

Section 2.5

The Point-Slope Form of the Equation of a Line

Where Goes the Bride????



Americans' attitudes about marriage are changing.
More and more people are getting married later in life,
or not getting married at all.



In this section of your textbook, we will use the concepts we study to write an equation of a line that models this trend.

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 2.5 of your textbook which begins on page 154.
- Complete the *Concept and Vocabulary Check* on page 161 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**

1. Write the point-slope form and the slope-intercept form of the equation of the line with slope -2 that passes through the point $(4, -3)$.

Point-Slope Form:

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

$$y - (-3) = -2(x - 4)$$

$$y + 3 = -2(x - 4)$$

Now we solve $y + 3 = -2(x - 4)$, the point-slope form, for y and write an equivalent equation in slope-intercept form ($y = mx + b$).

Slope-Intercept Form

$$y + 3 = -2(x - 4)$$

$$y + 3 = -2x + 8$$

$$y = -2x + 5$$

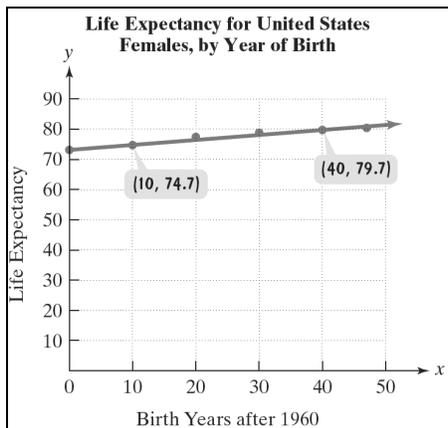
$$f(x) = -2x + 5$$

Pencil Problem #1

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

Objective #2: Model data with linear functions and make predictions.**✓ Solved Problem #2**

2. The data for the life expectancy for American women are displayed as a set of six points in the scatter plot. Also shown is a line that passes through or near the six points.



Use the data points labeled by the voice balloons to write the slope-intercept form of the equation of this line. Round the slope to two decimal places. Then use the linear function to predict the life expectancy of an American woman born in 2020.

First, find the slope.

$$m = \frac{79.7 - 74.7}{40 - 10} = \frac{5}{30} \approx 0.17$$

Then use the slope and one of the points to write the equation in point-slope form.

Using the point (10, 74.7):

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

$$y - 74.7 = 0.17(x - 10)$$

$$y = 0.17x + 73$$

$$f(x) = 0.17x + 73$$

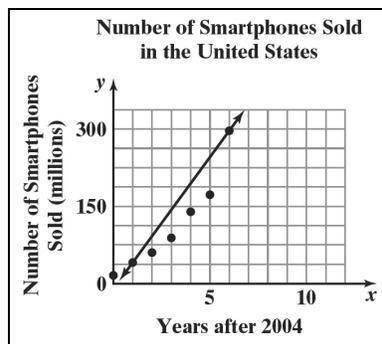
Next, since 2020 is 60 years after 1960, substitute 60 into the function: $f(60) = 0.17(60) + 73 = 83.2$.

This means that the life expectancy of American women in 2020 is predicted to be 83.2 years.

Answers vary due to rounding and choice of point. If point (40, 79.7) is chosen, $f(x) = 0.17x + 72.9$ and the life expectancy of American women in 2020 is predicted to be 83.1 years.

✎ Pencil Problem #2 ✎

2. In 2005 there were 40.8 million smartphones sold in the United States. In 2010 there were 296.6 million smartphones sold. A scatterplot of smartphone sales from 2004 to 2010 is shown, where x represents the number of years after 2004 and y represents the number of smartphones sold, in millions.



A line is drawn through the two points that show the number of smartphones sold in 2005 and 2010. Use the coordinates of these points to write the line's equation in point-slope form and slope-intercept form.

Objective #3: Find slopes and equations of parallel and perpendicular lines.

 **Solved Problem #3**

- 3a.** Write an equation of the line passing through $(-2, 5)$ and parallel to the line whose equation is $y = 3x + 1$. Express the equation in point-slope form and slope-intercept form.

Since the line is parallel to $y = 3x + 1$, we know it will have slope $m = 3$.

We are given that it passes through $(-2, 5)$. We use the slope and point to write the equation in point-slope form.

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

$$y - 5 = 3(x - (-2))$$

$$y - 5 = 3(x + 2)$$

Point-Slope form: $y - 5 = 3(x + 2)$

Solve for y to obtain slope-intercept form.

$$y - 5 = 3(x + 2)$$

$$y - 5 = 3x + 6$$

$$y = 3x + 11$$

$$f(x) = 3x + 11$$

Slope-Intercept form: $y = 3x + 11$

 **Pencil Problem #3** 

- 3a.** Write an equation of the line passing through $(-8, -10)$ and parallel to the line whose equation is $y = -4x + 3$. Express the equation in point-slope form and slope-intercept form.

3b. Write an equation of the line passing through $(-2, -6)$ and perpendicular to the line whose equation is $x + 3y = 12$. Express the equation in point-slope form and slope-intercept form.

First, find the slope of the line $x + 3y = 12$.

Solve the given equation for y to obtain slope-intercept form.

$$x + 3y = 12$$

$$3y = -x + 12$$

$$y = -\frac{1}{3}x + 4$$

Since the slope of the given line is $-\frac{1}{3}$, the slope of any line perpendicular to the given line is 3.

We use the slope of 3 and the point $(-2, -6)$ to write the equation in point-slope form.

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

$$y - (-6) = 3(x - (-2))$$

$$y + 6 = 3(x + 2)$$

Solve for y to obtain slope-intercept form.

$$y + 6 = 3(x + 2)$$

$$y + 6 = 3x + 6$$

$$y = 3x$$

$$f(x) = 3x$$

3b. Write an equation of the line passing through $(2, -3)$ and perpendicular to the line whose equation is $y = \frac{1}{5}x + 6$.

Express the equation in point-slope form and slope-intercept form.

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

1. Point-Slope form: $y - 6 = 5(x + 2)$, Slope-Intercept form: $y = 5x + 16$ (2.5 #3)

2. Point-Slope form: $y - 40.8 = 51.16(x - 1)$ or $y - 296.6 = 51.16(x - 6)$,
Slope-Intercept form: $y = 51.16x - 10.36$ (2.5 #69b)

3a. Point-Slope form: $y + 10 = -4(x + 8)$, Slope-Intercept form: $y = -4x - 42$ (2.5 #49)

3b. Point-Slope form: $y + 3 = -5(x - 2)$, Slope-Intercept form: $y = -5x + 7$ (2.5 #51)

Homework:

Review the Section 2.5 summary on page 170 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.