

Name:**IN THIS LESSON, YOU WILL:**

- Graph linear inequalities and identify solutions.
- Write linear inequalities from word problems.
- Interpret solutions to inequalities in terms of a real-world context.
- Model budgeting constraints based on two sources of income.

**INTRO****INTERACTIVE: The Uber Game**

We all encounter different limitations as we go through the day - what we can and can't do.

We have to make decisions based on those limitations. How do we spend our limited time, money, and energy? Play the game and answer the reflection questions.

1. **Which choices were the hardest to make in the game? Why?**
2. **While playing the game, what limitations or constraints did you face?**
3. **At the end of the game, how much did you earn per hour on average?**
4. **Write an equation representing how many hours you have to work (x) in order to earn \$1,000 after paying expenses (y).**
5. **Adjust your equation to reflect that you want to earn MORE than \$1000, not exactly \$1000.**

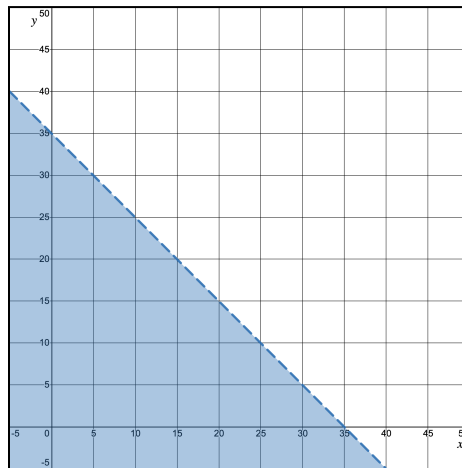


EXPLORE IT

Linear Inequalities

In the previous activity, you made trade-offs based on real-world constraints. We can represent these types of constraints using linear inequalities. Explore the example inequality and graph below, before learning how to graph real-world linear inequalities in the next activity.

1. **You're looking for two numbers that add up to less than 35. Identify three possible sets of numbers that add up to less than 35.**
2. **Write a linear inequality to represent that constraint, where x is one number and y is the other number.**
3. **The graph below represents that inequality.**



- a. What do you notice about this graph? How is it similar or different from graphs you've seen of linear equations?
 - b. Mark the three solutions from Question 1 on the graph of the inequality. What do you notice?
4. **What do you think the shaded region represents on the graph?**
 5. **Mark the point (19, 16) on the graph.**
 - a. Is (19, 16) a solution to the inequality $x + y < 35$? Why or why not?
 - b. Why do you think the line in the graph is dashed, not solid?



LEARN IT

Graphing Linear Inequalities

Graphing linear inequalities can be a useful way to visualize and understand constraints. You already know how to graph linear equations; in this activity, you'll learn how to graph linear inequalities.

A **linear inequality** is like a linear equation, except it uses an inequality sign ($<$, $\leq$, $>$, $\geq$) instead of an equals sign ($=$). In a **linear equation**, all the solutions that satisfy the equation fall exactly in a line when graphed. In a linear inequality, the solution set includes all the points that satisfy the inequality, which are represented by the shaded area.

1. Summarize: What is the difference between a linear inequality and a linear equation?

2. Graph the linear inequality $y \geq 15x$.

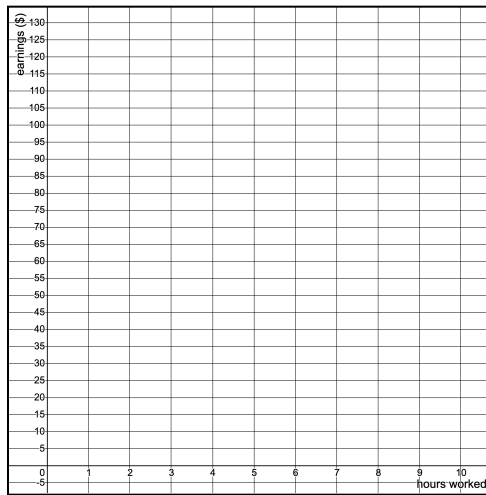
Note: This represents Cole's earnings working as a lead barista, where he earns at least \$15 per hour, depending on tips.

1 Identify key features
In slope-intercept form, find the y-intercept and slope. In standard form, find the x-intercept and y-intercept.

2 Graph the line
If the inequality uses $\leq$ or $\geq$, the line is solid. If it uses $<$ or $>$, the line is dashed.

3 Test point and shade
Choose a point and plug it into the inequality. If the point makes the statement true, shade that side of the line. If not, shade the other side.

4 Identify solution(s)



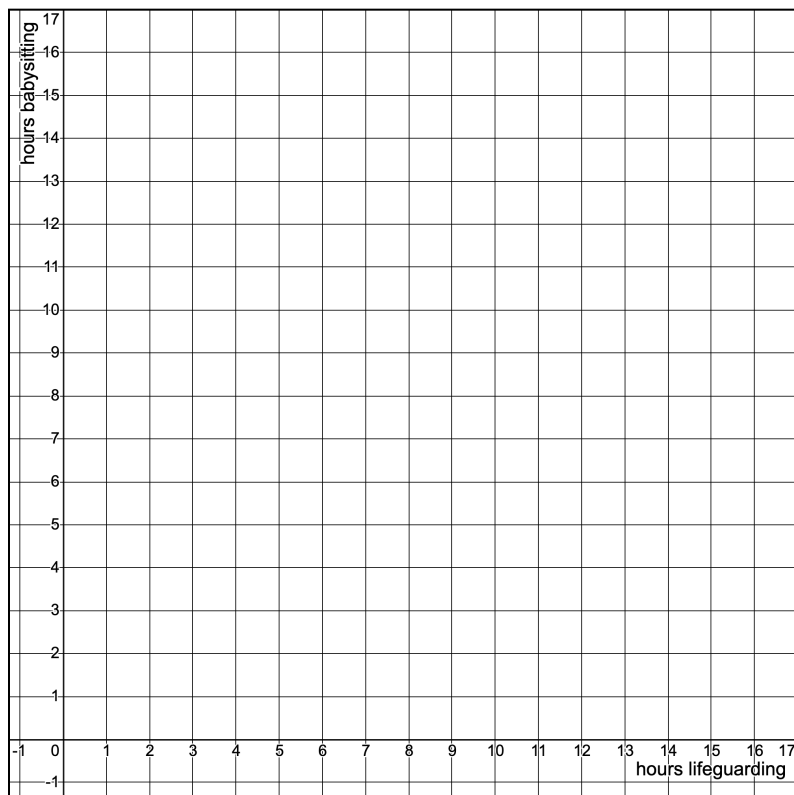
3. Jordan wants to earn more than \$120 each week. They earn \$12 per hour as a lifeguard and \$8 per hour babysitting. Graph the linear inequality representing this scenario: $12x + 8y > 120$

1 Identify key features
Intercepts and/or slope

2 Graph the line
Dashed or solid?

3 Test point and shade
Choose a point and plug it into the inequality. If the point makes the statement true, shade that side of the line. If not, shade the other side.

4 Identify solution(s)



- a. Mark the point (7, 7) on the graph. Would Jordan earn enough money if they worked 7 hours lifeguarding and 7 hours babysitting? Justify your response.

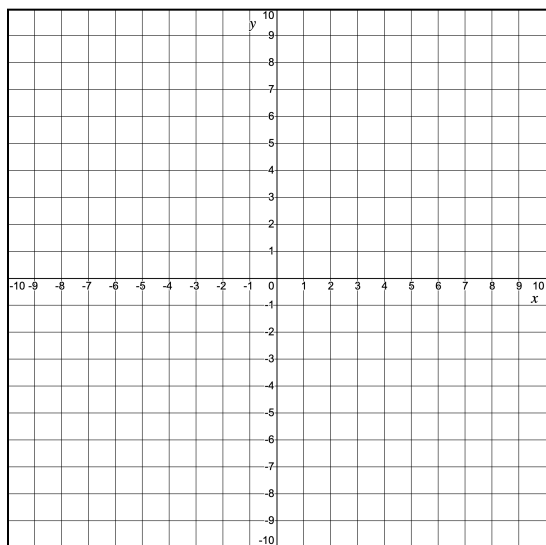
- b. Is (8, 3) a solution to this inequality? How do you know?

Additional Practice

Follow your teacher's directions to complete the examples below.

1. Graph the inequality $y \leq \frac{1}{2}x + 3$ and identify a possible solution.

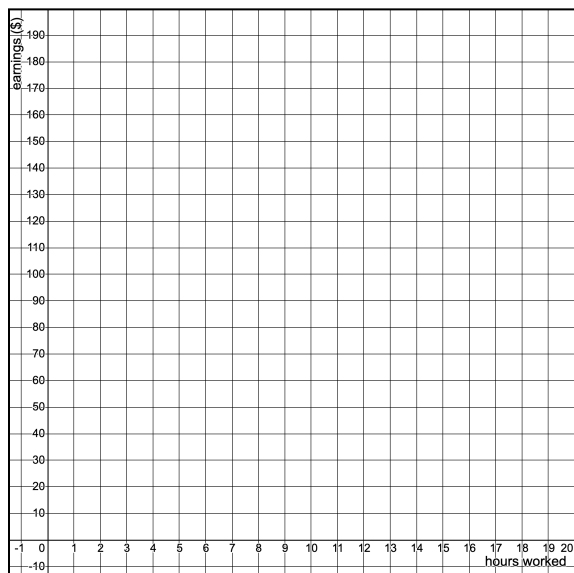
2. Graph the inequality $2x + 5y > -10$ and identify a possible solution.
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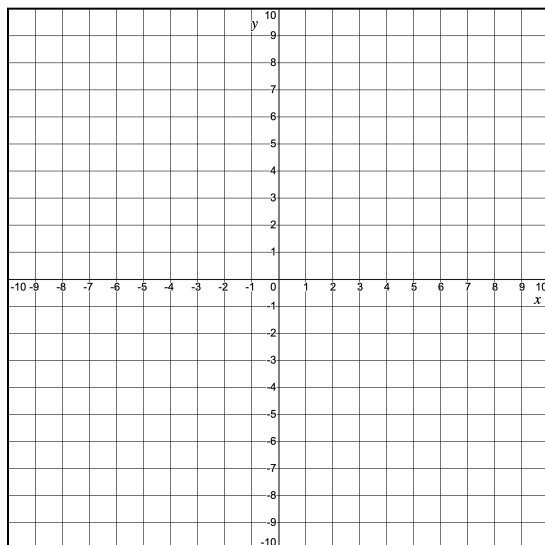
Possible solution(s): _____

- 3. You need to work at least 8 hours per week to keep your part-time job.**

a. Graph the inequality $x \geq 8$



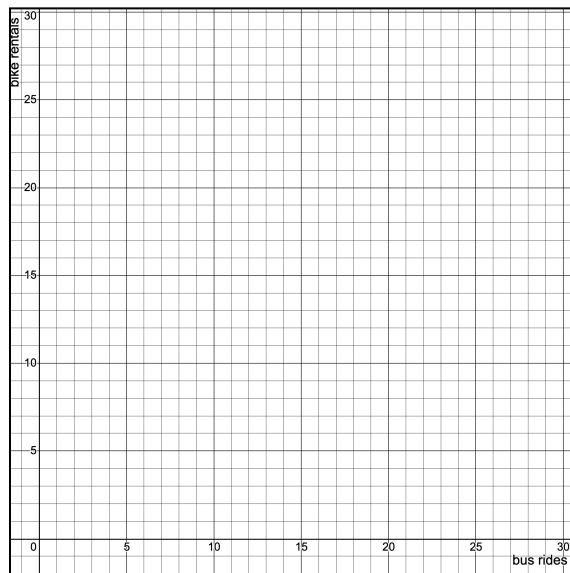
b. Identify one possible solution.



Possible solution(s): _____

- 4. You have a \$60 transportation budget to spend on \$2 bus rides and \$6 bike rentals.**

a. Graph the inequality $2x + 6y \leq 60$



b. Identify one possible solution.



PRACTICE IT

ACTIVITY: Point Collector- Lines

Follow your teacher's instructions to complete this Desmos activity. Then, answer the question.

1. When graphing a linear inequality, how do you know which direction to shade?



LEARN IT

Contextualizing Linear Inequalities

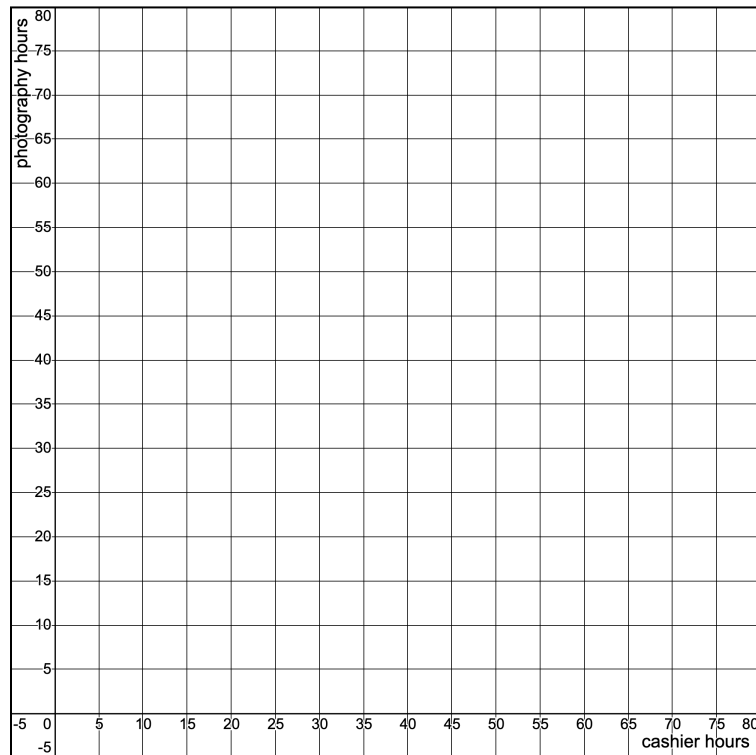
You know how to write linear equations from word problems. Now, you'll adapt that skill to write linear inequalities. Look out for key phrases that will tell you which sign to use, like "at least", "a minimum" and "no more than".

1. Brainstorm keywords associated with each inequality sign to complete the chart below.

$>$	$\geq$	$<$	$\leq$

2. Lovely needs to earn at least \$770 per week. She works part-time as a cashier for \$11 per hour. She also earns \$35 per hour doing freelance event photography, but it is hard to find freelance work.
 - a. Define your variables.
 - b. Write an inequality representing the scenario.

- c. Graph the inequality.

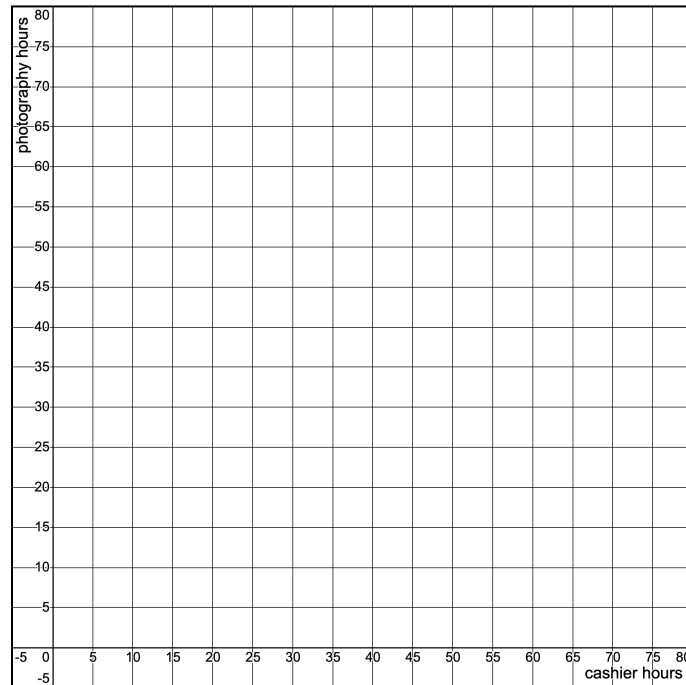


- d. If she only worked as a cashier, at least how many hours would she need to work?
- e. Is working all of her hours as a cashier an optimal real-world solution? Why or why not?
- f. The point (0, 22) is a solution. What does that mean in this context? Why is it NOT an optimal real-world solution?
- g. If you were Lovely, what solution would you choose? Why?

3. At most, Lovely can find 10 hours of freelance photography work each week.

- a. Write an inequality representing this constraint.

b. Graph the inequality.



PRACTICE IT

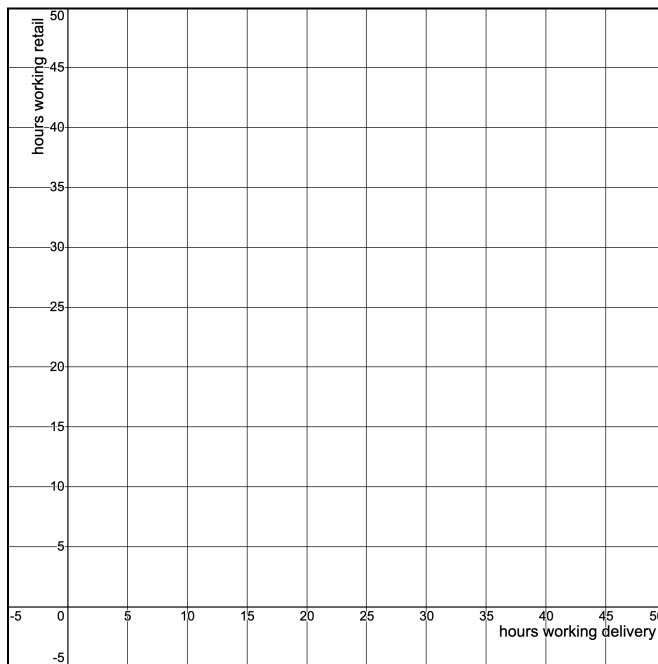
1. Match each inequality with the situation it represents.

- | | |
|---|------------------------|
| A. A \$50 one-time signing bonus and earnings of at least \$15 per hour | I. $y > 15x - 50$ |
| B. A \$50 one-time signing bonus and earnings up to \$15 per hour | II. $x + 15y > 50$ |
| C. A \$50 one-time expense to purchase necessary supplies and earnings of more than \$15 per hour | III. $y \geq 15x + 50$ |
| D. A \$50 one-time expense to purchase necessary supplies and maximum earnings of \$15 per hour | IV. $y \leq 15x - 50$ |
| E. A transportation budget of at most \$50 to spend on \$1 bus rides and \$15 cab rides | V. $y \leq 15x + 50$ |
| F. A yard sale earns more than \$50 selling \$15 clothing items and \$1 books | VI. $x + 15y \leq 50$ |

2. Kevin works two part-time jobs and wants to earn a total of at least \$504 per week. He earns an average of \$12 per hour delivering food and \$14 per hour working retail.

a. Write an inequality representing the scenario.

b. Graph the inequality.



c. The point (42, 0) is a solution to the inequality. What does that point represent in this context?

d. Is that point an optimal real-world solution? Why or why not?

e. Identify another possible combination of hours that Kevin could work.



APPLY IT

Follow your teacher's directions to complete the Application Problems.

Teachers, you can find the Application problems linked in the Lesson Guide.