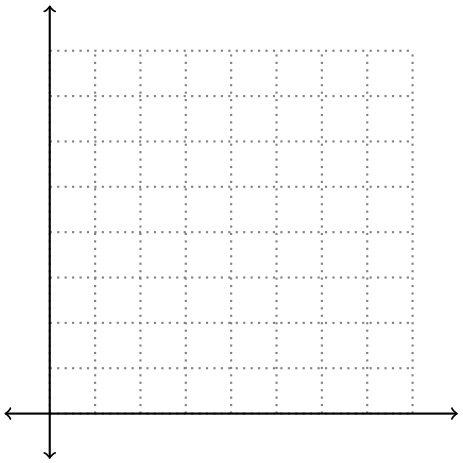
Name: _____

MA162-020
2010-06-28

Quiz 3.1: Graphing inequalities

1. Graph the region defined by:

$$\left\{\begin{array}{rcrcr} x & + & y & \leq & 6 \\ x & & & \leq & 3 \\ & & x,\ y & \geq & 0 \end{array}\right\}$$

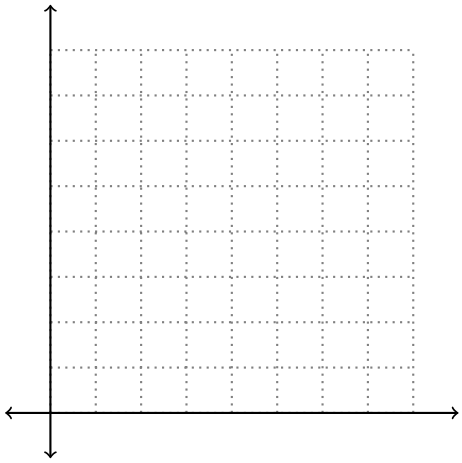


Is the region bounded or unbounded?

What are the corners?

2. Graph the region defined by:

$$\left\{\begin{array}{rcrcr} 3x & - & 6y & \leq & 12 \\ -x & + & 2y & \leq & 4 \\ & & x,\ y & \geq & 0 \end{array}\right\}$$



Is the region bounded or unbounded?

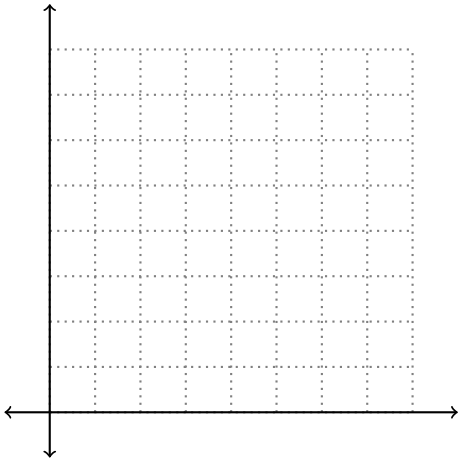
What are the corners?

3. Graph the region defined by:

$$\left\{\begin{array}{rcrcr} 6x & + & 5y & \leq & 30 \\ 3x & + & y & \geq & 6 \\ x & + & y & \geq & 4 \\ & & x,\ y & \geq & 0 \end{array}\right\}$$

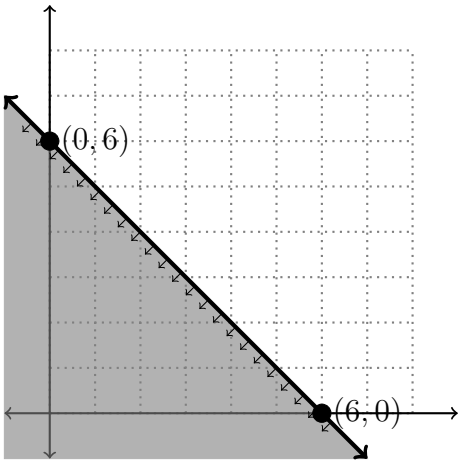
Is the region bounded or unbounded?

What are the corners?

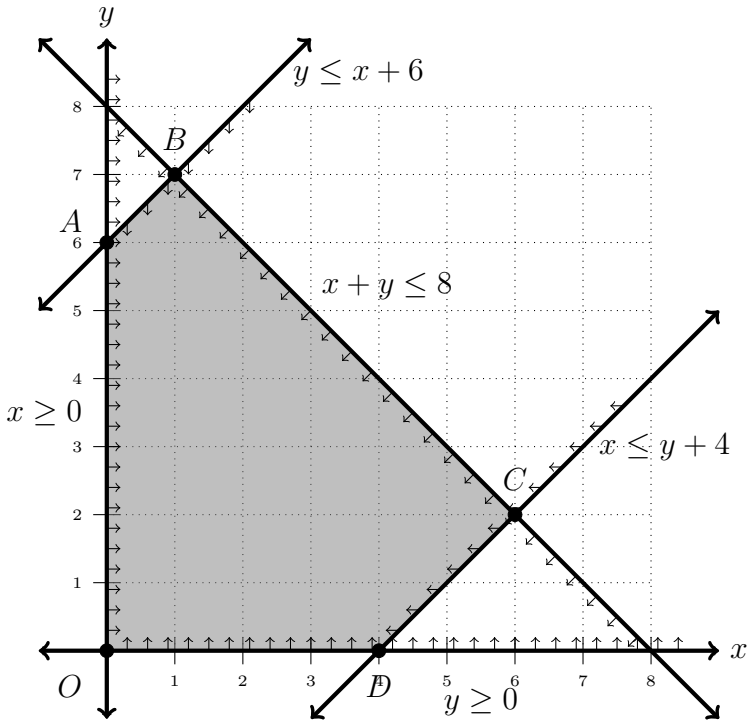


Examples 3.1: Graphing inequalities

You'll need to be able to convert between inequalities like $x + y \leq 6$ and their graphs. The graph consists of the **edges** and the **shaded region**. The edges are defined by the equation ($x + y = 6$), and the shaded region by the inequality. In chapter 1 we covered how to draw the edges, and so in this chapter the new thing is the shaded region. There are many ways to tell **which side of the edge** is the correct side for the inequality. The book describes a good method, the **test point** where you test an easy point in the inequality. For instance ($x = 0, y = 0$) is reasonably easy to check: $0 + 0 \leq 6$ is true, so $(0, 0)$ is on the correct side. At the other extreme ($x = 8, y = 8$) gives $8 + 8 \not\leq 6$, so $(8, 8)$ is on the wrong side.



In bigger examples we want to satisfy several inequalities **simultaneously**.



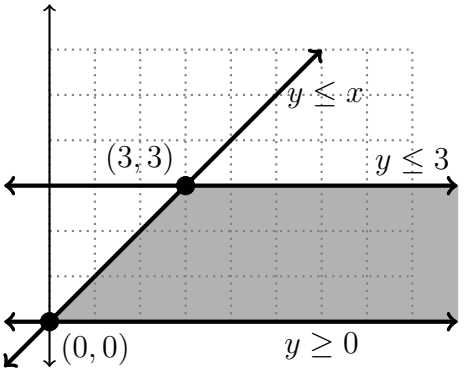
If you were given the **corners** $O = (0, 0)$, $A = (0, 6)$, $B = (1, 7)$, $C = (6, 2)$, $D = (0, 4)$, then you would be expected to give the equations of the lines **and** the inequality describing which side of the line the shape is on:

- OA is $x \geq 0$
- AB is $y \leq x + 6$
- BC is $x + y \leq 8$
- CD is $x \leq y + 4$
- DO is $y \geq 0$

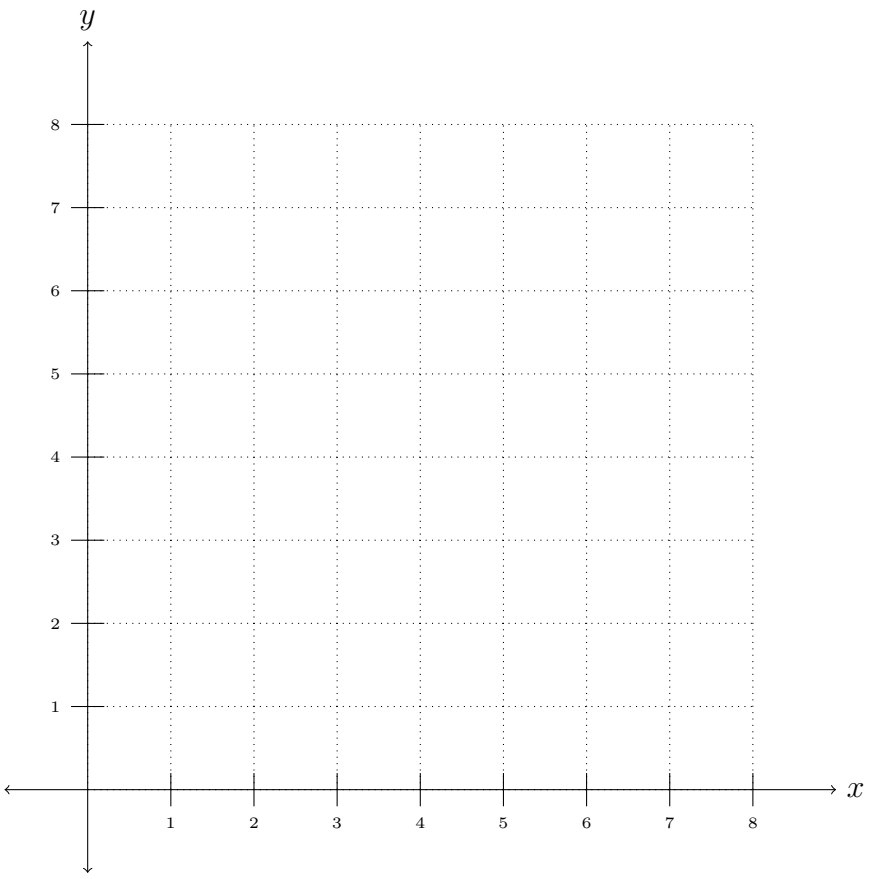
Similarly given those inequalities, you would be expected to graph the lines, determine which side of the line the shape is on, and determines the corners of the shape, by finding the intersections of the lines.

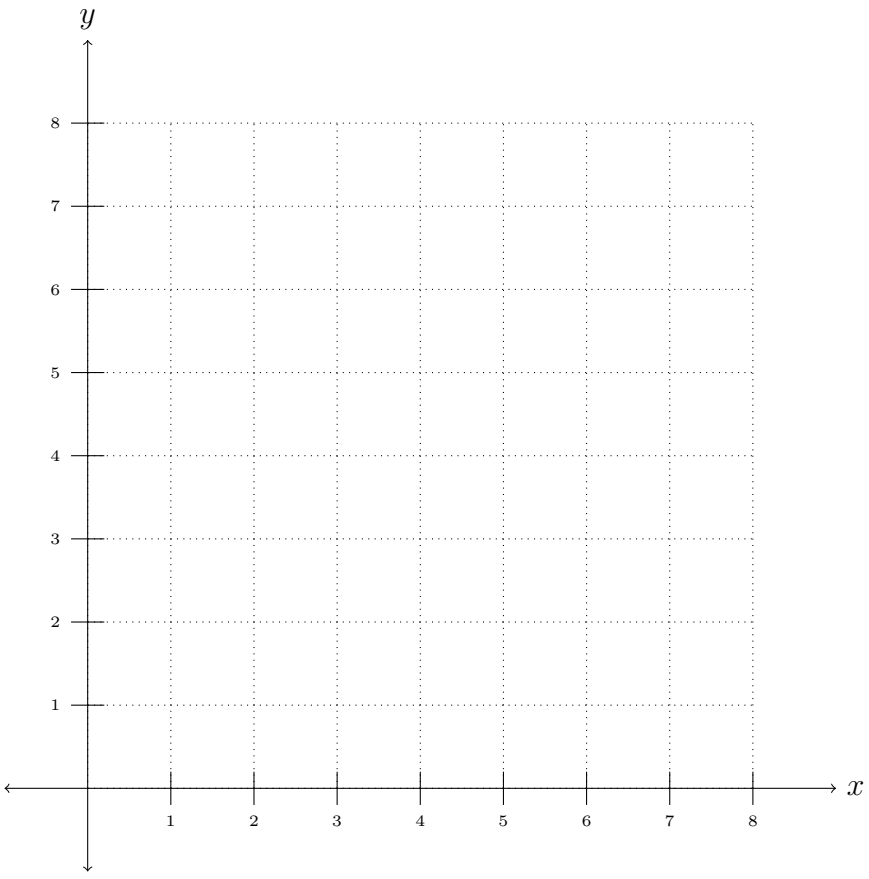
Note how the shaded region can fit inside a (big) circle. A region like that is called **bounded** and notices it has the same number of corners as edges. A triangle has three edges and three corners. A rectangle has four edges and four corners. However, not all shapes are like this. A region that cannot fit inside any circle, no matter how large, is called **unbounded** and it is typically **missing a corner**.

For example: $\{y \leq x, y \leq 3, y \geq 0\}$ has corners $(0, 0)$, and $(3, 3)$, but it has three edges. It is **unbounded**.



Graph paper





Graph paper