

Chapter Summary

Chapter 4: Writing Linear Functions

Learning Goals

Write equations in slope-intercept form.

Use linear equations to solve real-life problems.

Write an equation of a line given its slope and a point on the line.

Write an equation of a line given two points on the line.

Use linear equations to solve real-life problems.

Identify and write equations of parallel lines.

Identify and write equations of perpendicular lines.

Use parallel and perpendicular lines in real-life problems.

Interpret scatter plots.

Identify correlations between data sets.

Use lines of fit to model data.

Use residuals to determine how well lines of fit model data.

Use technology to find lines of best fit.

Distinguish between correlation and causation.

Write the terms of arithmetic sequences.

Graph arithmetic sequences.

Write arithmetic sequences as functions.

Evaluate piecewise functions.

Graph and write piecewise functions.

Graph and write step functions.

Write absolute value functions.

Essential Questions

Given the graph of a linear function, how can you write an equation of the line?

How can you write an equation of a line when you are given the slope and a point on the line?

How can you recognize lines that are parallel or perpendicular?

How can you use a scatter plot and a line of fit to make conclusions about data?

How can you *analytically* find a line of best fit for a scatter plot?

How can you use an arithmetic sequence to describe a pattern?

How can you describe a function that is represented by more than one equation?

Games

- P or P
- Foot and Forearm Examination Activity

These are available online in the *Game Closet* at www.bigideasmath.com.

Core Vocabulary

A **linear model** is a linear function that models a real-life situation.

A linear equation written in the form $y - y_1 = m(x - x_1)$ is in **point-slope form**.

Two lines in the same plane that never intersect are **parallel lines**.

Two lines in the same plane that intersect to form right angles are **perpendicular lines**.

A **scatter plot** is a graph that shows the relationship between two data sets.

A **correlation** is a relationship between data sets.

A **line of fit** is a line drawn on a scatter plot that is close to most of the data points.

A **residual** is the difference of the y -value of a data point and the corresponding y -value found using the line of fit.

Linear regression is a method that graphing calculators use to find a precise line of fit that models a set of data.

A line that best models a set of data is called a **line of best fit**.

A value r that tells how closely the equation of the line of best fit models the data is called the **correlation coefficient**.

Using a graph or its equation to approximate a value between two known values is called **interpolation**.

Using a graph or its equation to predict a value outside the range of known values is called **extrapolation**.

When a change in one variable causes a change in another variable, it is called **causation**.

A **sequence** is an ordered list of numbers.

Each number in a sequence is called a **term**.

An ordered list of numbers in which the difference between each pair of consecutive terms is the same is an **arithmetic sequence**.

The difference between each pair of consecutive terms in an arithmetic sequence is called the **common difference**.

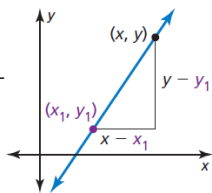
A **piecewise function** is a function defined by two or more equations.

A **step function** is a piecewise function defined by a constant value over each part of its domain.

Core Concept

Point-Slope Form

A linear equation written in the form $y - y_1 = m(x - x_1)$ is in point-slope form. The line passes through the point (x_1, y_1) , and the slope of the line is m .



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

slope

passes through (x_1, y_1)

Perpendicular Lines and Slopes

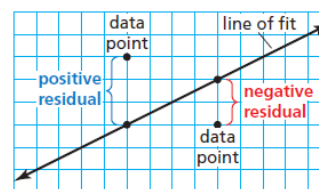
- Two lines in the same plane that intersect to form right angles are perpendicular lines.
- Nonvertical lines are perpendicular if and only if their slopes are negative reciprocals.
- Vertical lines are perpendicular to horizontal lines.

Using a Line of Fit to Model Data

- Step 1** Make a scatter plot of the data.
- Step 2** Decide whether the data can be modeled by a line.
- Step 3** Draw a line that appears to fit the data closely. There should be approximately as many points above the line as below it.
- Step 4** Write an equation using two points on the line. The points do not have to represent actual data pairs, but they must lie on the line of fit.

Residuals

- A residual is the difference of the y -value of a data point and the corresponding y -value found using the line of fit.
- A residual can be positive, negative, or zero.
- A scatter plot of the residuals shows how well a model fits a data set.
- If the model is a good fit, then the absolute values of the residuals are relatively small, and the residual points will be more or less evenly dispersed about the horizontal axis.
- If the model is not a good fit, then the residual points will form some type of pattern that suggests the data are not linear.
- Wildly scattered residual points suggest that the data might have no correlation.



Parallel Lines and Slopes

- Two lines in the same plane that never intersect are parallel lines.
- Nonvertical lines are parallel if and only if they have the same slope.
- All vertical lines are parallel.

Scatter Plot

- A scatter plot is a graph that shows the relationship between two data sets.
- The two data sets are graphed as ordered pairs in a coordinate plane.
- Scatter plots can show trends in the data.

Arithmetic Sequence

- In an arithmetic sequence, the difference between each pair of consecutive terms is the same.
- This difference is called the common difference.
- Each term is found by adding the common difference to the previous term.



Equation for an Arithmetic Sequence

Let a_n be the n th term of an arithmetic sequence with first term a_1 and common difference d . The n th term is given by $a_n = a_1 + (n - 1)d$.

Piecewise Function

- A piecewise function is a function defined by two or more equations.
- Each “piece” of the function applies to a different part of its domain.

Additional Review

- Using Slope-Intercept Form, p. 176
- Using Point-Slope Form, p. 182
- Identifying Correlations, p. 197
- Lines of Best Fit, p. 203
- Correlation and Causation, p. 205
- Step Function, p. 220
- Writing Absolute Value Functions, p. 221

What's the Point?

The STEM Videos available online show ways to use mathematics in real-life situations. The Chapter 4: Future Wind Power STEM Video is available online at www.bigideasmath.com.