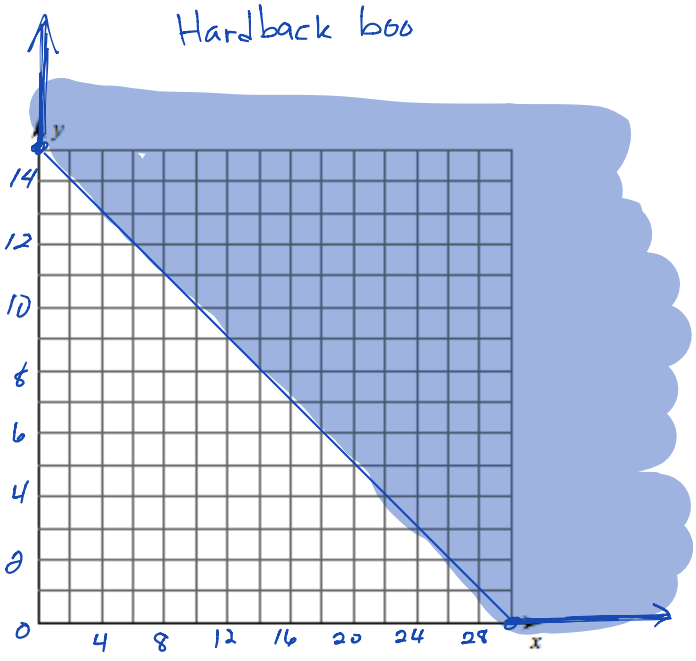
y = days biking

$5x + 10y \geq 150$

x	y
0	15
30	0

$0 \geq 150$?

NO



days walking

Name _____ ***6-5 Practice Worksheet*** Period _____

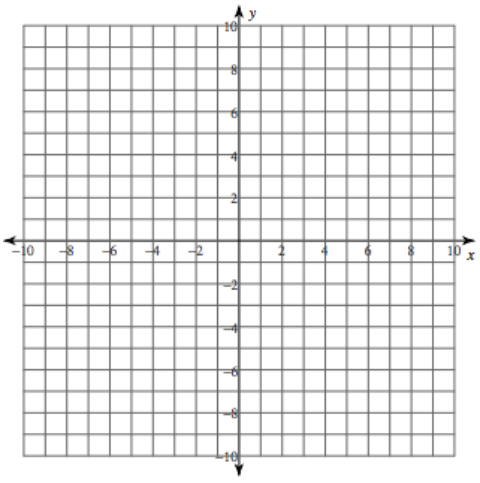
Determine whether point *P* is a solution of the linear inequality.

1. $y \le -2x + 1; P(2,2)$

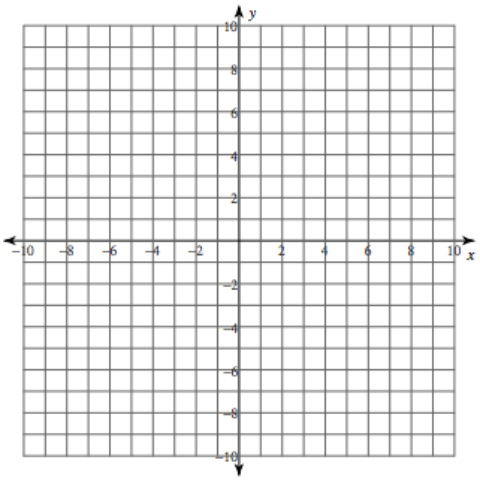
2. $y > \frac{5}{3}x - 4; P(0,1)$

Graph each linear inequality.

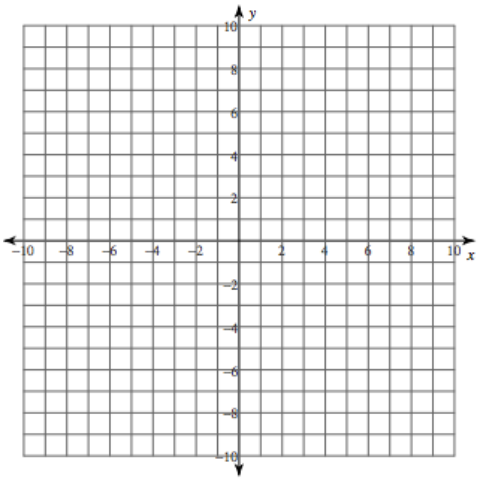
3. $y \ge \frac{1}{4}x - 1$



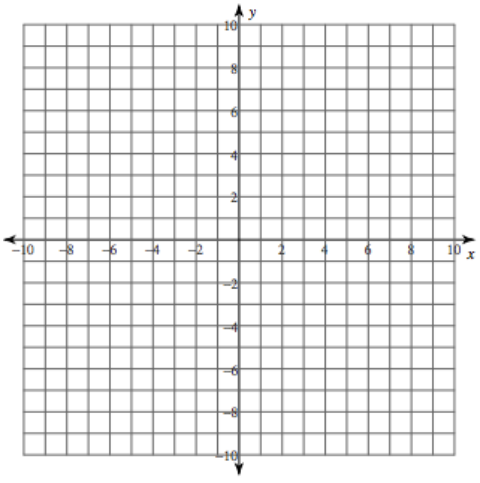
4. $y \le \frac{2}{5}x - 3$



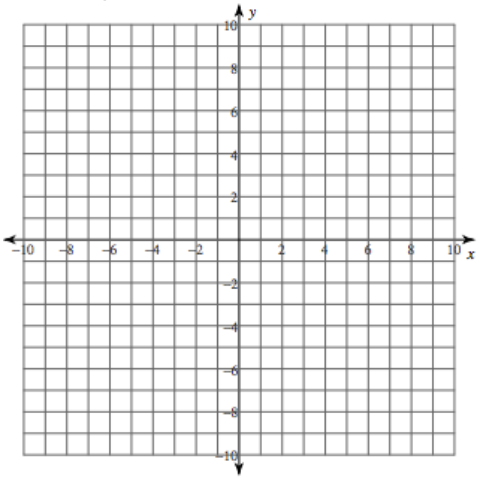
5. $2x - 3y \ge 12$



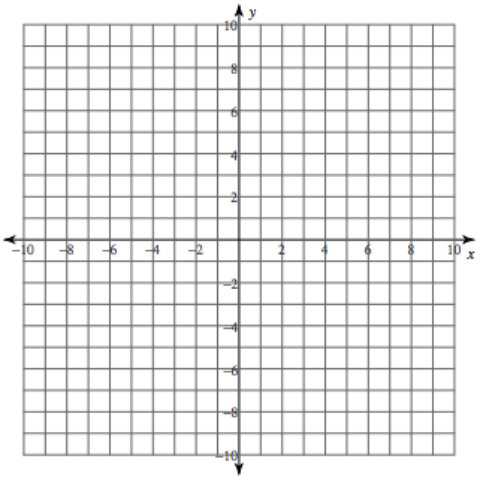
6. $y > -2x + 3$



7. $4x + 5y \ge 10$

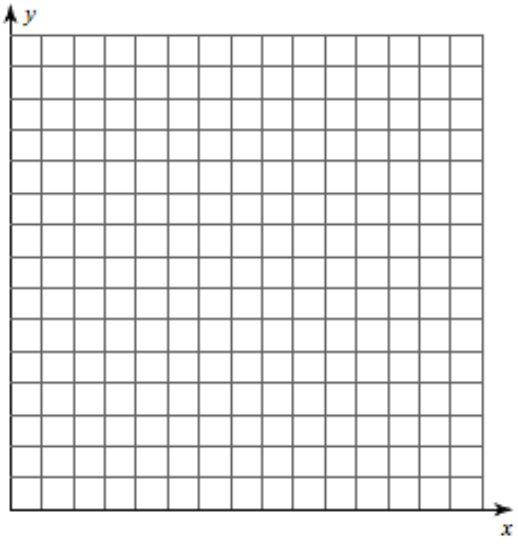


8. $4x - 4y < 8$



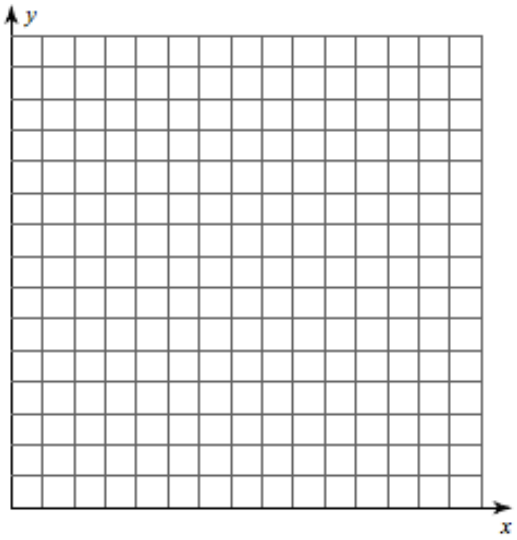
9. A company makes nylon and canvas backpacks. The profit on a nylon backpack is $3 and the profit on a canvas backpack is $10. How many backpacks must the company sell to make a profit of at least $250?

a) Write a linear inequality to model the situation.
b) Graph the linear inequality.
c) Write three possible solutions to the problem.



10. Suppose you work at a local radio station. You are in charge of a $180 budget for new tapes and CDs. Record companies will give you 21 promotional (free) CDs. You can buy tapes for $8 and CDs for $12.

a) Write an inequality that shows the number of tapes and CDs you can buy.
b) Graph the inequality.
c) Is (8,9) a solution of the inequality? Explain what the solution means.
d) If you buy only CDs, and you buy as many as possible, how many new recordings will the station get?



11. The points (0, -3) and (8,5) lie on the boundary line of a linear inequality, but neither point is a solution. The point (1,1) is not a solution. Write the inequality that is described by this situation.

12.
a) Is the point (4,5) a solution to the inequality $y > x - 1$?
b) Is the point (4,5) a solution to the inequality $y < 3x$?
c) Find one other point that is a solution of both inequalities.
d) Draw a graph that shows all the points that are solutions of both inequalities.