

Section 3.5

The Point-Slope Form of the Equation of a Line

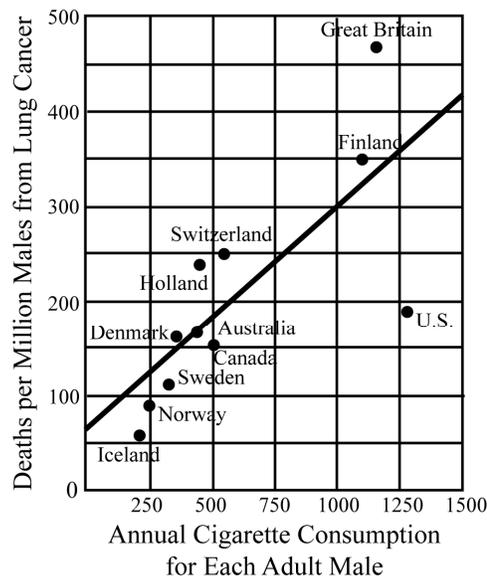
Cigarettes and Lung Cancer

Most people are surprised by the number of people that they see smoking cigarettes in movies and television shows made in the 1940s and 1950s. At that time, there was little awareness of the relationship between tobacco use and numerous diseases. Cigarette smoking was seen as a healthy way to relax and help digest a hearty meal.

Then, in 1964, a linear equation changed everything.

This scatter plot shows a relationship between cigarette consumption among males and deaths due to lung cancer per million males. The data are from 11 countries and date back to a 1964 report by the U.S. Surgeon General.

The scatter plot can be modeled by a line whose slope indicates an increasing death rate from lung cancer with increased cigarette consumption. At that time, the tobacco industry argued that in spite of this regression line, tobacco use is not the cause of cancer. Recent data do, indeed, show a causal effect between tobacco use and numerous diseases.



Source: *Smoking and Health*, Washington, D.C., 1964

The concepts that you learn in this section of your textbook will help you understand the mathematics behind this turning point in public health.

First Steps:

- Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 3.5 of your textbook which begins on page 254.
- Complete the ***Concept and Vocabulary Check*** on page 259 of the textbook.

Guided Practice:

- Review each of the following *Solved Problems* and complete each *Pencil Problem*.

Objective #1: Use the point-slope form to write equations of a line.

 **Solved Problem #1**

- 1a.** Write the point-slope form and the slope-intercept form of the equation of the line with slope 6 that passes through the point $(2, -5)$.

Begin by finding the point-slope equation of a line.

$$y - y_1 = m(x - x_1)$$

$$y - (-5) = 6(x - 2)$$

$$y + 5 = 6(x - 2)$$

Now solve this equation for y to write the equation in slope-intercept form.

$$y + 5 = 6(x - 2)$$

$$y + 5 = 6x - 12$$

$$y = 6x - 17$$

 **Pencil Problem #1** 

- 1a.** Write the point-slope form and the slope-intercept form of the equation of the line with slope -8 that passes through the point $(-3, -2)$.

- 1b.** A line passes through the points $(-2, -1)$ and $(-1, -6)$.
Find the equation of the line in point-slope form and in slope-intercept form.

Begin by finding the slope: $m = \frac{-6 - (-1)}{-1 - (-2)} = \frac{-5}{1} = -5$

Using the slope and either point, find the point-slope equation of a line.

$$y - y_1 = m(x - x_1) \quad \text{or} \quad y - y_1 = m(x - x_1)$$

$$y - (-1) = -5(x - (-2)) \quad y - (-6) = -5(x - (-1))$$

$$y + 1 = -5(x + 2) \quad y + 6 = -5(x + 1)$$

To obtain slope-intercept form, solve the above equation for y :

$$y + 1 = -5(x + 2) \quad \text{or} \quad y + 6 = -5(x + 1)$$

$$y + 1 = -5x - 10 \quad y + 6 = -5x - 5$$

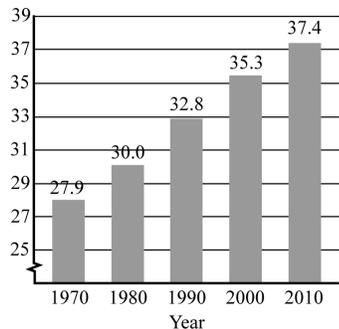
$$y = -5x - 11 \quad y = -5x - 11$$

- 1b.** A line passes through the points $(-3, -1)$ and $(2, 4)$.
Find the equation of the line in point-slope form and in slope-intercept form.

Objective #2: Write linear equations that model data and make predictions.

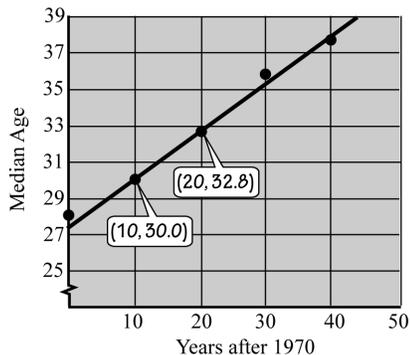
 **Solved Problem #2**

2. The bar graph below gives the median age of the U.S. population in the indicated year.



Source: U.S. Census Bureau

Here, the data are displayed as a set of five points in a rectangular coordinate system.



Source: U.S. Census Bureau

- 2a. Use the data points (10, 30.0) and (20, 32.8) from the figure to write the slope-intercept form of an equation that models the median age of the U.S. population x years after 1970.

First, find the slope: $m = \frac{32.8 - 30.0}{20 - 10} = \frac{2.8}{10} = 0.28$

Next, use the point-slope form to write the equation.

$$y - y_1 = m(x - x_1)$$

$$y - 30.0 = 0.28(x - 10)$$

Then solve for y to obtain slope-intercept form.

$$y - 30.0 = 0.28(x - 10)$$

$$y - 30.0 = 0.28x - 2.8$$

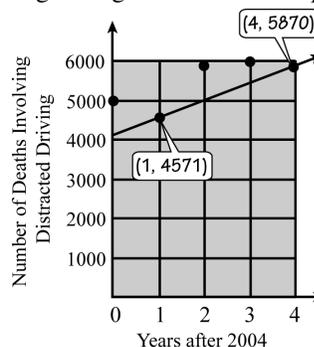
$$y = 0.28x + 27.2$$

 **Pencil Problem #2**

2. The chart shows the number of fatalities in the United States involving distracted driving from 2004 through 2008.

Year	2004	2005	2006	2007	2008
Fatalities	4978	4571	5917	5988	5870

Here, the data are displayed as a scatter plot with a line passing through two of the data points.



Source: National Highway Traffic Safety Administration

- 2a. Use the two points whose coordinates are shown by the voice balloons to write the slope-intercept form of an equation that models the number of highway fatalities involving distracted driving, y , in the United States x years after 2004.

2b. Use this model from part (a) to predict the median age in 2020.

Because 2020 is 50 years after 1970, substitute 50 for x and compute y .

$$\begin{aligned}y &= 0.28x + 27.2 \\ &= 0.28(50) + 27.2 \\ &= 14 + 27.2 \\ &= 41.2\end{aligned}$$

The model predicts that 41.2 will be the median age in 2020.

2b. Use this model from part (a) to project the number of fatalities in the United States in 2014 involving distracted driving.

Answers for Pencil Problems (Textbook Exercise references in parentheses):

1a. point-slope form: $y + 2 = -8(x + 3)$; slope-intercept form: $y = -8x - 26$ (3.5 #5)

1b. point-slope form: $y + 1 = 1(x + 3)$ or $y - 4 = 1(x - 2)$; slope-intercept form: $y = x + 2$ (3.5 #19)

2a. $y = 433x + 4138$ (3.5 #39a)

2b. 8468 fatalities (3.5 #39b)

Homework:

- Review the Section 3.5 summary** on page 274 of the textbook.
- Insert your homework** into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.