Linear inequalities have two variables, so we have to show the possible solutions on a coordinate plane (graph).

Since what we shade is two-dimensional (as opposed to the # line), the shaded region on a graph represents all of the (x,y) combinations that make the inequality true.

The solution set to a linear inequality is represented by a shaded graph.
Graphing Linear Inequalities

1. Get the linear inequality into slope-int form.
   - if you multiply or divide by a negative, flip the inequality sign!

2. Graph points as if it were a linear function.
   - plot the y-intercept (0, b)
   - find the two slopes (rise/run)
   - graph all possible points
3. Look at the inequality sign to see if the points that were graphed (boundary) are included or not included in the solution set.

- < or >  ➔ not included in the solution set
dotted/dashed line ←-------------
- ≤ or ≥  ➔ included in the solution set
solid line ←→

Solid line under the inequality = solid line on graph

4. Shade the side that has the solution set where the ordered pairs make the linear inequality true.

- We want to test an ordered pair to see if it is part of the solution set. If it is, then all of the ordered pairs on that side of the linear inequality are part of the solution set.
Input the ordered pair to test the inequality.

If the ordered pair makes the inequality TRUE:
Shade the side of the graph that has the ordered pair.

If the ordered pair makes the inequality FALSE:
Shade the other side of the graph than the side that the ordered pair is on.

You must pick an ordered pair that is NOT on the line!

(0,0) is the best point to pick if the line does not go through it.

But you can pick any point that you want (as long as it is not on a line.)
Thought Process for Graphing Linear Inequalities M/C
1. Type of Line.....Look @ ineq sign (</> = dotted, </> = solid)
2. Y-Intercept......May need to convert to slope-intercept form
3. Type of Slope.................................Positive or Negative?
4. Rise/Run...............................................Find from two points
5. Test Point for Shading............(0,0) unless line goes through
5 Things to Know: Linear Inequalities M/C questions

1. TYPE OF BOUNDARY LINE
   Solid Line $\Rightarrow \leq \text{ or } \geq$  Dotted/Dashed Line $\Rightarrow \leq \text{ or } \geq$

2. Y-INTERCEPT
   The b-value in slope-intercept form (convert if not in $y = mx + b$)

3. SLOPE TYPE
   Is the slope (in equation/on the graph) positive or negative?

4. RISE OVER RUN
   Find the change in Y over change in X over 2 points.

5. TEST POINT FOR SHADING
   Use the ordered pair (0,0) unless the line goes through origin

If the linear inequality given is in **standard form**, then you can find the **line type** (solid/dotted) and **test the ordered pair** (0,0) before converting it to slope-intercept form.
Without graphing, what can we know about the graph of \( y > 3x - 1 \)?

- \( y \)-intercept is \((0, -1)\)
- boundary line is dotted/not included
- slope type is positive
- rise/run is \(3/1\) or \(-3/-1\)
- \((0,0)\) is part of the solution set/shaded area because it makes the inequality true

Without graphing, what can we know about the graph of \( 3x - 5y > 10 \)?

\[
-\frac{3x}{5} < \frac{-3x + 10}{-5}
\]

- boundary line is dotted/not included
- \( y \)-intercept is \((0, -2)\)
- slope type is positive
- rise/run is \(3/5\) or \(-3/-5\)
- \((0,0)\) is NOT part of the solution set/shaded area because it makes the inequality false
Which graph represents the inequality, $2x - 2y > 8$?

\[
-2x - 2y > 8
\]

\[
-2y > -2x + 8
\]

\[
y < x - 4
\]

Which graph represents the inequality, $-x - 3y \geq -6$?

\[
-x - 3y \geq -6
\]

\[
y \leq -\frac{1}{3}x + \frac{2}{3}
\]

$0 \geq -6$

true
Write the linear inequality for the graph shown.

\[ y \square mx + b \]

\( b = 2 \) (y-int)
slope type = positive
line type = solid (\( \leq \) or \( \geq \))
rise/run = \( \frac{2}{3} \)
(0,0) is shaded, so it will make the inequality true, which \( 0 \leq \frac{2}{3}x + 2 \)

\[ y \leq \frac{2}{3}x + 2 \]

Write the linear inequality for the graph shown.

\[ y \square mx + b \]

\( b = -1 \) (y-int)
slope type = negative
line type = dotted (\( < \) or \( > \))
rise/run = \( \frac{1}{3} \)
(0,0) is shaded, so it will make the inequality true, which \( 0 \geq -1 \)

\[ y \geq \frac{1}{3}x - 1 \]
Is \((2,3)\) a possible solution to \(4x - 3y > 8\)?

\[
4(2) - 3(-3) > 8
\]
\[
8 + 9 > 8
\]
\[
17 > 8
\]

\((2,-3)\) is part of the solution set.

Is \((6,0)\) a possible solution to \(2x + 6y > 12\)?

\[
2(6) + 6(0) > 12
\]
\[
12 + 0 > 12
\]
\[
12 > 12
\]

\((6,0)\) is not part of the solution set, but it is on the boundary line.
Linear Inequalities Word Problems

- Very similar to linear equation word problems, except that instead of an equals sign (=), there is an inequality sign (<, >, ≤, ≥)

- Phrases that will indicate an inequality:
  "a is more than b" means a > b
  "a is at least b" means a ≥ b
  "a is less than b" means a < b
  "a is no more than b" means a ≤ b

Steps to be Successful:
1. What do you not know/what are you looking for?
2. Assign variables to what you don't know/what you are looking for. (Write it down!)
3. Identify other information/numbers in the problem.

    See the quantities and their relationship instead of numbers.
Kendra is hosting a banquet to raise funds for charity. The goal of the fundraiser is to raise more than $9,400. Individual tickets cost $67 and an entire table can be purchased for $570. Write a linear inequality that represents this situation.

\[ x = \# \text{ of tickets} \quad 67x + 570y > 9,400 \]
\[ y = \# \text{ of tables} \]

Ronnie is inviting people to his parents' anniversary party and wants to stay at or below his budget of $3,500 for the food. The catering cost will be $51 for each adult's meal and $18 for each child's meal. Write a linear inequality that represents this situation.

\[ x = \# \text{ of adult meals} \quad 51x + 18y > 3,500 \]
\[ y = \# \text{ of child meals} \]
Linear Inequalities Word Problems

- Do these the same way as the 1-variable inequality word problems, except that instead of an equals sign (=), there is an inequality sign (<, >, ≤, ≥)

- Phrases that will indicate an inequality:

  "... more than the total"  means  amount > total
  "... at least the total"    means  amount ≥ total
  "... less than the total"  means  amount < total
  "... no more than the total"  means  amount ≤ total

Steps to be Successful:
1. What do you not know/what are you looking for?
2. Assign variables to what you don't know/what you are looking for. (Write it down!)
3. Identify other information/numbers in the problem.

See the quantities and their relationship instead of numbers.
Kendra is hosting a banquet to raise funds for charity. The goal of the fundraiser is to raise more than $9,400. Individual tickets cost $67 and an entire table can be purchased for $570. Write a linear inequality that represents this situation.

\[ x = \# \text{ of individual tickets} \quad \text{total given = standard form} \]
\[ y = \# \text{ of tables} \]

\[
67x + 570y > 9,400
\]

Ronnie is inviting people to his parents' anniversary party and wants to stay at or below his budget of $3,500 for the food. The catering cost will be $51 for each adult's meal and $18 for each child's meal. Write a linear inequality that represents this situation.

\[ x = \# \text{ of adult meals} \]
\[ y = \# \text{ of children meals} \]

\[
51x + 18y \leq 3,500
\]