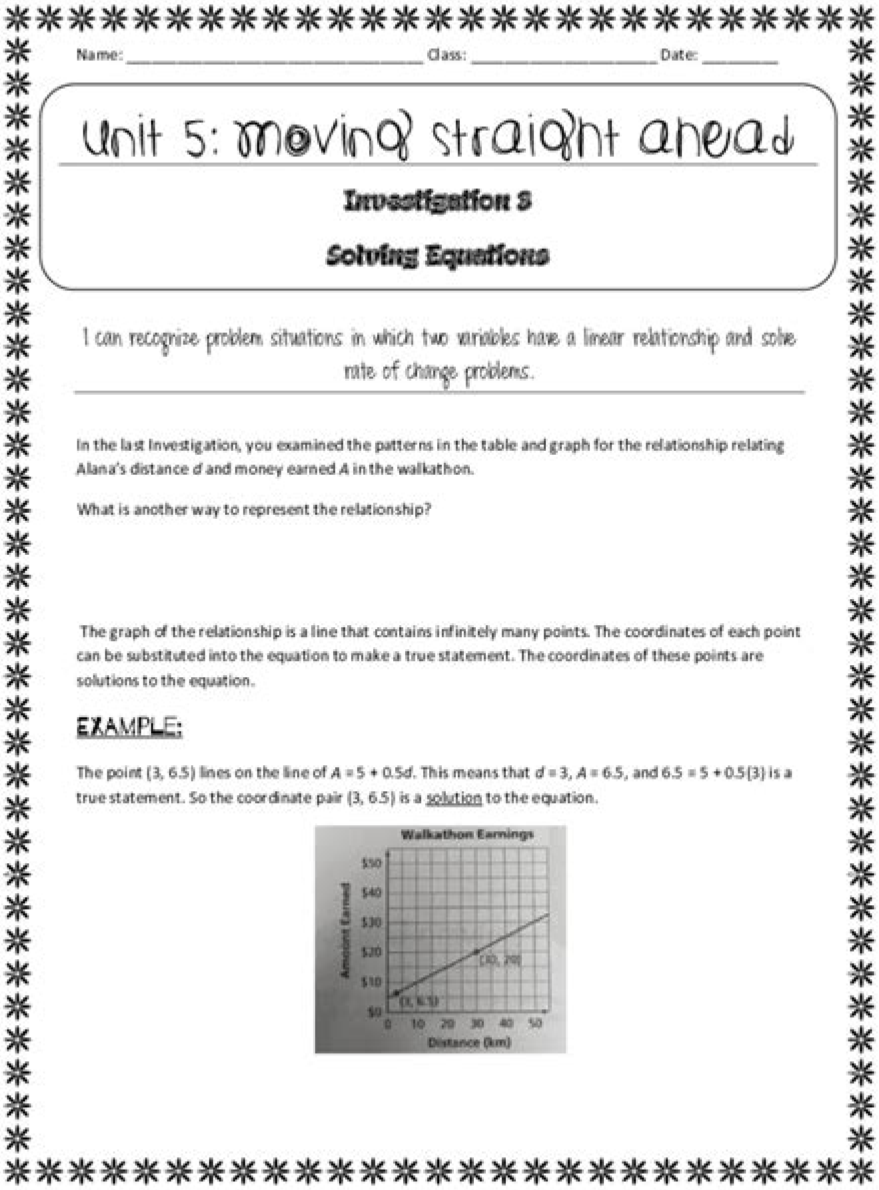
Moving Straight Ahead Linear Relationships Answer Key



Name: ______________________________ Class: __________________ Date: ________

Unit 5: moving straight ahead

Investigation 3

Solving Equations

I can recognize problem situations in which two variables have a linear relationship and solve rate of change problems.

In the last Investigation, you examined the patterns in the table and graph for the relationship relating Alana's distance *d* and money earned *A* in the walkathon.

What is another way to represent the relationship?

The graph of the relationship is a line that contains infinitely many points. The coordinates of each point can be substituted into the equation to make a true statement. The coordinates of these points are solutions to the equation.

EXAMPLE:

The point (3, 6.5) lines on the line of $A = 5 + 0.5d$. This means that $d = 3$, $A = 6.5$, and $6.5 = 5 + 0.5(3)$ is a true statement. So the coordinate pair (3, 6.5) is a solution to the equation.

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Understanding linear relationships is a fundamental aspect of mathematics, particularly in algebra. Linear relationships are those that can be represented by a straight line on a graph. They describe how one variable changes in relation to another and are foundational in various fields such as physics, economics, and engineering. This article serves as a comprehensive guide on moving straight ahead linear relationships, exploring their definitions, characteristics, and practical applications. Additionally, it provides an answer key for common problems related to linear relationships, which can be a valuable resource for students and educators alike.

What Are Linear Relationships?

Linear relationships can be defined as a relationship between two variables where a change in one variable results in a proportional change in the other. Mathematically, this can be represented by the equation of a line:

$$y = mx + b$$

Where:
- y is the dependent variable.
- x is the independent variable.
- m is the slope of the line, indicating the rate of change.
- b is the y-intercept, which is the value of y when $x = 0$.

Characteristics of Linear Relationships

1. Straight Line: The graphical representation of a linear relationship is a straight line.
2. Constant Rate of Change: The slope m represents a constant rate of change. This means that for every unit increase in x, y increases by m units.
3. Intercepts: The y-intercept b indicates where the line crosses the y-axis, while the x-intercept is where the line crosses the x-axis.
4. Domain and Range: Linear functions have an infinite domain and range unless specified otherwise.

Types of Linear Relationships

Linear relationships can be classified into several types based on their characteristics:

1. Positive Linear Relationships

In a positive linear relationship, as one variable increases, the other variable also increases. The slope m is positive.

- Example: Height and weight often have a positive linear relationship; as height increases, weight tends to increase as well.

2. Negative Linear Relationships

In a negative linear relationship, as one variable increases, the other variable decreases. The slope m is negative.

- Example: The amount of gas in a tank and the distance traveled often demonstrate a negative linear relationship; as the gas decreases, the distance that can be traveled decreases.

3. Zero Linear Relationships

A zero linear relationship indicates that changes in one variable do not affect the other. The slope m is zero, resulting in a horizontal line.

- Example: The number of hours studied and a person's shoe size typically exhibit a zero linear relationship; changes in study time do not impact shoe size.

Applications of Linear Relationships

Linear relationships are prevalent in various real-world contexts, including:

1. Economics: Understanding supply and demand curves helps businesses make informed decisions.
2. Physics: Describing motion, such as speed and distance, can be modeled using linear equations.
3. Statistics: Linear regression is a statistical method used for predicting outcomes and analyzing relationships between variables.
4. Finance: Budgeting and forecasting often rely on linear models to predict expenses and revenue.

Common Problems Involving Linear Relationships

Below are some common problems associated with linear relationships, along with an answer key to provide clarity and guidance.

Problem 1: Finding the Slope

Determine the slope of the line that passes through the points (2, 3) and (4, 7).

Solution:
- Use the formula for the slope m:

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

- Answer: The slope is 2.

Problem 2: Writing the Equation of a Line

Write the equation of the line with a slope of -3 that passes through the point (1, 4).

Solution:
- Use the point-slope form:

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

- Plugging in the values:

$$ y - 4 = -3(x - 1) $$

- Simplifying:

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

$$ y = -3x + 7 $$

- Answer: The equation of the line is $y = -3x + 7$.

Problem 3: Finding the Y-Intercept

Find the y-intercept of the line represented by the equation $2x + 3y = 6$.

Solution:
- To find the y-intercept, set $x = 0$:

$$ 2(0) + 3y = 6 $$

$$ 3y = 6 $$

$$ y = 2 $$

- Answer: The y-intercept is 2.

Problem 4: Solving for X and Y Intercepts

Determine both the x-intercept and y-intercept of the line described by the equation $4x - 2y = 8$.

Solution:
- To find the x-intercept, set $y = 0$:

$$ 4x - 2(0) = 8 $$

$$4x = 8$$

$$x = 2$$

- To find the y-intercept, set $x = 0$:

$$4(0) - 2y = 8$$

$$-2y = 8$$

$$y = -4$$

- Answer: The x-intercept is 2, and the y-intercept is -4.

Conclusion

Understanding linear relationships is vital for solving various mathematical problems and applying these concepts in real-world scenarios. From the basic definition to the application of linear equations in different fields, knowledge of linear relationships enables individuals to analyze data effectively and make informed decisions. This article provided a detailed overview of the characteristics, types, and practical applications of linear relationships, accompanied by common problems and their solutions. Whether you are a student seeking to grasp algebraic concepts or an educator preparing to teach, the insights and answer key offered here can aid in navigating the world of linear relationships.

Frequently Asked Questions

What is a linear relationship in the context of moving straight ahead?

A linear relationship is a connection between two variables that can be represented by a straight line on a graph, indicating that as one variable changes, the other changes at a constant rate.

How can I determine the slope of a linear relationship?

The slope can be determined by taking two points on the line (x_1, y_1) and (x_2, y_2) and using the formula: slope $(m) = (y_2 - y_1) / (x_2 - x_1)$.

What does the y-intercept represent in a linear equation?

The y-intercept represents the point where the line crosses the y-axis, indicating the value of y when x is zero in the equation of the form $y = mx + b$.

How can I apply linear relationships to real-life situations?

Linear relationships can be applied in various real-life situations, such as budgeting, predicting expenses, or determining distances traveled over time, where one variable depends linearly on another.

What are some common errors to avoid when analyzing linear relationships?

Common errors include misinterpreting the slope, overlooking the importance of the y-intercept, and assuming a linear relationship exists when the data may actually be non-linear.

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