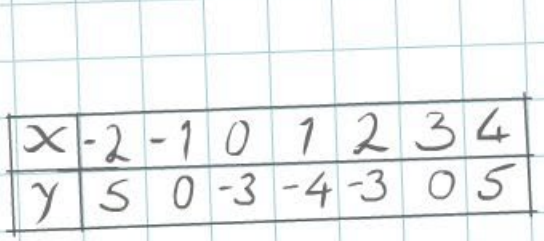
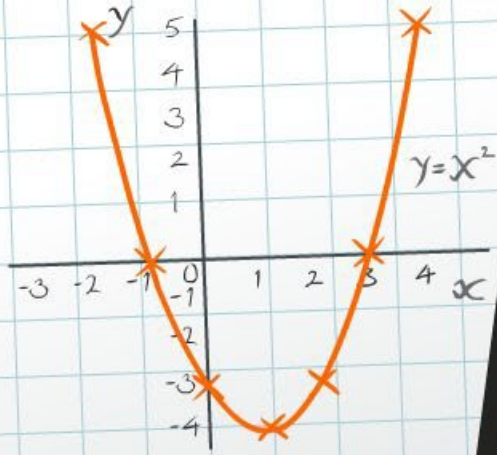
Graphing inequalities in two variables

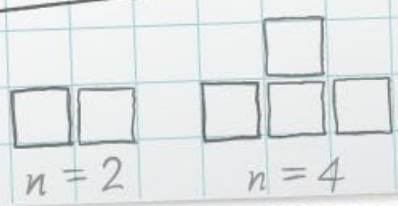


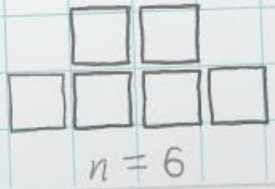


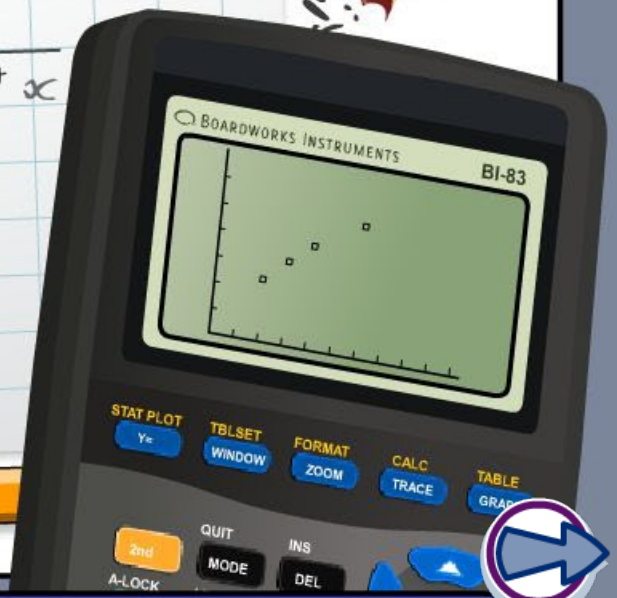
$x^2 - 2x - 3 = 0$

$(x+1)(x-3) = 0$

$x = -1$ or $x = 3$







Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

They are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Inequalities in two variables

Linear inequalities can be given in two variables x and y.

For example, $x + y > 3$

Can you name a pair of values that satisfy the inequality?

Some example solution pairs are:

$x = 1$ and $y = 4$ $\quad$ $x = -1$ and $y = 5$

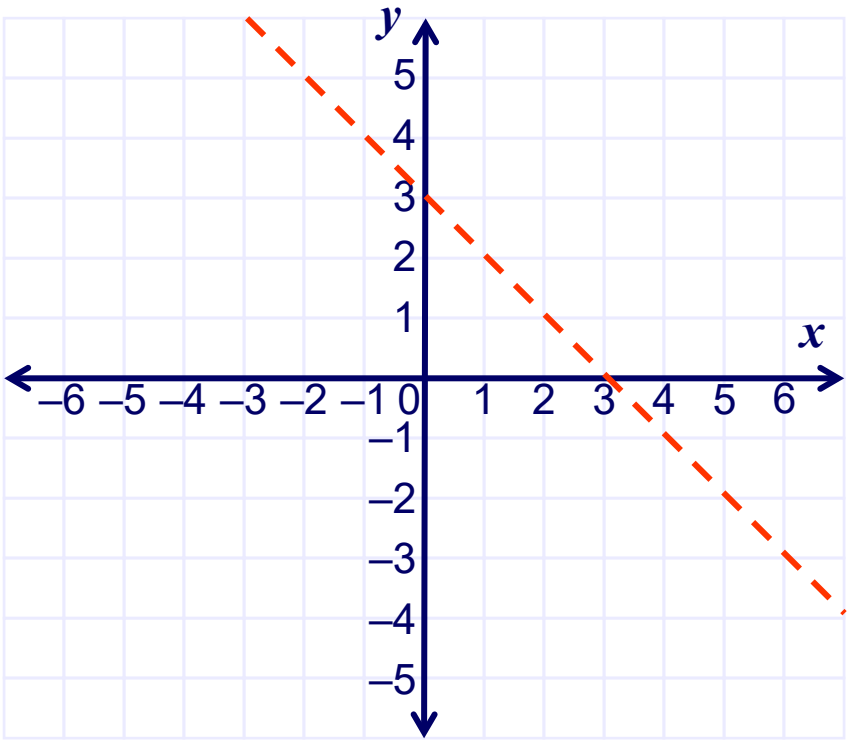
$x = 4$ and $y = 5$ $\quad$ $x = 12$ and $y = -6$

These solutions are usually written as coordinate pairs as (1, 4), (–1, 5), (4, 5), (12, –6).

The whole solution set can be represented using a graph.

Graphing the inequality

We can represent all the points where the x-coordinate and the y-coordinate add up to 3 with the line $x + y = 3$.



The region where $x + y > 3$ does *not* include points where $x + y = 3$ and so we draw this as a **dotted** line.

We need to decide which part of the graph is the solution set. How can we check?

Checking the origin

Choose a point off the line and see if it satisfies the inequality.

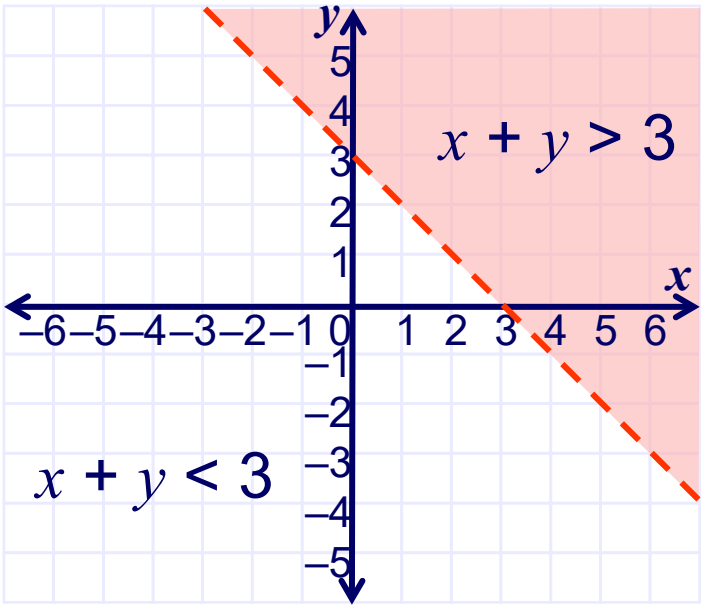
It is often easiest to check the origin, (0, 0).

Is the origin in the region $x + y > 3$?

Substitute $x = 0$ and $y = 0$ into the inequality $x + y > 3$:

$$0 + 0 > 3$$
$$0 > 2$$

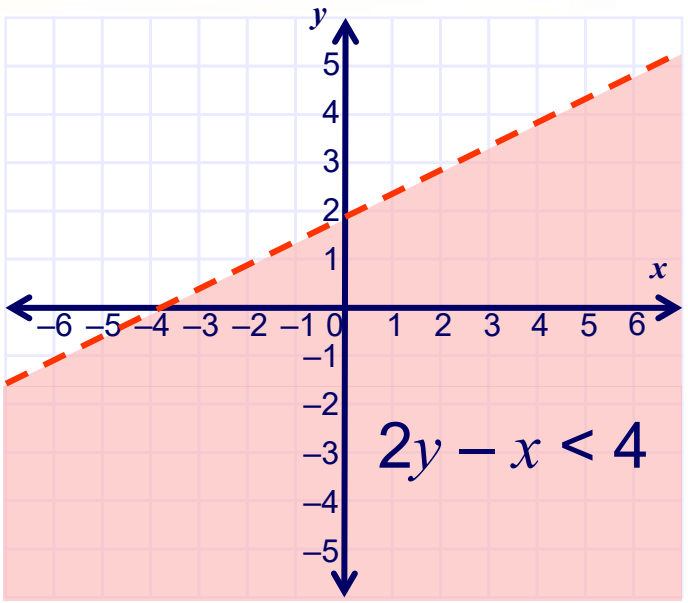
0 is **not** greater than 2, so the origin is not in the solution region.



The region representing $x + y > 3$ is therefore the region **above** the line.

Inequalities in two variables

Represent the solutions to the inequality $2y - x < 4$ on a graph.



Draw the line $2y - x = 4$.

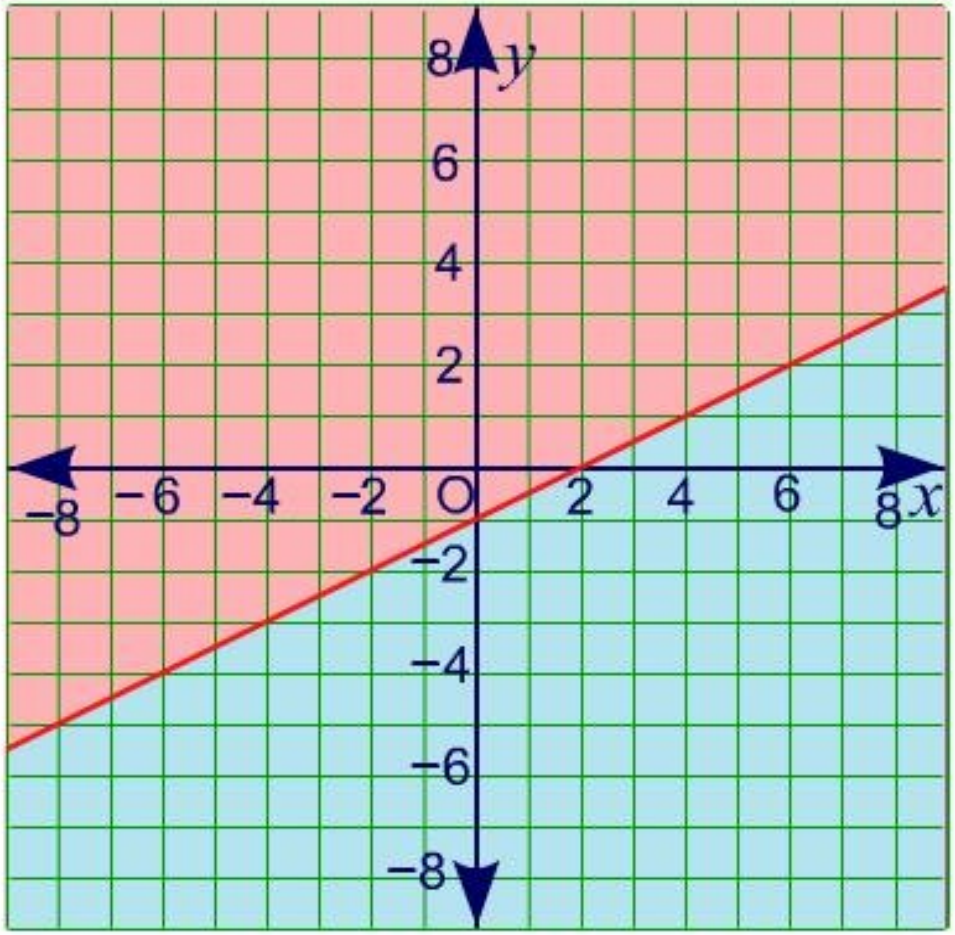
Check if the origin is in the region by substituting $x = 0$ and $y = 0$ into the inequality $2y - x < 4$:

$2(0) - 0 = 0 < 4$ ✓

This is true, so we know that (0, 0) is in the solution set.

The solution set is therefore the region **below** the line.

Inequalities in two variables

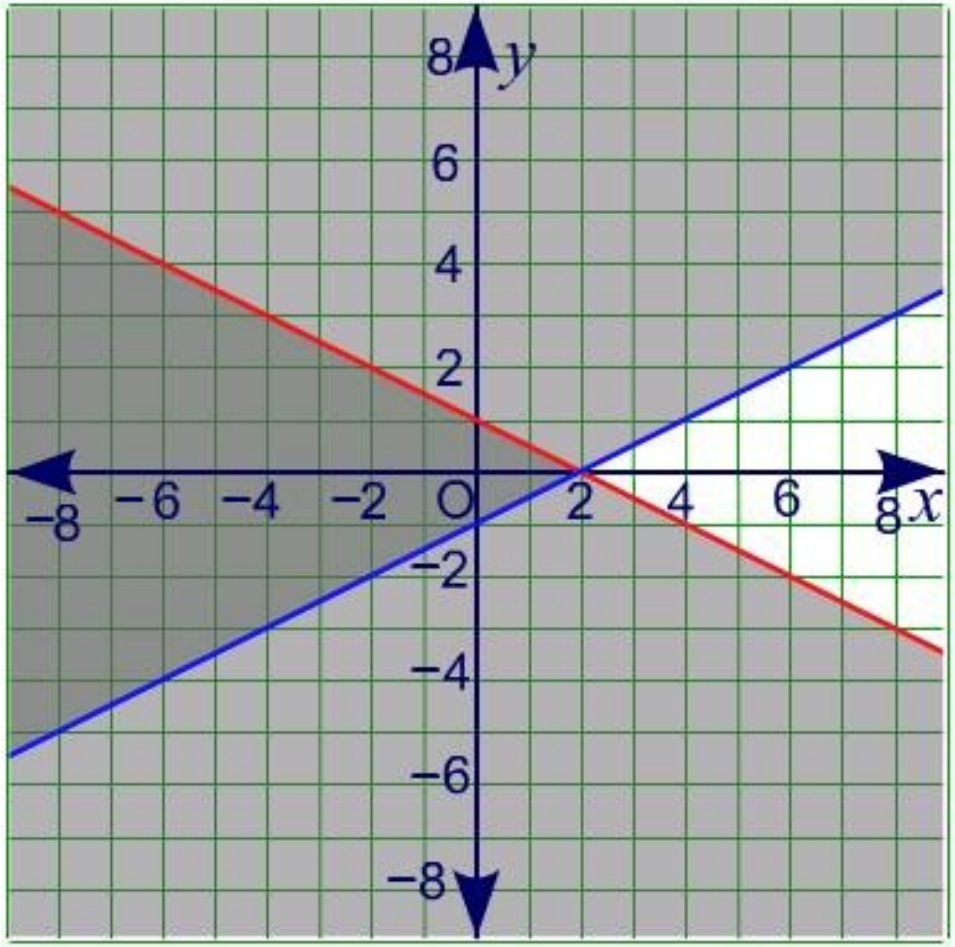


Experiment to see how different inequalities create different regions.

$1x - 2y \geq 2$

$1x - 2y \leq 2$

Combining two inequalities

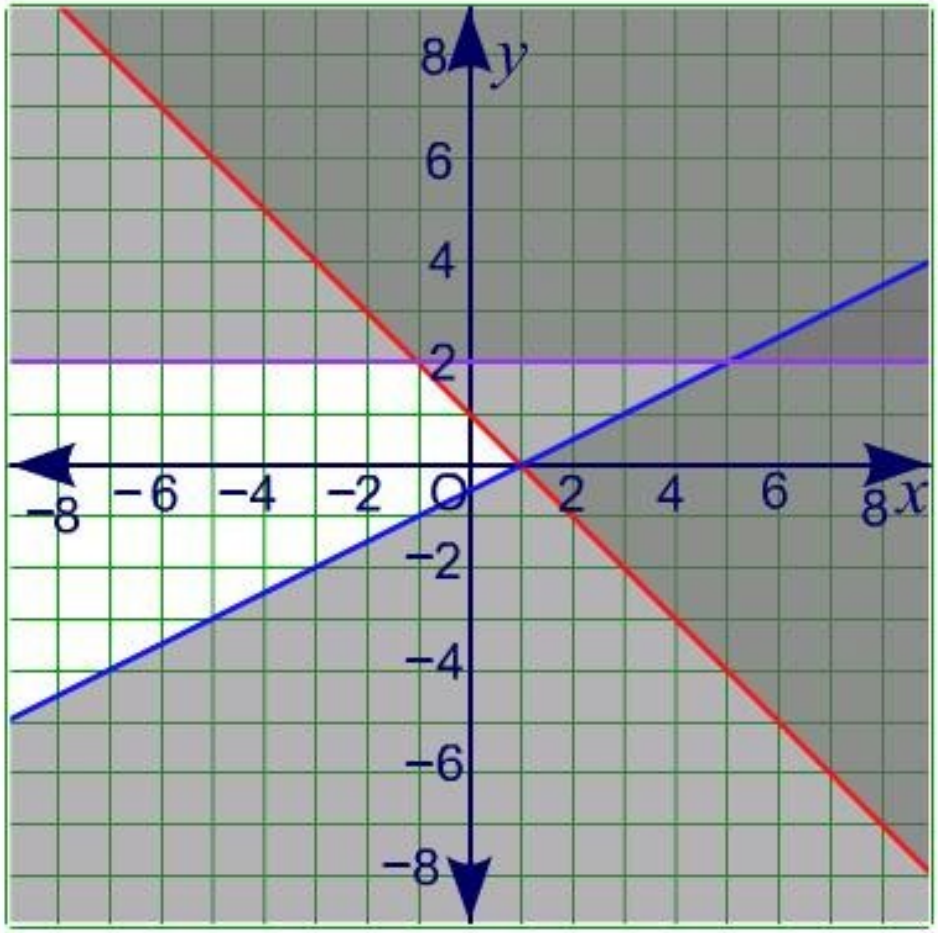


Experiment to see how different inequalities create different regions.

$1x + 2y \leq 2$

$1x - 2y \leq 2$

Combining three inequalities



Experiment to see how different inequalities create different regions.

$y \geq 2$

$2x + 2y \geq 2$

$1x - 2y \geq 1$

Cars and trucks

A ferry cannot hold more than 30 tons. If it holds x cars weighing 1 ton each and y trucks weighing 3 tons each, write down an inequality in x and y.

$x + 3y \leq 30$

If 20 cars were already on board, how many more trucks could the ferry carry?

Substitute into $x + 3y \leq 30$ and solve for y,

$$20 + 3y \leq 30$$

subtract 20 from both sides: $3y \leq 10$

divide both sides by 3: $y \leq 3.3$ (to nearest tenth)

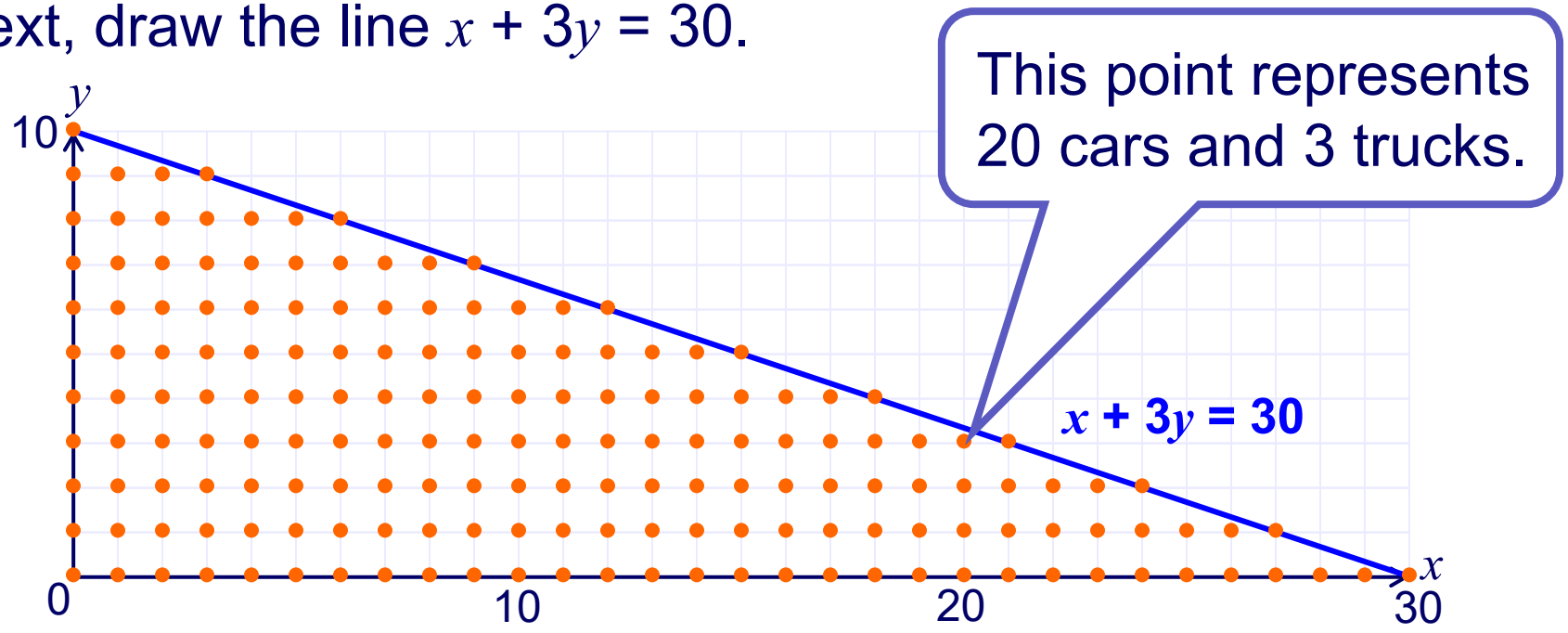
The ferry can hold **3 more trucks**.

Cars and trucks

Show the possible numbers of cars and trucks that the ferry can carry on a graph.

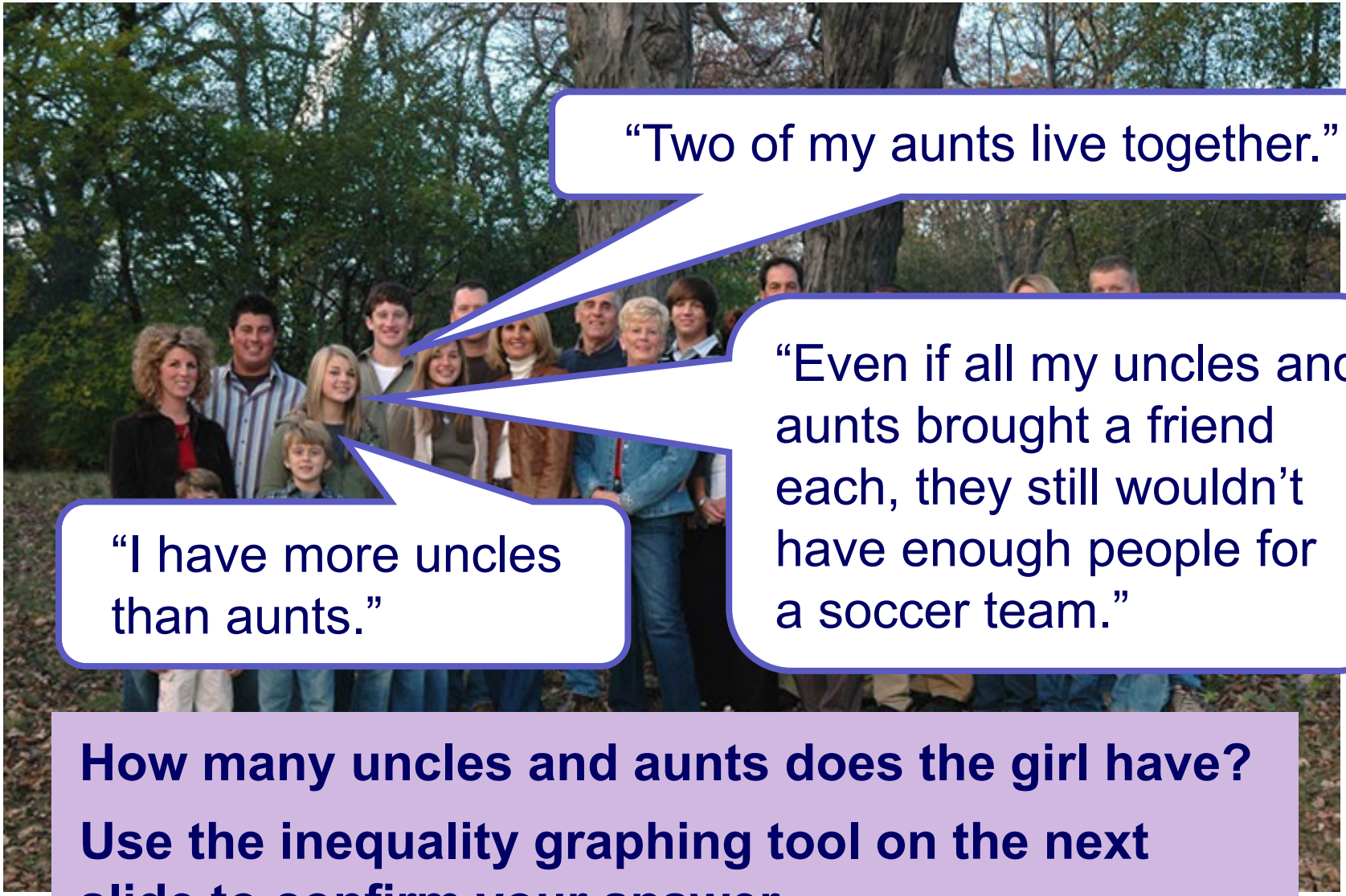
Start by drawing the x-axis between 0 and 30 and y-axis between 0 and 10.

Next, draw the line $x + 3y = 30$.



The points on the graph represent the solution set.

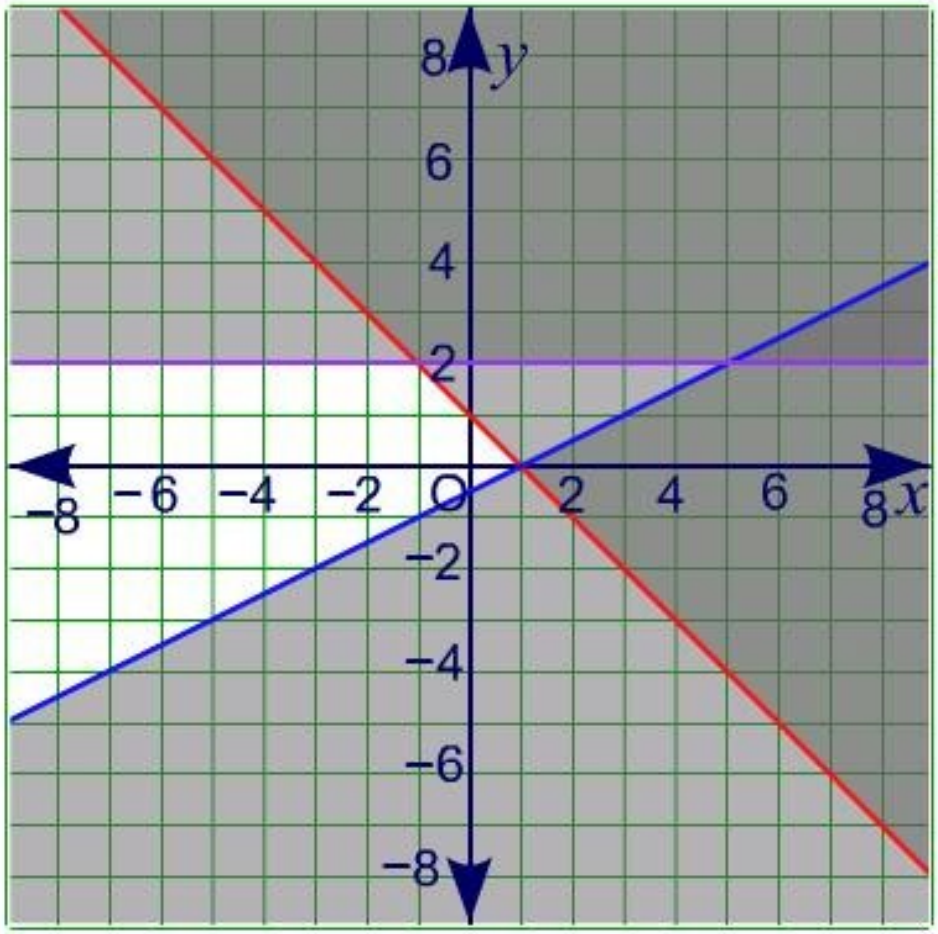
Uncles and aunts



How many uncles and aunts does the girl have?

Use the inequality graphing tool on the next slide to confirm your answer.

Uncles and aunts graph



Use this graphing tool to help answer the question on the previous slide.

$y \geq 2$

$2x + 2y \geq 2$

$1x - 2y \geq 1$