Practical Situations Modeled by Linear Functions

STRAND: Patterns, Functions and Algebra

STRAND CONCEPT: Relations and Functions

SOL: 8.16 d, e

Remediation Plan Summary

This lesson focuses on graphing linear equations using the form y=mx + b.

Common Errors and Misconceptions

- When graphing functions students may confuse the input, independent variable or domain with the output, dependent variable or range.
- When graphing functions students may assume that points should be connected to form a line.
- Students have difficulty seeing the pattern of linear equations as y = mx + b, especially when the equations are written as mx + b = y.

Materials

- Displayable "Warm-up"
- "Using Linear Functions in the Real World" handout
- Calculators

Introductory Activity

Display the "Warm-up". Have students work with a partner to complete working, then engage students in a whole group discussion to review correct answers.

Warm-up

Match the verbal expression with its algebraic representation.

1.	$n + 3$	a.	one-third of a number
2.	$3n$	b.	3 added to a number
3.	$\frac{1}{3}n$	c.	a number multiplied by 3
4.	$3 - n$	d.	3 subtracted from a number
5.	$\frac{3}{n}$	e.	a number subtracted from 3
6.	$n - 3$	f.	3 divided by a number

Plan for Instruction

- Begin the lesson by presenting the following situation: Maria delivers newspapers. She is paid $15.00 a day plus $.50 for each newspaper she delivers. How much money will Maria make if she delivers only 1 newspaper? 2 newspapers? 5 newspapers? Have students explain in words how they arrived at their answers. What operations did they use? Which operation did they use first? Why?

- Ask for student volunteers to come to the board and translate their words into an equation. If necessary, prompt them by helping them decide what the variables will represent, i.e., *m* = money and *n* = newspapers. Lead students to derive the equation $.50*n* + $15.00 = *m*, or **0.5*n* + 15 = *m***. Lead them to see that m = 0.5n + 15 is an equivalent equation.

- Tell students that this equation is an example of a pattern but that the pattern is hard to recognize by looking at the equation. Distribute the "Using Linear Functions in the Real World" worksheets, and have students fill in the data table, which shows the pattern. Ask, "What is the pattern that the data in the table shows?" (A steady or even increase of $.50 per newspaper). Have students discuss the use of the pattern for finding any amount of money that Maria could make.

- Once students understand how to use the equation, point out that Maria's earnings *depend* on the number of papers she sells. Therefore, *m* is called the *dependent variable.* On the other hand, *n* does not depend on any other value—it is independent—so it is called the *independent variable.*

- Discuss how to graph the data in the table. Graph the first two points with the students, and allow them to complete the graph.

- When the students have completed the graph, conduct a discussion. Have students name the three representations of the function that they have used (equation, data table, graph) and describe the use of each. (Using an equation allows for a fast calculation of any given value of the independent variable. A data table displays all of the data points. Looking at a graph displays the trend occurring based on the values of the independent variable.) Have students point out the merits of all three representations of the function.

- It is important that you conduct a discussion of the graph. Students should *not* connect the points graphed. Ask them why. (Because the line between the whole number points would represent part of a newspaper, and Maria does not deliver parts of newspapers!) Have a discussion about why connecting the points would show all possible answers to the equation but would not fit the word problem.

- Discuss other word problems in which connecting the graphed points would or would not be appropriate, such as the following:
    - The amount of money made per hour worked
    - The amount of money charged for a speeding ticket based on the number of miles one is caught driving over the speed limit
    - The number of dolls sold and the amount of money made

- At this point, ask students for the *domain* values (the *x*-axis values) in Maria's story and the *range* values (the *y*-axis values). Discuss how these are related to dependent and

independent variables. (domain values = independent variable values; range values = dependent variable values)

Pulling It All Together (Reflection)

Have students work in groups of two or three to model the problems below with an equation, table, and graph. Have them include 5 data points for each story.

- Joe rents inline skates to customers on the Boardwalk in Virginia Beach. He charges a $5.00 basic rental fee and $1.50 per hour to use them.

- When a certain city gives out speeding tickets, it charges a basic fine of $75.00 plus $15.00 for every mile the offender was going over the speed limit.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Virginia Department of Education 2018

Name:

Using Linear Functions in the Real World

Using the equation **0.5n + 15 = m**, fill in the amount of money earned when delivering each number of newspapers.

Number of Newspapers Delivered (n)	1	2	3	4	5	6	7	8	9	10
Amount of Money Earned (m)										

Make a graph of the data you filled in above.