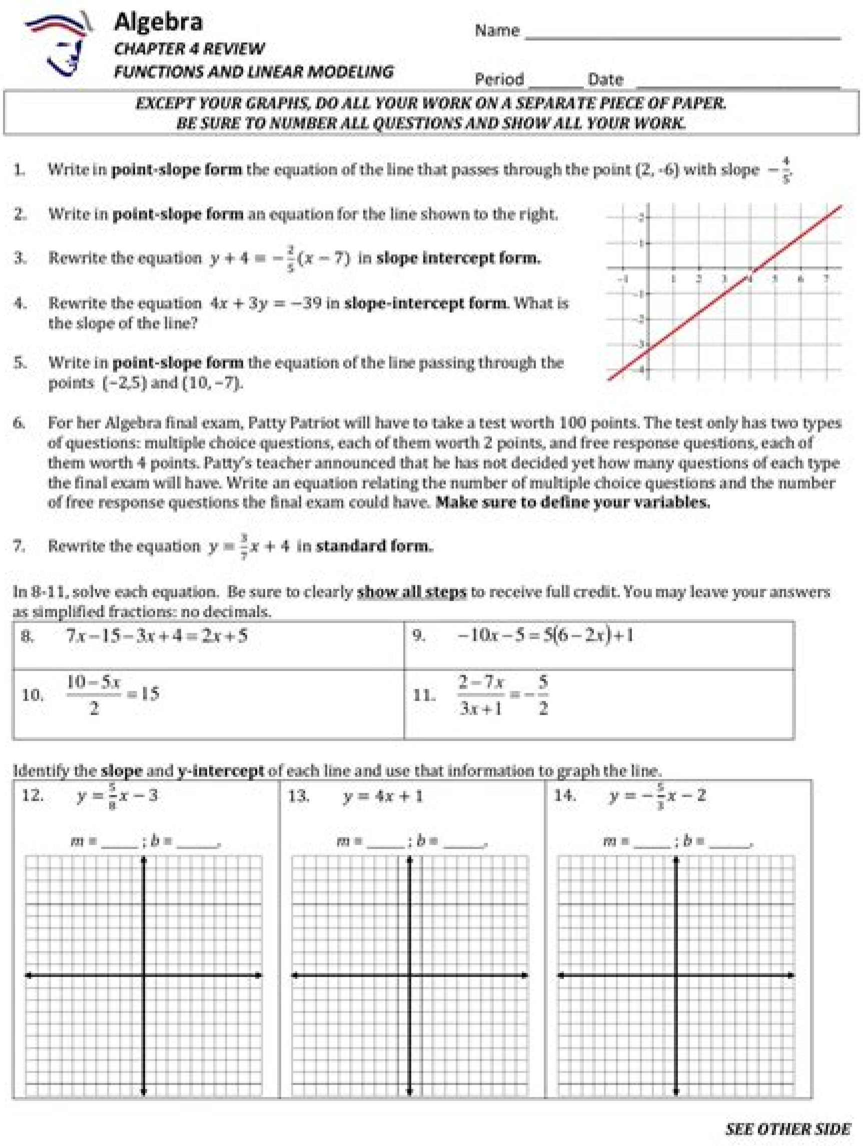
13 Modeling With Linear Functions Answer Key



Algebra

CHAPTER 4 REVIEW

FUNCTIONS AND LINEAR MODELING

Name ______________________

Period ______ Date ______________

EXCEPT YOUR GRAPHS, DO ALL YOUR WORK ON A SEPARATE PIECE OF PAPER.
BE SURE TO NUMBER ALL QUESTIONS AND SHOW ALL YOUR WORK.

1. Write in **point-slope form** the equation of the line that passes through the point (2, -6) with slope $-\frac{4}{5}$.
2. Write in **point-slope form** an equation for the line shown to the right.
3. Rewrite the equation $y + 4 = -\frac{2}{5}(x - 7)$ in **slope intercept form.**
4. Rewrite the equation $4x + 3y = -39$ in **slope-intercept form**. What is the slope of the line?
5. Write in **point-slope form** the equation of the line passing through the points $(-2,5)$ and $(10,-7)$.
6. For her Algebra final exam, Patty Patriot will have to take a test worth 100 points. The test only has two types of questions: multiple choice questions, each of them worth 2 points, and free response questions, each of them worth 4 points. Patty's teacher announced that he has not decided yet how many questions of each type the final exam will have. Write an equation relating the number of multiple choice questions and the number of free response questions the final exam could have. **Make sure to define your variables.**
7. Rewrite the equation $y = \frac{3}{7}x + 4$ in **standard form.**

In 8-11, solve each equation. Be sure to clearly **show all steps** to receive full credit. You may leave your answers as simplified fractions: no decimals.

8. $7x - 15 - 3x + 4 = 2x + 5$	9. $-10x - 5 = 5(6 - 2x) + 1$
10. $\frac{10 - 5x}{2} = 15$	11. $\frac{2 - 7x}{3x + 1} = -\frac{5}{2}$

Identify the **slope** and **y-intercept** of each line and use that information to graph the line.

12. $y = \frac{5}{8}x - 3$	13. $y = 4x + 1$	14. $y = -\frac{5}{3}x - 2$
$m =$ ____; $b =$ ____.	$m =$ ____; $b =$ ____.	$m =$ ____; $b =$ ____.

SEE OTHER SIDE

13 modeling with linear functions answer key is a crucial resource for students learning about the applications of linear equations in real-world scenarios. This article will delve into the concept of modeling with linear functions, outline the types of problems typically encountered, and provide a comprehensive answer key to assist learners in mastering this essential algebraic skill. By understanding how to model various situations using linear functions, students can better prepare themselves for more advanced mathematical concepts and their applications in fields such as economics, engineering, and the social sciences.

Understanding Linear Functions

Definition of Linear Functions

Linear functions are mathematical expressions that represent a straight line when graphed on a coordinate plane. The general form of a linear function is:

$$y = mx + b$$

where:
- m is the slope of the line,
- b is the y-intercept (the point where the line crosses the y-axis),
- x is the independent variable, and
- y is the dependent variable.

Characteristics of Linear Functions

When dealing with linear functions, it's essential to understand their characteristics:

1. Slope (m): Indicates the rate of change of y with respect to x. A positive slope means that as x increases, y also increases, while a negative slope indicates the opposite.

2. Y-intercept (b): This is the value of y when $x = 0$. It provides a starting point for the graph of the function.

3. Graphical Representation: The graph of a linear function is a straight line, which can be determined by plotting at least two points derived from the equation.

4. Domain and Range: For linear functions, both the domain (the set of all possible \(x \) values) and the range (the set of all possible \(y \) values) are typically all real numbers.

Modeling Real-World Situations with Linear Functions

Linear functions are often used to model real-world situations, allowing us to make predictions or understand relationships between variables. Here are some common applications:

Examples of Situations

1. Cost Analysis: A company might want to model the relationship between the number of products sold and total revenue.
2. Distance and Time: The relationship between distance traveled and time taken at a constant speed can be represented as a linear function.
3. Temperature Changes: The change in temperature over time can also be modeled linearly, particularly in controlled environments.
4. Population Growth: In some cases, populations may grow at a constant rate, which can be modeled using linear functions.

Common Problems in Modeling with Linear Functions

When learning to model with linear functions, students often encounter a variety of problem types. Here are some common examples:

Problem Types

1. Finding the Equation: Given two points, students may be asked to find the linear equation that passes through them.
2. Interpreting the Slope and Y-intercept: Students might need to explain what the slope and y-intercept represent in a given context.
3. Graphing Linear Functions: Students may be tasked with graphing a linear function based on its equation.
4. Solving Real-World Problems: This involves creating a linear model from a word problem and using it to calculate specific values.

13 Modeling with Linear Functions Answer Key

Below is the answer key for a set of 13 problems designed to help students practice modeling with linear functions. Each problem will be outlined, followed by a detailed solution.

Problem 1: Finding the Equation

Problem: Find the equation of the line that passes through the points (2, 3) and (4, 7).

Solution:

1. Calculate the slope m:

$$ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 3}{4 - 2} = \frac{4}{2} = 2 $$

2. Use point-slope form:

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

Using point (2, 3):

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

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

$$ y = 2x - 1 $$

Answer: $y = 2x - 1$

Problem 2: Interpreting Slope and Y-Intercept

Problem: Given the equation $y = 4x + 5$, identify the slope and the y-intercept.

Solution:

- Slope $m = 4$ (indicates the output increases by 4 for every 1 unit increase in x).
- Y-intercept $b = 5$ (the line crosses the y-axis at (0, 5)).

Answer: Slope = 4, Y-Intercept = 5

Problem 3: Graphing Linear Functions

Problem: Graph the function $y = -3x + 2$.

Solution:

1. Identify the y-intercept (2).
2. Use the slope (-3) to find another point. From (0, 2), move down 3 units and right 1 unit to (1, -1).
3. Plot points (0, 2) and (1, -1) and draw the line through these points.

Answer: The graph of $y = -3x + 2$ is a line with a y-intercept at (0, 2) and slope -3.

Problem 4: Solving Real-World Problems

Problem: A taxi charges a flat fee of $3 plus $2 for each mile driven. Write the linear function representing the total cost \(C \) in terms of miles \(m \).

Solution:
Using the equation \(C = 2m + 3 \):
- Slope = 2 (cost per mile),
- Y-intercept = 3 (base fare).

Answer: \(C = 2m + 3 \)

Problem 5: Finding the Y-Intercept

Problem: If the equation of a line is \(y = 6x - 12 \), what is the y-intercept?

Solution:
The y-intercept can be found by setting \(x = 0 \):
\[y = 6(0) - 12 = -12 \]

Answer: Y-intercept = -12

Problem 6: Parallel Lines

Problem: Write the equation of a line parallel to \(y = 2x + 1 \) and passing through the point (3, 4).

Solution:
1. The slope of the parallel line is also 2.

2. Using point-slope form:

\[y - 4 = 2(x - 3) \]

\[y = 2x - 6 + 4 \]

\[y = 2x - 2 \]

Answer: \(y = 2x - 2 \)

Problem 7: Perpendicular Lines

Problem: Find the equation of a line perpendicular to \(y = 1/2x - 3 \) that passes through the point (2, 1).

Solution:

1. The slope of the given line is \(\frac{1}{2} \), so the slope of the perpendicular line is \(-2 \).

2. Using point-slope form:

\[y - 1 = -2(x - 2) \]

\[y = -2x + 4 + 1 \]

\[y = -2x + 5 \]

Answer: \(y = -2x + 5 \)

Problem 8: Revenue Model

Problem: A company sells widgets for $20 each, with a fixed cost of $100. Write a linear function for the total revenue \(R \) based on the number of widgets \(n \).

Solution:

Using the equation:

\[R = 20n \] (ignoring fixed costs for revenue calculation).

Answer: $R = 20n$

Problem 9: Temperature Change

Problem: The temperature rises at a rate of 3 degrees per hour starting from 15 degrees. Write the linear function for temperature T in terms of hours h.

Solution:
The equation will be:
$$T = 3h + 15$$

Answer: $T = 3h + 15$

Problem 10: Distance and Time

Problem: A car travels at a constant speed of 60 miles per hour. Write the distance d in terms of time t.

Solution:
Using the formula:
$$d = 60t$$

Answer: $d = 60t$

Problem 11: Cost Function

Problem:

Frequently Asked Questions

What is the primary purpose of using linear functions in modeling?

The primary purpose of using linear functions in modeling is to represent relationships between variables in a way that allows for predictions and analysis of trends.

How can you determine if a set of data points can be modeled by a linear function?

You can determine if a set of data points can be modeled by a linear function by plotting the points on a graph and checking if they form a straight line or by calculating the correlation coefficient.

What is the standard form of a linear equation and what do the variables represent?

The standard form of a linear equation is $Ax + By = C$, where A, B, and C are constants, and x and y are the variables representing the coordinates of points on the line.

What is the significance of the slope in a linear function?

The slope of a linear function indicates the rate of change of the dependent variable with respect to the independent variable, representing how steep the line is.

How do you find the y-intercept of a linear function from its equation?

You find the y-intercept of a linear function from its equation by setting the value of x to zero and solving for y.

What role does the x-intercept play in a linear function?

The x-intercept is the point where the line crosses the x-axis, indicating the value of x when y equals zero, which is useful for understanding the function's behavior.

Can linear functions be used for non-linear data? If so, how?

Linear functions can be used to approximate non-linear data within a limited range by using techniques such as linear regression, but they may not accurately represent the overall trend.

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