**Chapter 7: Linear Equations and Graphs**

**Review (6.5 Slope)**

1. How can you find the slope?
2. What is the slope of the following graph?



1. Determine the slope of the following:
	1. $y = 5x - 3$

Slope = \_\_\_\_\_\_\_\_\_\_\_

* 1. $2y = -6x + 3$

Slope = \_\_\_\_\_\_\_\_\_\_\_

* 1. $y = 0.5x - 2.5$

Slope = \_\_\_\_\_\_\_\_\_\_\_

**7.1 Slope-Intercept Form**

**Outcome:** 3. Demonstrate an understanding of slope with relations to rise and run, and line segments and lines

6. Relate linear relations expressed in **slope-intercept form** to their graphs.

7. Determine the equation of a linear relation using a graph and a point and the slope to solve problems.

**Definitions:**

Y-Intercept: the y-coordinate of the point where a line or curve crosses the y-axis

 You can find the value of y when x=0

 Example: y = 2x - 12 when x = 0, y = -12 ; (0, -12)

Slope-Intercept Form: the equation of a line in the form **y = mx + b**

* **m** = the slope
* **b** is the y-intercept

Parameter: a variable that has a constant value in a particular equation

 Example: y = 10m + 100. Determine the value of the parameter b.

Solution: “the parameter, b, represents the y-intercept, which is equal to 100”

**Example 1:**

What are the slope and y-intercepts of each equation?

1. y = 25x + 3
2. y = 5x
3. y = 7
4. y = ½ x - 4 ½
5. y = ⅗ x + 2
6. y = 2x - 1

**Example 2:**

1. What are the slope and y-intercept of the line shown in the graph?



1. What is the equation of the line in slope-intercept form, y = mx + b?
2. Use graph technology to check your equation.

**Example 3:**

Parents of members of the cheerleading squad rent a hall. They arrange a talent show as a fundraiser. The relationship between the number of tickets sold, x, and the profit, y, in dollars, may be represented by the equation 12x - y - 840 = 0.

1. What is the slope of the line? What does the slope represent?

1. Identify the y-intercept. What does it represent?
2. How many tickets must the parents sell to reach the break-even point?

**Example 4:**

Asha has selected a hotel for her wedding reception. The cost involves a fee for the deluxe ballroom and a buffet charge that depends on the number of guests. This is shown in the table. 

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| **Number of Guests** | **Cost ($)** |
| 0 | 425 |
| 25 | 1800 |
| 50 | 3175 |
| 75 | 4550 |

1. Sketch a graph of the data in the table.
2. What are the slope and y-intercept of the line? What does each parameter represent?
3. Write an equation that describes the relationship between the cost and the number of guests. Express the equation in slope-intercept form.
4. What is the cost for 140 guests?
5. Asha would like the total cost to be no more than $15,000. What is the maximum number of guests that can attend?

**Example 5:**

A decorator’s fee can be modelled by the equation F = 75t + b. In the equation, F represents the fee, in dollars, t represents time, in hours, and b represents the cost of the initial consultation, in dollars.

1. Suppose the decorator spends 4 hours working for a client and charges the client $450. Determine the value of the parameter b.
2. How many hours does the decorator work if a client is charged $975?

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| **Key Ideas**  |
| * The slope-intercept form of a linear equation is y = mx + b, where m is the slope of the line and b represents the y-intercept

Example: y = 2x + 1 The slope = 2 y-intercept = 1  $\frac{rise}{run} = \frac{2}{1}$ the graph passes through (0, 1)  |

**Textbook Questions:** pg. 349 # 1 - 13, 15, 17

**7.2 General Form**

**Outcome:** 6. Relate linear relations expressed in **general form** to their graphs.

**Definitions:**

General Form: the equation of a line in the form Ax + By + C = 0

* Where A, B, and C are real numbers
* A and B are **not both** zero.
* By convention, A is a whole number. This means that A will **always** be positive

Example: 3x + 5y - 11 = 0

X-intercept: the x-coordinate of the point where a line or curve crosses the x-axis.

* The value of x when y = 0

 Example: y = 2x - 12, when y = 0, x = 6 ; (6, 0)

**Example 1:**

Rewrite the equation in general form, Ax + By + C = 0

1. y = $\frac{3}{4}x-2$
2. y = $-x-5$
3. y =$\frac{2}{5}x +\frac{1}{8}$
4. y = $\frac{4}{3}x + 6$

**Example 2:**

Consider the linear equation 4x + 5y - 20 = 0

1. What is the x-intercept of a graph of the equation?
2. What is the y-intercept of the graph of the equation?
3. Use the intercepts to graph the line.

**Example 3:**

Sketch each linear relation and identify the intercepts. What are the domain and range for each relation?

1. x - 3 = 0



1. x = 0



c) y + 2 = 0



**Example 4:**

Brooke wants to save $336 to decorate her bedroom. She has two part-time jobs. On weekends, she works as a snowboard instructor and earns $12 per hour. On weeknights, she earns $16 per hour working as a high school tutor.

1. Write an equation to represent the number of hours Brooke needs to work as a snowboard instructor, S, and as a tutor, T.
2. What is the S-intercept of a graph of the equation? What does the S-intercept represent?
3. What would the T-intercept be? What does it represent?
4. Suppose Brooke works 8 hrs as a snowboard instructor. How many hours will she need to work as a tutor?

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| **Key Ideas** |
| * The general form of a linear equation is Ax + By + C = 0, where A, B, and C are real numbers, and A and B are not both zero. By convention, A is a whole number.
* To graph an equation in general form, determine the intercepts, the draw a line joining the intercepts; or convert to slope-intercept form.
* To determine the x-intercepts, substitute y = 0 and solve.

To determine the y-intercepts, substitute x = 0 and solve. * A sketch of a linear relation may have one, two or an infinite number of intercepts. A line that represents an axis has an infinite number of intercepts with that axis. A horizontal or vertical line that does not represent an axis has only one intercept.

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**Textbook Questions:** Pg. 365 # 1 - 8, 10, 13 -15

**7.3 Slope-Point Form**

**Outcome:** 6. Relate linear relations expressed in **slope-point form** to their graphs.

7. Determine the equation of a linear relation using a graph, a point and the slope, and two points to solve problems

**Definitions:**

Slope-Point Form: the equation of a non-vertical line in the form $y-y\_{1}=m(x-x\_{1})$

* Where *m* is the slope, and $(x\_{1},y\_{1})$ are the coordinates of a point on the line

**Example 1:**

Write an equation in slope-point form, $y-y\_{1}=m(x-x\_{1})$ , of the line passing through the given points.



b) convert the equation to general form Ax + By + C = 0, and slope-intercept form y = mx+b

**Example 2:** **Writing an Equation of a Line Using Two Points**

Use slope-point form to write an equation of the line through (-5, 2) and (-2, 1). Then, write the equation in general form, Ax + By + C = 0

**Example 3:** **Writing an Equation of a Line Using a Point and Slope**

1. Use slope-point form to write an equation of the line through (3, -4) with slope 2. Sketch a graph of the line.
2. Express the equation in slope-intercept form, y = mx + b. Sketch a graph of this line.



1. Compare your graphs.

**Example 4:**

A family drives at a constant speed from Calgary, AB, to visit relatives in Edmonton, AB. When they start driving at 9:00 am, they are 300km away from Edmonton. At 10:30am they reach Red Deer located 154 km from Edmonton.

1. Write an equation that describes the distance, *d*, in kilometers, from Edmonton in terms of *t* hours past 9:00 am.
2. What time will the family reach Edmonton?

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| **Key Ideas** |
| * The slope-point form of a non-vertical line in the form $y-y\_{1}=m(x-x\_{1})$, where *m* is the slope, and $(x\_{1},y\_{1})$ are the coordinates of a point on the line.
* An equation written in slope-point form can be converted to either slope-intercept form or general form
* Any point on a line can be used when determining the equation of a line in slope-point form.
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**Textbook Questions:** Pg. 377 #1 - 3, 5 - 8, 10 - 14

**7.4 Parallel and Perpendicular Lines**

**Outcome:** 3. Demonstrate an understanding of slope with relations to parallel lines and perpendicular lines.

7. Determine the equation of a linear relation using a point and the equation of a parallel or perpendicular line to solve problems.

**Definitions:**

Parallel Lines: lines in the same plane that do not intersect

* Lines that have the same slope, but different intercepts



Perpendicular Lines: two lines that intersect each other at right angles (90 degrees)

* Lines that have slopes that are negative reciprocals of each other.



**Example 1:**

State the slopes of lines that are parallel and lines that are perpendicular to each linear equation.

1. $y =3x+5$
2. $2x-5y -10 = 0$

**Example 2:**

Determine whether the lines in each pair are parallel, or perpendicular, or neither.

1. $y =\frac{1}{2}x-7$

$y = 2x-7$

1. $y = 3x-4$

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

1. $y = \frac{2}{5}x -6$

$5x+2y=8$

**Example 3:**

Write an equation in slope-intercept form of a line that is parallel to 3x + y + 3 = 0 and passes through (5, -6). Use technology to verify that the lines are parallel.

**Example 4:**

A line is perpendicular to 4x + y - 12 = 0 and passes through (8, -6). Write the equation of the line in both slope-intercept form and general form.

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| **Key Ideas** |
| * Parallel lines have the same slope and different intercepts. Vertical lines are parallel to each other, as are horizontal lines, if they have different intercepts.
* Perpendicular lines have slopes that are negative reciprocals of each other. A vertical line with an undefined slope and a horizontal line with a slope of zero are also perpendicular.
* The properties of parallel and perpendicular lines can give information about the slopes. Knowing the slopes can help you develop an equation.
	+ A line perpendicular to $y=5x+7$ has the same y-intercept. The line $y=5x+7$ has a slope of 5 and a y-intercept of 7. The perpendicular line has a slope of -⅕ and a y-intercept of 7. So, the equation of the perpendicular line is $y= -\frac{1}{5}x+7$
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**Textbook Questions:** Pg 390 # 1-8, 10-13, 15