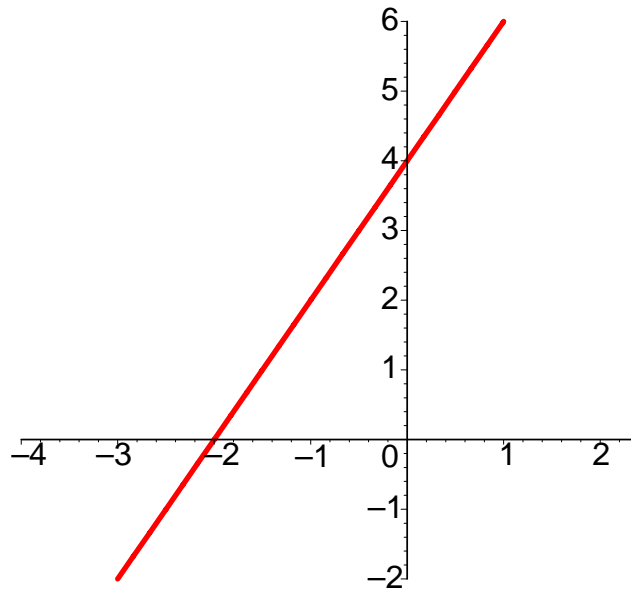


**Homework: Set builder notation and graphing inequalities**

II. Section 2.4 Lines. C. For problem #12, neatly copy the graph into your homework. What is the equation for the line? Answer in a sentence, "The equation for the line is...." Referring to the line in #12, express each of the following sets in set builder notation:

- i.  $S_1$  is the set of all points that lie above the line.
- ii.  $S_2$  is the set of all points that lie on the line.
- iii.  $S_3$  is the set of all points that lie above or on the line.



The  $y$  intercept is  $b = 4$ .

I will use the line using the points  $(x_1, y_1) = (-2, 0)$  and  $(x_2, y_2) = (0, 4)$ .

The slope is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 0}{0 - (-2)} = 2.$$

The formula for a line using slope-intercept form is  $y = mx + b$ , so in this case, we get

$$y = 2x + 4.$$

Now we want to write the set builder notation representing the set of all points above the line. Set builder notation for a set in the plane looks like this:

$$\{(x, y) | \text{inequality goes here}\}$$

So we need to figure out what the inequality should be.

We know the edge of the region is the line  $y = 2x + 4$ . And we want the points above, but not on, the line. So the inequality will either be

$$y < 2x + 4 \quad \text{or} \quad y > 2x + 4.$$

We will use reverse engineering to figure this out. Supposed we were asked to graph the inequality  $y < 2x + 4$ . We would graph the line  $y = 2x + 4$  and then check a point to see which side of the line to shade. Let us check the point  $(x, y) = (0, 0)$ . We have  $0 < 2(0) + 4$ , which is true. So the point  $(0, 0)$  is in the region corresponding to the inequality  $y < 2x + 4$ . We would shade the area containing the point  $(0, 0)$ , which lies below the line.

So the inequality  $y < 2x + 4$  represents the area below the line. This means the inequality  $y > 2x + 4$  represents the area above the line. We find

$$S_1 = \{(x, y) | y > 2x + 4\}.$$

The points on the line are given by

$$S_2 = \{(x, y) | y = 2x + 4\},$$

and the points above or on the line are given by

$$S_3 = \{(x, y) | y \geq 2x + 4\}.$$

**By the way,** the set builder notation for a set in the number line looks like this

$$\{x | \text{inequality goes here}\}.$$

For example, the set shown here



Can be written as

$$S\{x | -2 \leq x\}.$$