Graphs of Inequalities

Inequalities are used when comparing two quantities that are not equal. These quantities may or may not vary as a function of another variable. In both cases the inequalities may be represented graphically.

To find the region where $f(x) > 0$, solve the equation $f(x) = 0$, then identify the region by testing whether an arbitrary point lies in the region or not.

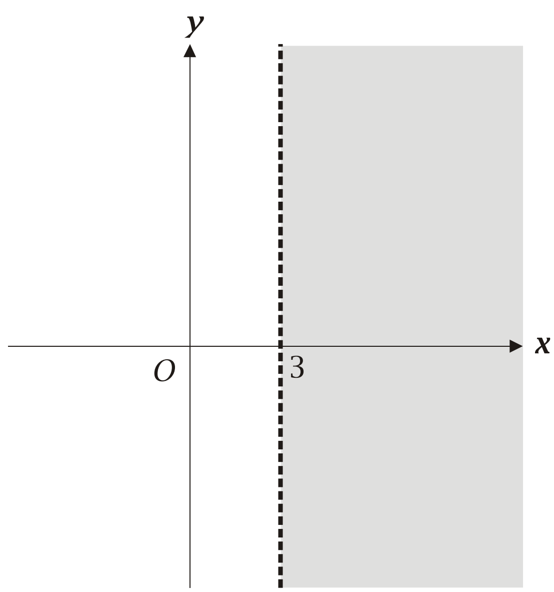
<u>Example 1</u>

Show the inequality $x > 3$ graphically.

Solution

First, let $x = 3$. Draw this line on the graph.

The region where $x > 3$ will lie on one side of this line. To find which side the region is test one point. Often the origin, where $x = 0$, $y = 0$ is the most convenient point to test. When $x = 0$ it is <u>not</u> true that $x > 3$, so the origin does not lie in the required region. Therefore, the region lies to the right of the line.



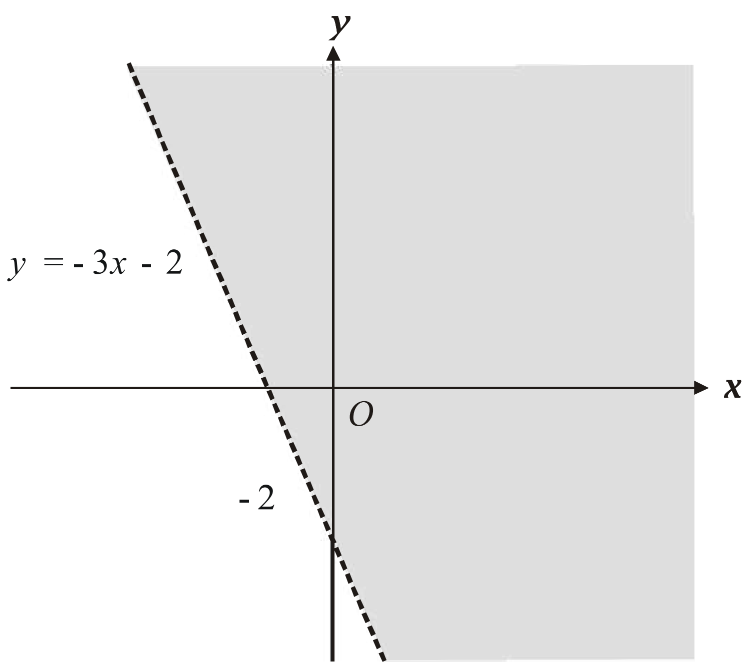
The dashed line indicates that the line is *not* included in the region. This is because the inequality takes the form $x > 3$ and not $x \geq 3$, so the inequality is not exact.

Example 2

Sketch the region where $y + 3x + 2 > 0$

Solution

Let $y = -3x - 2$
Does $x = 0,\ y = 0$ lie in the region?
When $x = 0, y = 0$ then $y + 3x + 2 = 2 > 0$
Hence, $(0,0)$ does lie in the region.



In the diagram the dashed line indicates that the line is *not* included in the region.

Example 3

Sketch the region where $y \geq x + 3$ and $y > 2x$

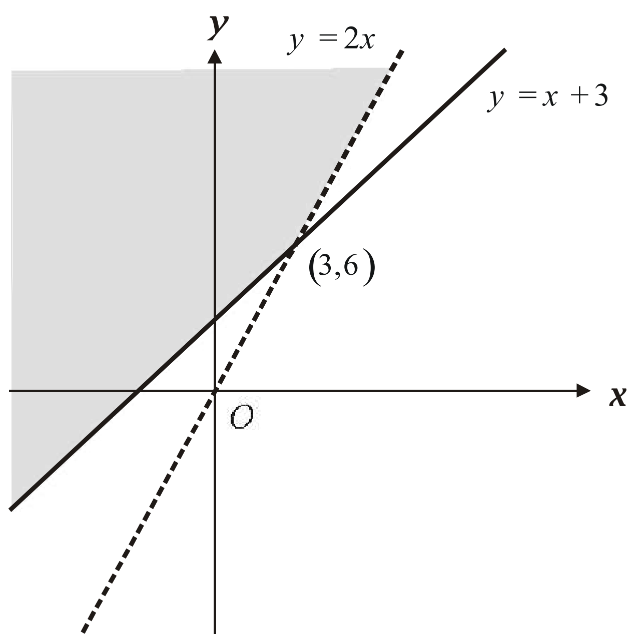
Solution

Let

$$x + 3 = 2x$$
$$x = 3$$

Thus, the intersection of the two lines occurs at $x = 3,\ y = 6$

That is to say at the point $(3, 6)$



The solid line for $y = x + 3$ indicates that this time the line *is* included in the region. This is because the inequality is in this case exact, $y \geq x + 3$ as opposed to $y > x + 3$.