

### Definition and most awesome fact

The equation  $y = mx + b$  is called the **slope-intercept form** of a linear equation.

The equation of any non-vertical line can be written in this form. When the equation is written in this form, the number  **$m$  is the slope of the line** and the point  **$(0, b)$  is the y-intercept of the line.**

#### Example 1

State the slope and y-intercept of the line with equation

$y = -\frac{2}{5}x + 3$ . Graph the line onto Figure 1.

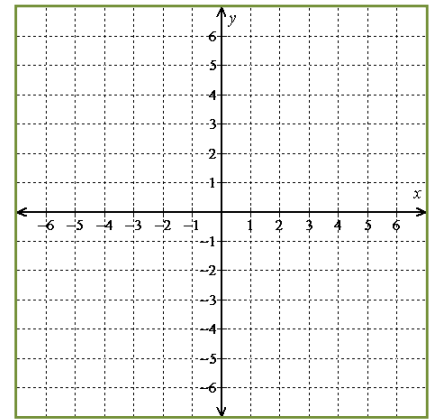


Figure 1:  $y = -\frac{2}{5}x + 3$

#### Example 2

State the slope and y-intercept of the line with equation  $y + 2x = -1$ . Graph the line onto Figure 2.

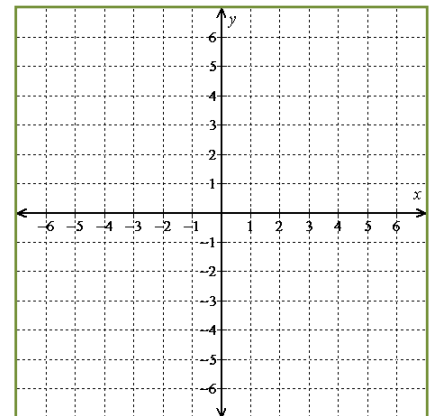


Figure 2:  $y + 2x = -1$

### Example 3

State the slope and y-intercept of the line with equation  $y = -3$ . Graph the line onto Figure 3.

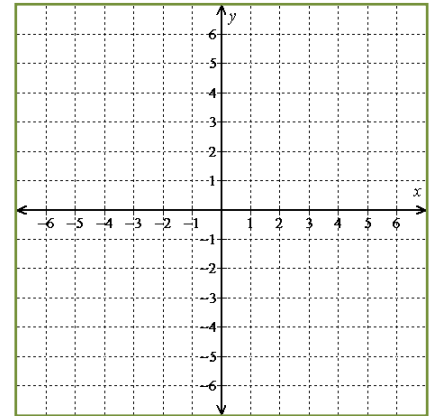


Figure 3:  $y = -3$

### Example 4

Find equations for the lines in figures 4 and 5.

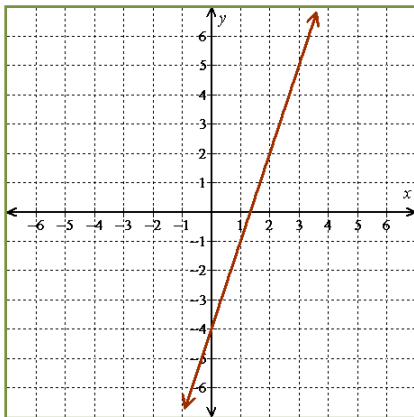


Figure 4

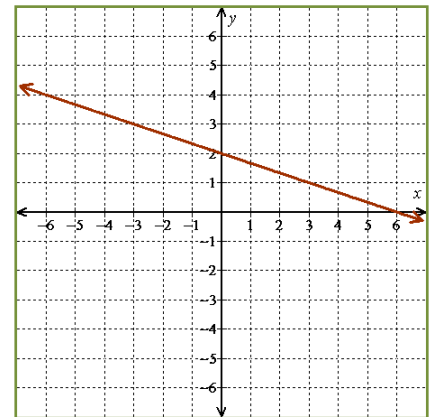


Figure 5

### Point-slope

The equation of the line with slope  $m$  that passes through the point  $(x_1, y_1)$  can be found using the template  $y - y_1 = m(x - x_1)$ .

#### Example 1

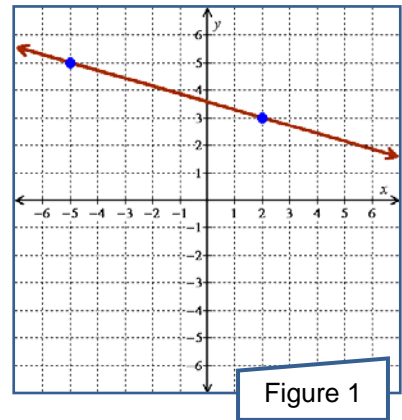
Use point-slope to find the equation of the line which passes through the point  $(2, 7)$  with a slope of  $-6$ . Write the equation in slope-intercept form.

#### Example 2

Use point-slope to find the equation of the line which passes through the points  $(-1, 0)$  and  $(9, -20)$ . Write the equation in slope-intercept form.

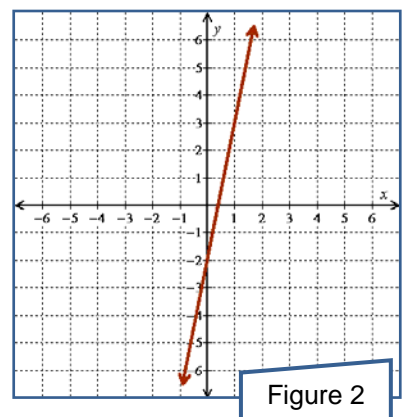
### Example 3

Use point-slope to find the equation of the line in Figure 1. Write the equation in slope-intercept form.



### Example 4

Why would it be kind of silly to use point-slope to find the equation of the line in Figure 2. What is the equation of the line?



**Example 5**

Find the equation of the line that passes through the point  $(2,4)$  with a slope of 3 two different ways; once using point-slope and once using slope-intercept.

**Example 6**

Use slope-intercept to find the equation of the line that passes through the point  $(1,7)$  that is perpendicular to the line with equation  $-3x - 4y = 6$ .

**Example 8**

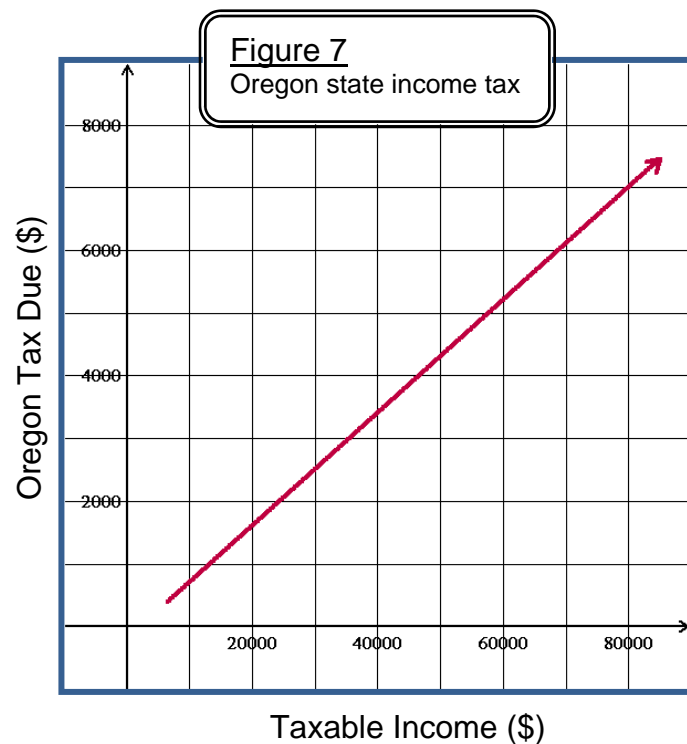
The purchase of real-estate in Detroit was not a good investment anytime between 1968 and 2000. On January 1, 1970, the house at the corner of Livernois Ave and Tireman Street had a value of \$143,000. Five years later, the value had fallen to \$86,000! Let's define  $t$  to be the number of years that had passed since January 1, 1970. Let's also assume that the decline in the value of the house was linear.

Use point-slope to find the equation of the line and then use the equation to predict when the house's value had fallen to \$50,000.

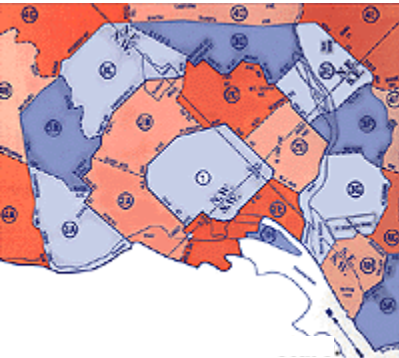
**Example 9**

If your taxable income in Oregon is greater than \$6,500, then the amount of income tax you have to pay for a given year is \$403 plus 9% of the amount of taxable income you have over \$6,500. The formula for this tax is  $T = 403 + .09(I - 6500)$  where  $T$  is the tax owed (\$) by a person whose taxable income is  $I$  dollars. A graph of the equation is shown in Figure 7.

Use the graph to estimate the taxable income of a person who had to pay \$5,500 in Oregon state income tax for 2005. Then use the formula to find the exact taxable income of a person who paid \$5,500 in Oregon state income tax for 2006.



Group work problems

1. Use point-slope to find the equation of the line which passes through the points  $(5,3)$  and  $(-6,14)$ . Write the equation in slope-intercept form.
2. Use point-slope to find the equation of the line which passes through the point  $(-3,5)$  that is also perpendicular to the line with equation  $6x + 2y = 11$ . Write the equation in slope-intercept form.
3. The cost of a taxi cab rides in Washington, D.C. is dependent upon the number of zones you pass through. If  $x$  is the number of zones past your original zone you enter and  $y$  is the cost of the cab ride in \$, then the equation for the cab ride is  $y = 2.3x + 6.5$ .
  - a. What is the slope of this line (including unit). Interpret the slope as a rate of change.
  - b. What is the  $y$ -intercept of this line (including unit). Interpret the  $y$ -intercept in the context of this question; i.e., what does it tell you about the cost of cab rides in Washington, D.C.

FYI ... This problem is mostly factual - i.e., this really is for the most part how cab fares are determined in D.C.
4. Use point-slope to find the equation of the line that passes through the point  $(8.72, -2.84)$  that is parallel to the line that passes through the points  $(-14.86, 7.06)$  and  $(78.10, 7.06)$ .
5. Use slope-intercept to find the equation of the line that passes through the points  $(9,2)$  and  $(-5,30)$ .
6. A certain line passes through the point  $(9,10)$ . This line also happens to be parallel to the line that passes through the points  $(-2,7)$  and  $(1,-8)$ . Use slope-intercept to find the equation of this line.