Linear Inequalities in Two Variables

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Learning Objectives:

- Graph linear inequalities in two variables.

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Definition

Replacing the equal sign in the general linear equation $A\,x + B\,y = C$, by any of the symbols $<, \leq, >$ or $\geq$ gives a **linear inequality in two variables**.

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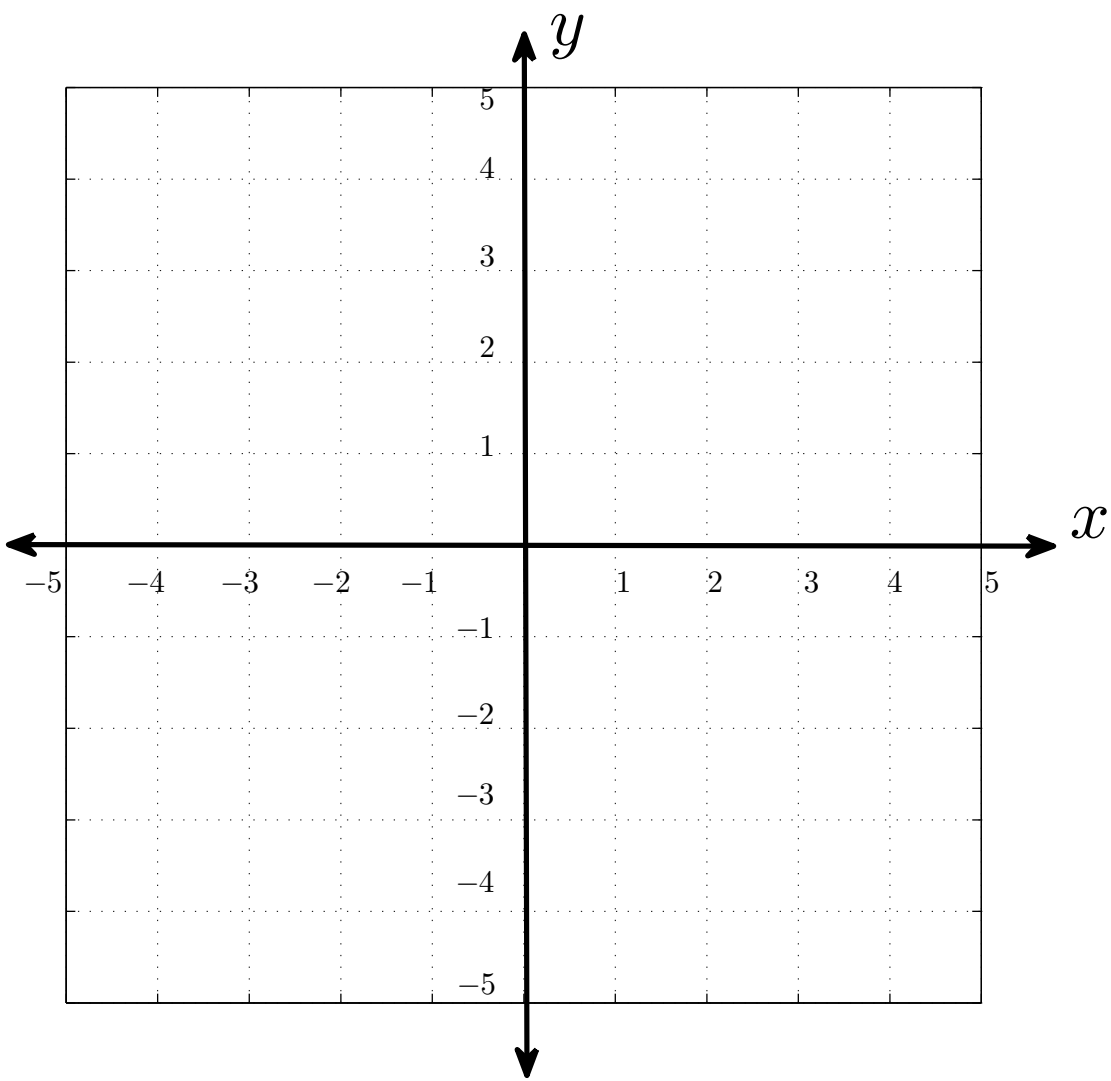
Linear Inequalities in Two Variables

The **boundary** for the section is found by replacing the inequality symbol with an equal sign and graphing the resulting equation.

- The boundary is included in the solution set (and represented with a solid line) if the inequality symbol originally used is $\leq$ or $\geq$.
- The boundary is *not* included (and represented with a broken line) if the inequality symbol originally used is $<$ or $>$.

Graph the solution set for $x - y \geq 3$

We first replace the inequality symbol with an equal sign: $x - y = 3$. This equation gives us the boundary of the solution set.



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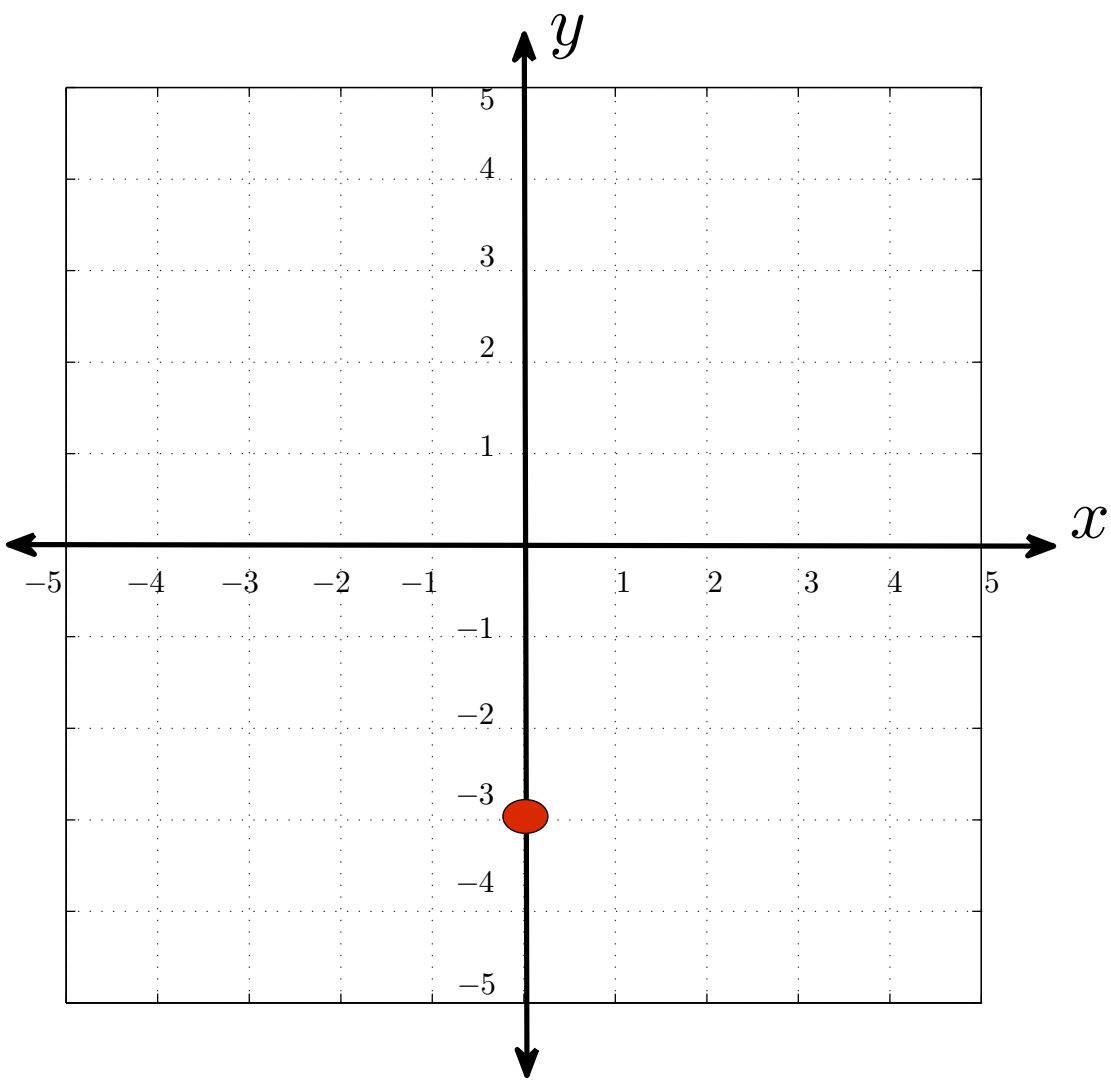
Next, we graph this boundary. One way to do that is to draw a line between the intercepts at $(0, -3)$ and $(3, 0)$.



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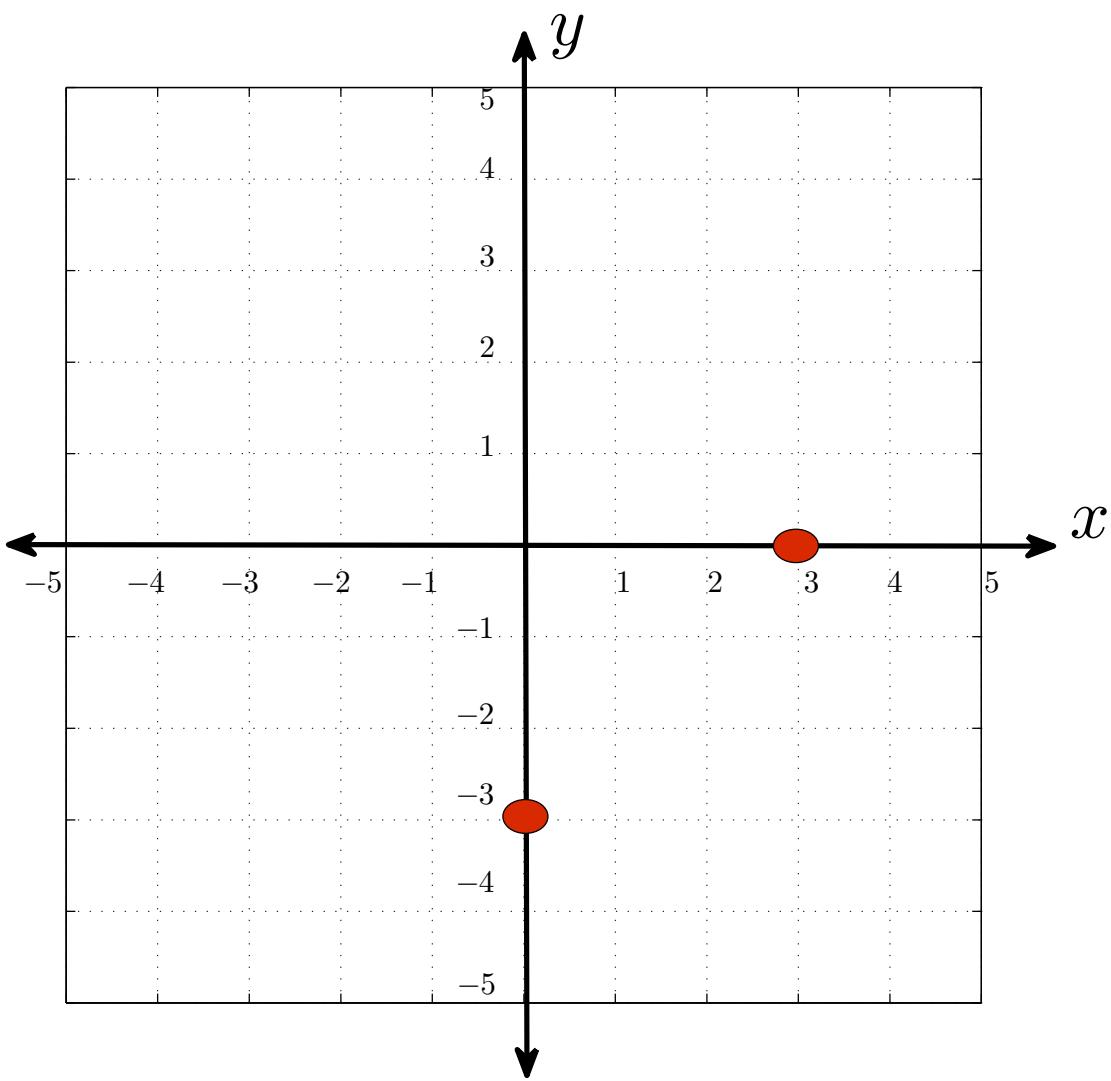

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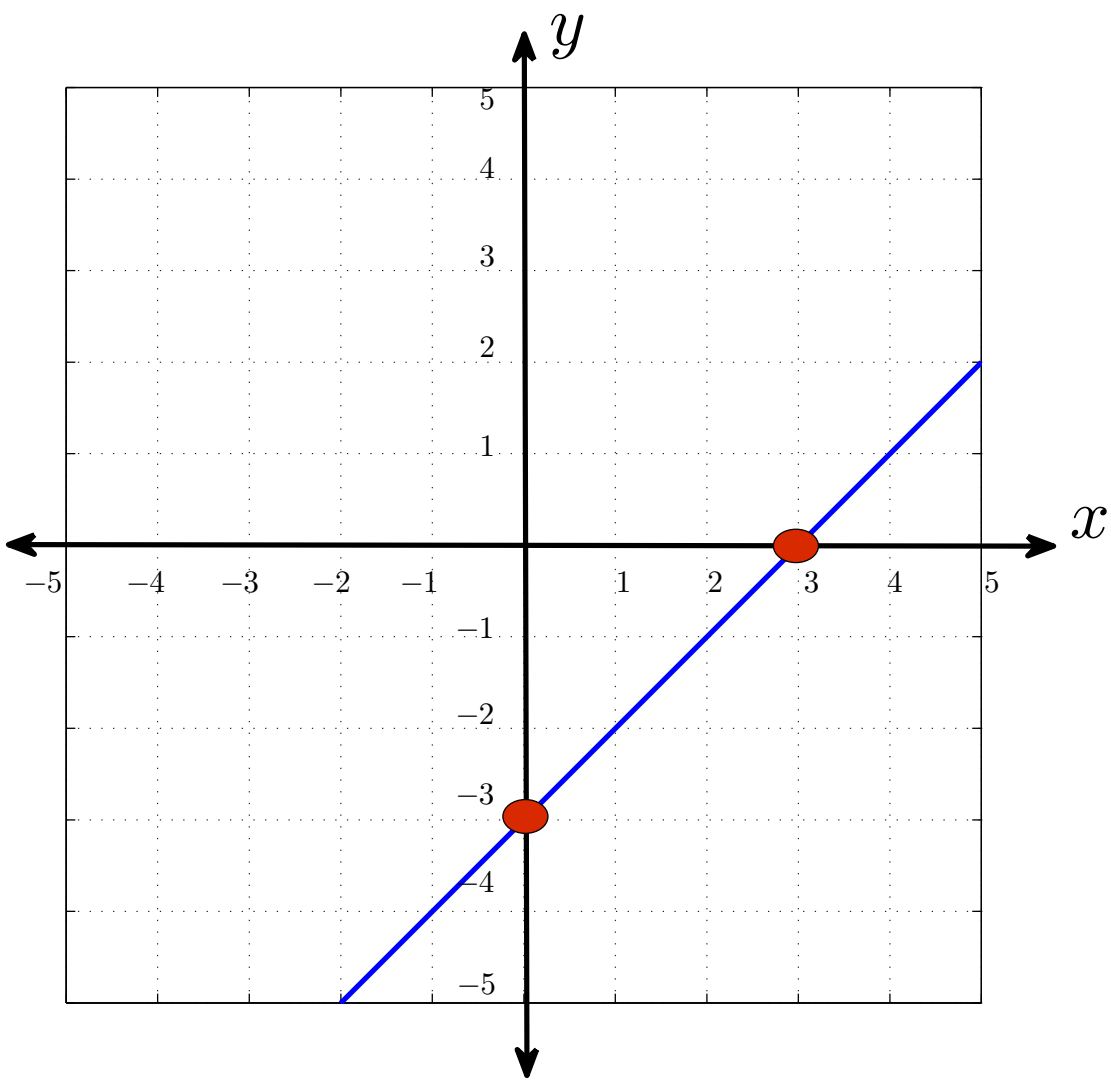

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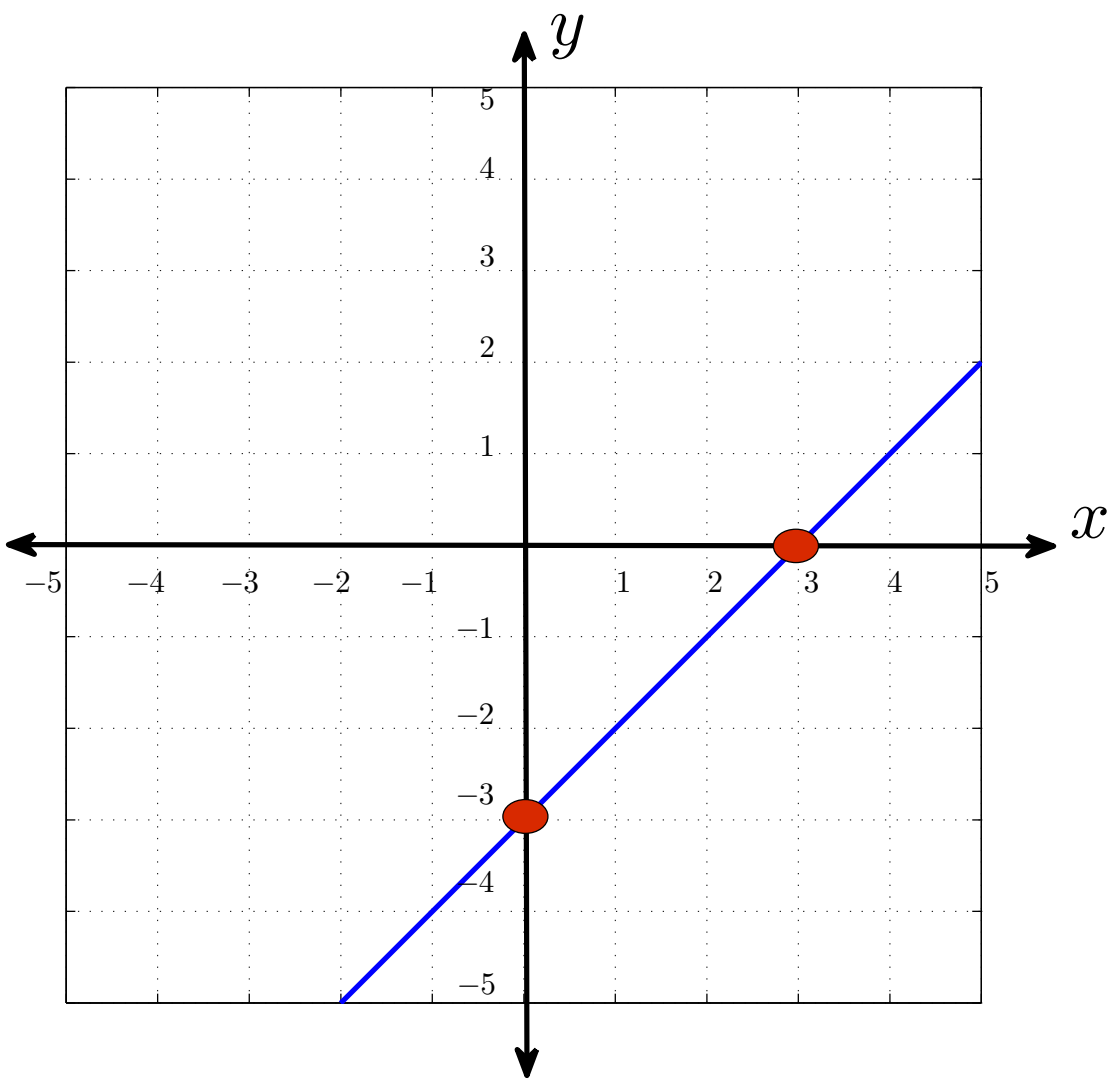
Note that the line representing the boundary of the solution set is intentionally graphed with a solid line since the original inequality was $\geq$.



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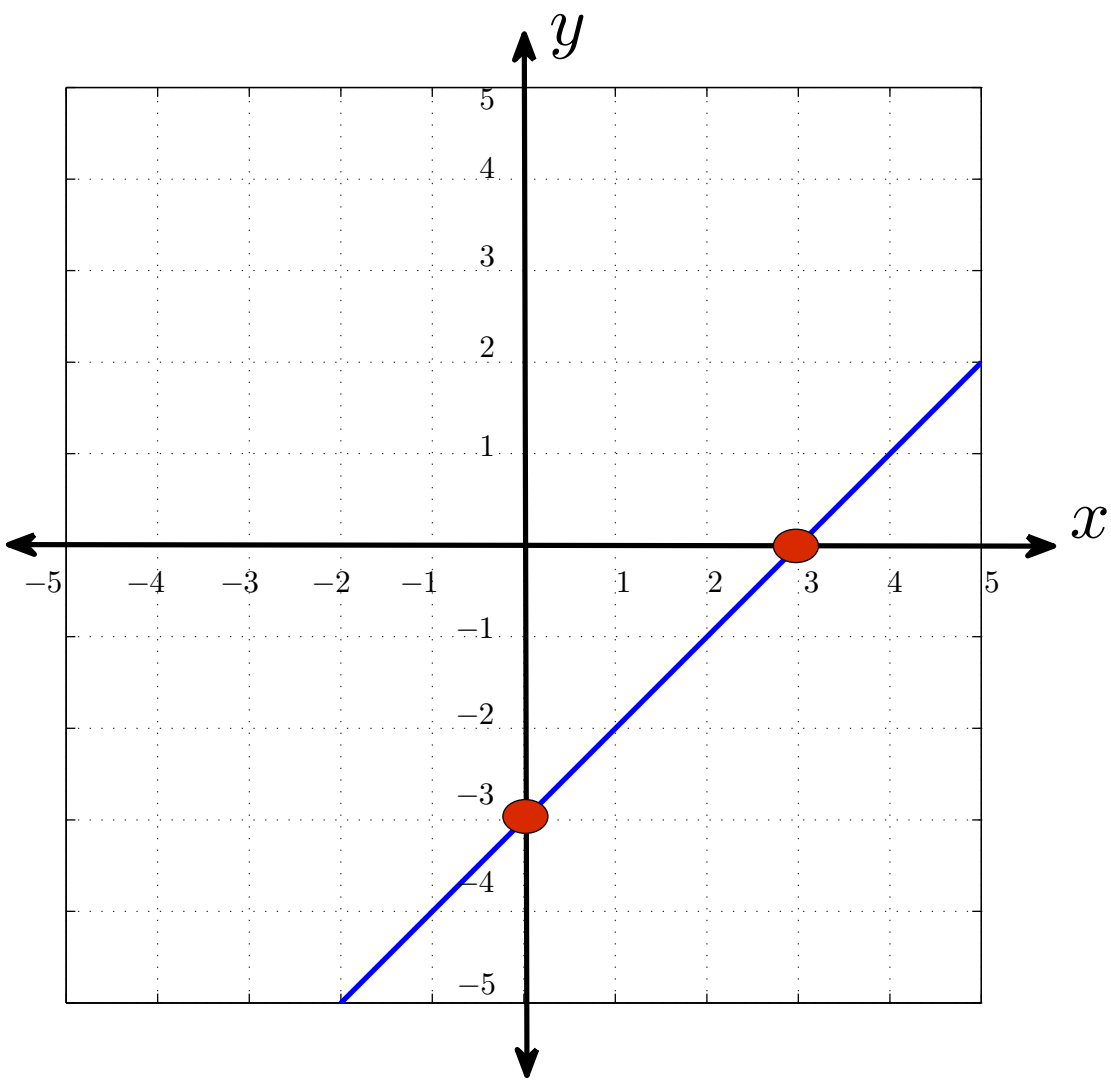
We choose a convenient point ***not*** on the boundary now, such as $(0, 0)$, and substitute the coordinates into the original inequality.



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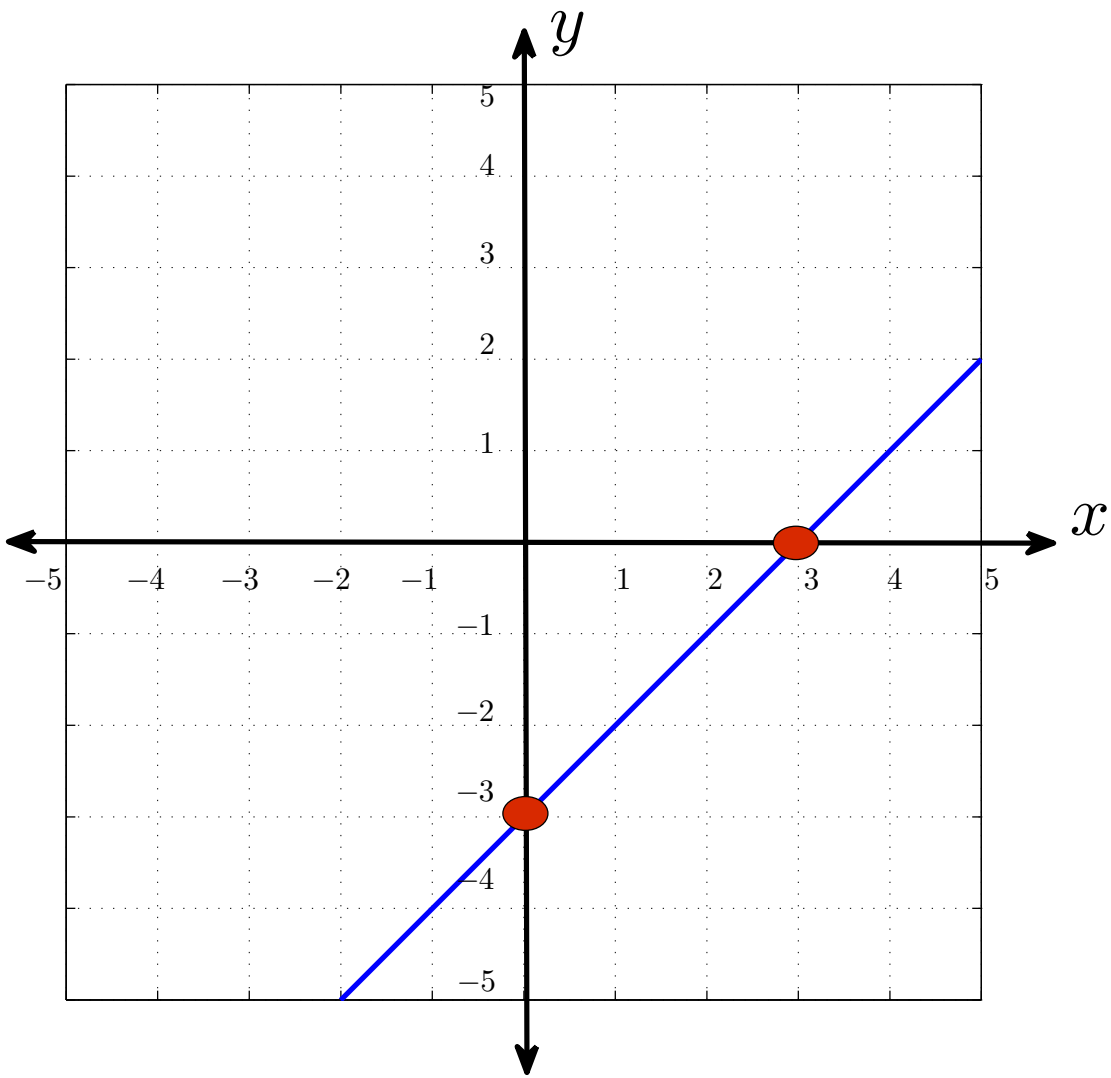
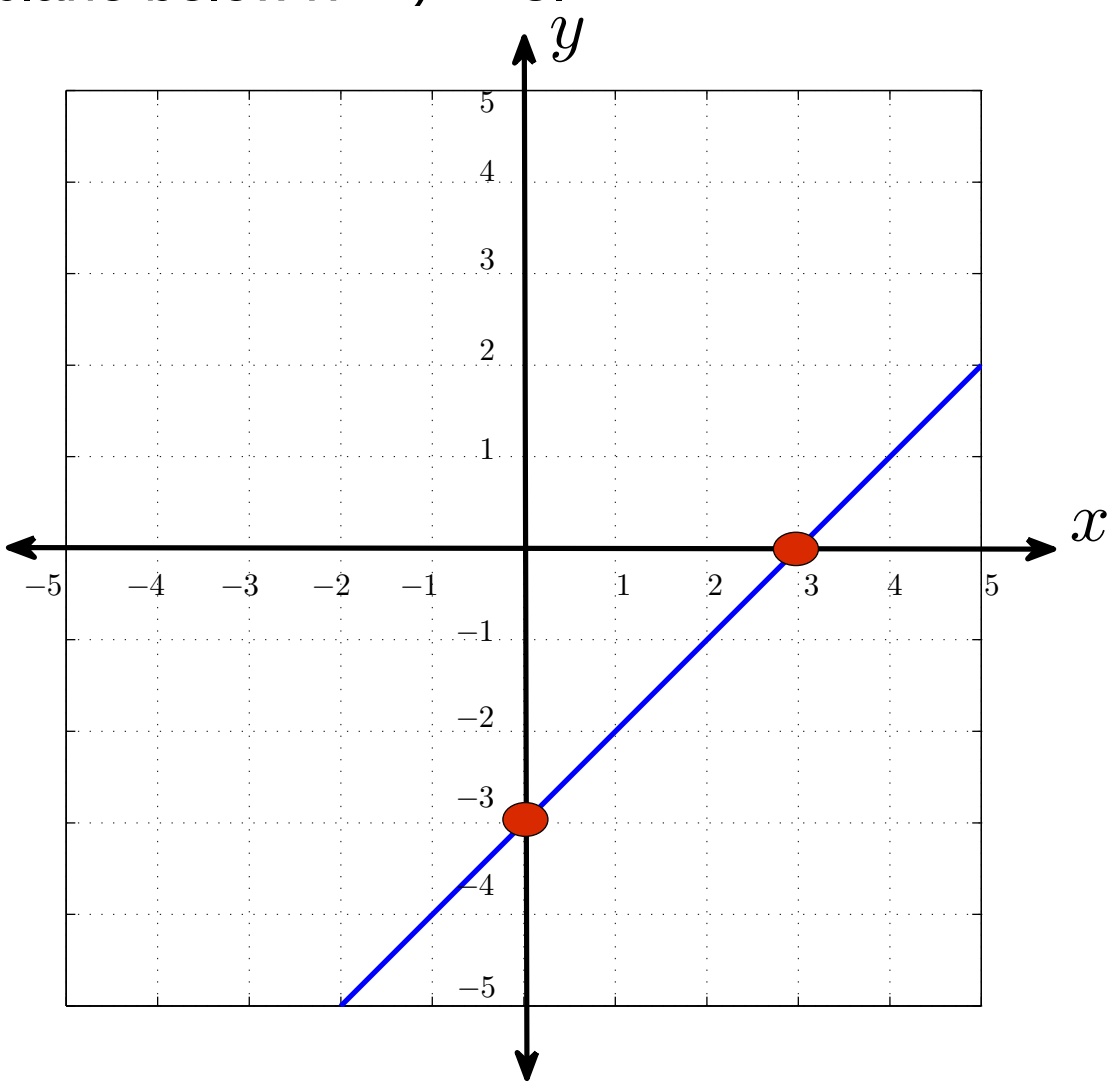
If the chosen point renders the inequality a true statement upon substitution, then we can assume that all points on the same side of the boundary as the chosen point are also in the solution set.



Graph the solution set for $x - y \geq 3$

But, in this case, since substitution of $x = 0$ and $y = 0$ into $x - y \geq 3$ gives $0 \geq 3$ (a false statement), we shade the section of the coordinate plane below $x - y = 3$.



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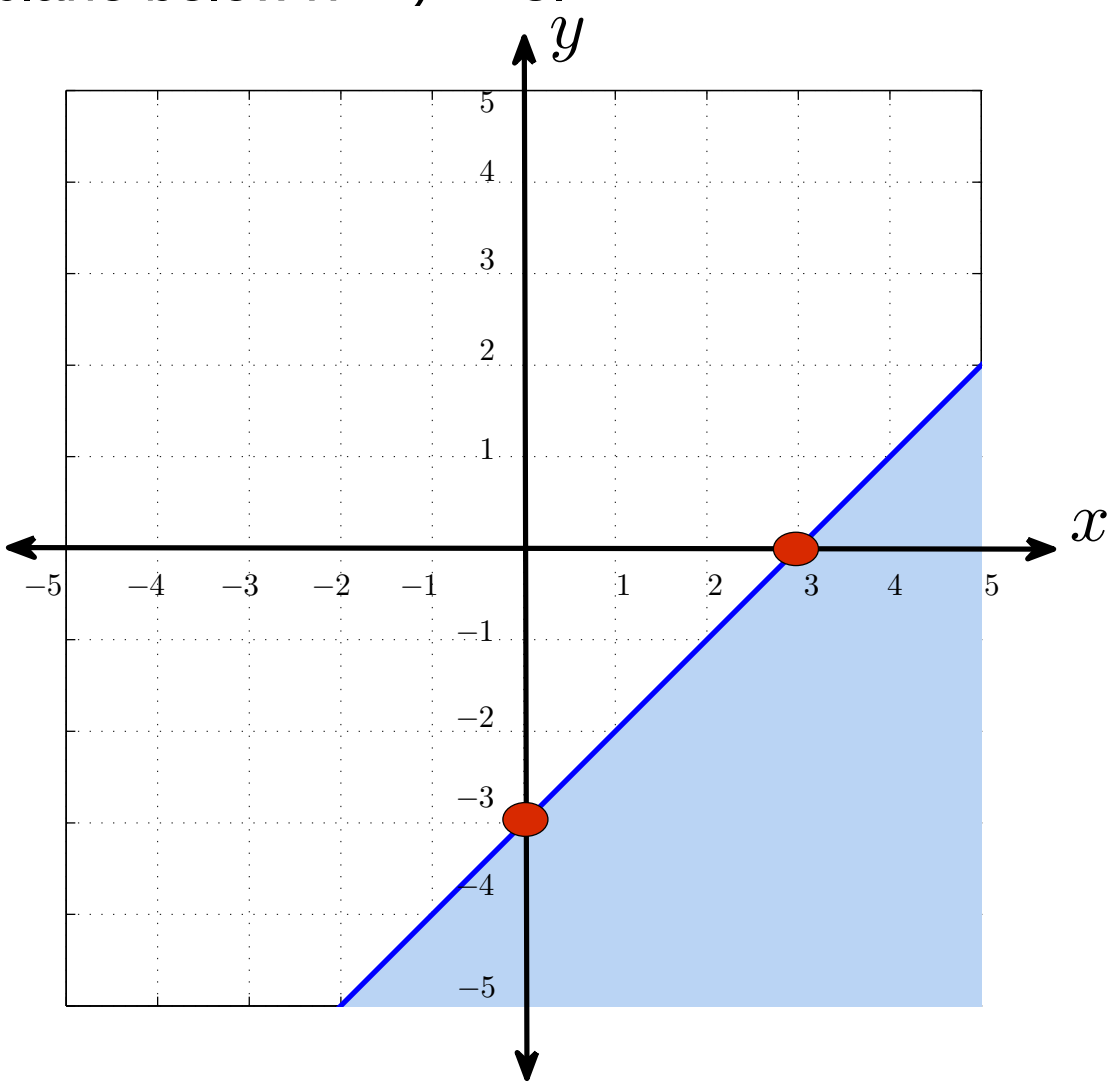

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Step 1: Replace the inequality symbol with an equal sign. The resulting equation represents the boundary for the solution set.

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Step 3: Choose any convenient point not on the boundary and substitute the coordinates into the original inequality. If the resulting statement is true, the graph lies on the same side of the boundary as the chosen point. If the resulting statement is false, the solution set lies on the opposite side of the boundary.