FAMILY GUIDE

› Read and share with your student.

CARNEGIE LEARNING

How to support your student as they learn about
Solving Linear Equations and Inequalities

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when encountering new concepts in this topic.

Where are we?

MODULE 2
Exploring Constant Change

TOPIC 1
Linear Functions

TOPIC 2
Solving Linear Equations and Inequalities

TOPIC 3
Systems of Equations and Inequalities

TOPIC 4
Functions Derived from Linear Relationships

In this MATHbook topic, students analyze linear functions and their key characteristics. They solve equations in one variable, examining the structure of each equation to predict the number of solutions. Students generalize their knowledge to solve literal equations. Students then graph linear inequalities. Finally, students solve compound inequalities and represent the solutions on a number line.

Where have we been?

In middle school, students solved increasingly complex linear equations and solved two-step inequalities. They understand the underpinnings of solving equations by maintaining equality. From this intuitive understanding, students use properties to justify each step in the equation-solving process.

Where are we going?

Students are preparing to solve linear absolute value equations and inequalities, exponential equations, and quadratic equations and inequalities by recognizing the connections between algebraic and graphical solutions to an equation or inequality.

MATHia

Encourage your students to work through the sequence of MATHia assigned to them. These workspaces deepen their understanding and provide practice with the concepts of ***Solving Linear Equations***.

Solving Linear and Literal Equations

- Reasoning About Solving Equations
- Solving Linear Equations in a Variety of Forms
- Extending Equations to Literal Equations
- Solving Literal Equations

Modeling Linear Inequalities

- Graphing Inequalities with Rational Numbers
- Solving Linear Inequalities
- Representing Compound Inequalities

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End of Topic Test: _____

How to support your student as they learn

MATH MYTH

Just watch a video, and you will understand it.

Has this ever happened to you? Someone explains something, and it all makes sense at the time. You feel like you get it. But then, a day later when you try to do it on your own, you suddenly feel like something's missing? If that feeling is familiar, don't worry. It happens to us all. It's called the illusion of explanatory depth, and it frequently happens after watching a video.

How do you break this illusion? The first step is to try to make the video interactive. Don't treat it like a TV show. Instead, pause the video and try to explain it to yourself or to a friend. Alternatively, attempt the steps in the video on your own and rewatch it if you hit a wall. Remember, it's easy to confuse familiarity with understanding.

#mathmythbusted

Talking Points

Discuss With Your Student

Your student is learning about solving linear equations and inequalities. You can further support your student's learning by asking questions about the work they do in class or at home.

Questions to Ask

1. *How does this problem look like something you did in class?*
2. *Can you show me the strategy you used to solve this problem? Do you know another way to solve it?*
3. *Does your answer make sense? How do you know?*
4. *Is there anything you don't understand? How can you use today's lesson to help?*

KEY TERMS

infinite solutions
A linear equation with infinite solutions means that any value for the variable makes the equation true.

literal equation
Literal equations are equations in which the variables represent specific measures.

solve an inequality
To solve an inequality means to determine the values of the variable that make the inequality true.

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MARK YOUR CALENDAR
End of Topic Test:

CARNEGIE LEARNING

How to support your student as they learn about
Quantities and Relationships

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when encountering new concepts in this topic.

Where are we?

MODULE 1
Searching for Patterns

TOPIC 1
Quantities and Relationships

TOPIC 2
Sequences

TOPIC 3
Linear Regression

In this MATHbook topic, students explore a variety of different functions. The intent is merely to introduce these new functions, providing an overview but not a deep understanding. The topic helps students recognize that function families have different key characteristics. Later in this course, they will formalize their understanding of the defining characteristics of each type of function.

Where have we been?

In previous grades, students defined a function and used linear functions to model the relationship between two quantities. They have written linear functions in slope-intercept form and can identify the slope and *y*-intercept in the equation. Students have also characterized graphs as functions using the terms *increasing, decreasing, constant, discrete, continuous, linear,* and *nonlinear*.

Where are we going?

The study of functions is a primary focus of high school mathematics. This topic builds the foundation for future, more in-depth study by familiarizing students with the concept of a function. They will continue to use formal function notation throughout this course and in higher-level math courses.

MATHia

Encourage your students to work through the sequence of MATHia assigned to them. These workspaces deepen their understanding and provide practice with the concepts of ***Quantities and Relationships***.

Understanding Quantities and Their Relationships

- Identifying Quantities

Recognizing Functions and Function Families

- Interpreting Function Notation
- Identifying Domain and Range
- Identifying Key Characteristics of Graphs of Functions
- Introduction to Function Families

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How to support your student as they learn

MATH MYTH

I don't have the math gene.

Let's be clear about something. There isn't a gene that controls the development of mathematical thinking. Instead, there are probably hundreds of genes that contribute to it.

A recent study suggests that mathematical thinking arises from the ability to learn a language. Given the right input from the environment, children learn to speak without formal instruction. They can learn number sense and pattern recognition the same way.

To further nurture your child's mathematical growth, attend to the learning environment. You can think of it as providing a nutritious mathematical diet that includes: discussing math in the real world, offering encouragement, being available to answer questions, allowing your student to struggle with difficult concepts, and providing space for plenty of practice.

#mathmythbusted

Talking Points

Discuss With Your Student

Your student is learning about types of functions and function relationships. You can further support your student's learning by asking questions about the work they do in class or at home.

Questions to Ask

1. *How does this problem look like something you did in class?*
2. *Can you show me the strategy you used to solve this problem? Do you know another way to solve it?*
3. *Does your answer make sense? How do you know?*
4. *Is there anything you don't understand? How can you use today's lesson to help?*

KEY TERMS

increasing function
If a function increases across the entire domain, then the function is an increasing function.

decreasing function
If a function decreases across the entire domain, then the function is a decreasing function.

function family
A function family is a group of functions that all share some characteristics.

***x*-intercept**
The *x*-intercept is the point where a graph crosses the *x*-axis.

***y*-intercept**
The *y*-intercept is the point where a graph crosses the *y*-axis.

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FAMILY GUIDE

› Read and share with your student.

CARNEGIE LEARNING

How to support your student as they learn about
Linear Functions

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when encountering new concepts in this topic.

Where are we?

MODULE 2
Exploring Constant Change

TOPIC 1
Linear Functions

TOPIC 2
Solving Linear Equations and Inequalities

TOPIC 3
Systems of Equations and Inequalities

TOPIC 4
Functions Derived from Linear Relationships

In this MATHbook topic, students begin with arithmetic sequences. They move from an arithmetic sequence and its explicit formula to a linear function. Students prove that the common difference of an arithmetic sequence and the slope of the corresponding linear function are both constant and equal. Students use vertical dilations and horizontal and vertical translations to transform functions.

Where have we been?

Throughout middle school, students have had extensive experience with linear relationships. They have represented relationships using tables, graphs, and equations. They understand slope as a unit rate of change and as the steepness and direction of a graph.

Where are we going?

Students should understand the key characteristics of a linear function represented in situations, tables, equations, and graphs. Solving equations using horizontal lines on the graph lays the foundation for solving systems of linear equations as well as the more complicated nonlinear equations.

MATHia

Encourage your students to work through the sequence of MATHia assigned to them. These workspaces deepen their understanding and provide practice with the concepts of ***Linear Functions***.

Connecting Arithmetic Sequences and Linear Functions

- Writing Sequences as Linear Functions
- Understanding Linear Functions
- Equal Differences Over Equal Intervals

Multiple Representations of a Linear Function

- Multiple Representations of Linear Functions
- Modeling Linear Functions Using Multiple Representations

Transforming Linear Functions

- Exploring Graphs of Linear Functions
- Vertically Translating Linear Functions
- Vertically Dilating Linear Functions
- Multiple Transformations of Linear Functions

Comparing Linear Functions in Different Forms

- Comparing Linear Functions in Different Forms

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How to support your student as they learn

MATH MYTH

Students only use 10% of their brains.

Hollywood is in love with the idea that humans only use a small portion of their brains. This notion formed the basis of the movies *Lucy* (2014) and *Limitless* (2011). Both films ask the audience: Imagine what you could accomplish if you could use 100% of your brain!

Well, this isn't Hollywood, and you're stuck with an ordinary brain. The good news is that you do use 100% of your brain. As you look around the room, your visual cortex is busy assembling images; your motor cortex is busy moving your neck; and all of the associative areas recognize the objects that you see. Meanwhile, the corpus callosum, which is a thick band of neurons that connect the two hemispheres, ensures that all of this information is kept coordinated. Moreover, the brain does this automatically, which frees up space to ponder deep, abstract concepts like mathematics!

#mathmythbusted

Talking Points

Discuss With Your Student

Your student is learning about linear functions. You can further support your student's learning by asking questions about the work they do in class or at home.

Questions to Ask

1. *How does this problem look like something you did in class?*
2. *Can you show me the strategy you used to solve this problem? Do you know another way to solve it?*
3. *Does your answer make sense? How do you know?*
4. *Is there anything you don't understand? How can you use today's lesson to help?*

KEY TERMS

first differences

First differences are the values determined by subtracting consecutive output values when the input values have an interval of 1. When the first differences are constant, the relationship is linear.

average rate of change

Another name for the slope of a linear function is average rate of change.

degree

The degree of a polynomial is the greatest exponent of a variable term in an expression.

zero of a function

A zero of a function is a real number that makes the value of the function equal to zero, or $f(x) = 0$.

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CARNEGIE LEARNING

How to support your student as they learn about
Systems of Equations and Inequalities

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when encountering new concepts in this topic.

Where are we?

MODULE 2
Exploring Constant Change

- TOPIC 1 Linear Functions
- TOPIC 2 Solving Linear Equations and Inequalities
- **TOPIC 3 Systems of Equations and Inequalities**
- TOPIC 4 Functions Derived from Linear Relationships

In this MATHbook topic, students begin by writing systems of linear equations and solving them graphically and algebraically. Students consider linear inequalities in two variables and learn that their solutions are half-planes on a coordinate plane. They then graph two linear inequalities. Finally, students solve problems using either a system of equations or a system of inequalities.

Where have we been?

Students know that every point on the graph of an equation represents a value that makes the equation true. They have learned that the point of intersection of two graphs provides *x*- and *y*-values that make both equations true. Students have written and solved systems of linear equations.

Where are we going?

Knowing how to solve systems of linear equations prepares students to solve systems that include nonlinear equations. In later courses, students may encounter more advanced methods, such as matrices, to solve systems of equations with more than two variables and more than two equations.

MATHia

Encourage your students to work through the sequence of MATHia assigned to them. These workspaces deepen their understanding and provide practice with the concepts of ***Systems of Equations and Inequalities***.

Introduction to Systems of Equations

- Representing Systems of Linear Functions
- Review of Modeling Linear Systems Involving Integers
- Solving Linear Systems Using Substitution

Using Linear Combinations to Solve a System of Linear Equations

- Solving Linear Systems Using Linear Combinations
- Solving Linear Systems Using Any Method

Graphing Linear Inequalities in Two Variables

- Exploring Linear Inequalities
- Graphing Linear Inequalities in Two Variables

Graphing a System of Linear Inequalities

- Systems of Linear Inequalities
- Interpreting Solutions to Systems of Inequalities

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How to support your student as they learn

MATH MYTH

Memory is like an audio or video recording.

Let's play a game. Memorize the following list of words: strawberry, grape, watermelon, banana, orange, peach, cherry, blueberry, raspberry. Got it? Good. Some believe that the brain stores memories in pristine form. The idea is that memories last for a long time and don't change—like recordings. Without looking back at the original list, was apple on it?

If you answered "yes," then go back and look at the list. You'll see that apple does not appear, even though it seems like it should. In other words, memory is an active, reconstructive process that takes additional information, like the category of words (e.g., fruit), and makes assumptions about the stored information.

This simple demonstration suggests memory is not like a recording. Instead, it is influenced by prior knowledge and decays over time. Therefore, students need to see and engage with the same information multiple times to minimize forgetting (and distortions).

#mathmythbusted

Talking Points

Discuss With Your Student

Your student is learning about systems of linear equations and inequalities. You can further support your student's learning by asking questions about the work they do in class or at home.

Questions to Ask

1. *How does this problem look like something you did in class?*
2. *Can you show me the strategy you used to solve this problem? Do you know another way to solve it?*
3. *Does your answer make sense? How do you know?*
4. *Is there anything you don't understand? How can you use today's lesson to help?*

KEY TERMS

consistent system
Systems that have one or many solutions are consistent systems.

inconsistent system
Systems with no solution are inconsistent systems.

half-plane
The graph of a linear inequality in two variables is a half-plane, or half of a coordinate plane.

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End of Topic Test:

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› Read and share with your student.

CARNEGIE LEARNING

How to support your student as they learn about

Introduction to Exponential Functions

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when encountering new concepts in this topic.

Where are we?

MODULE 3
Investigating Growth and Decay

TOPIC 1
Introduction to Exponential Functions

TOPIC 2
Using Exponential Functions

In this MATHbook topic, students build upon their previous understanding of sequences and common ratios to recognize that some geometric sequences are exponential functions. Next, students examine the structure of exponential functions, connecting the common ratio of a geometric sequence with the base of the power in an exponential function. Finally, students transform exponential functions.

Where have we been?

Students learned the rules of exponents and used them to rewrite expressions in equivalent forms. They transformed geometric objects in the coordinate plane and noted the effect of each transformation on the image. Students can write a recursive and explicit formula for a given geometric sequence.

Where are we going?

Students apply what they know about the key characteristics of functions to include exponential functions. This work has prepared them for their work with quadratic functions, both in this course and with more complex functions in subsequent courses.

MATHia

Encourage your students to work through the sequence of MATHia assigned to them. These workspaces deepen their understanding and provide practice with the concepts of ***Introduction to Exponential Functions***.

Geometric Sequences and Exponential Functions

- Writing Sequences as Exponential Functions

Rational Exponents

- Using Properties of Exponents
- Properties of Rational Exponents
- Rewriting Expressions with Radical and Rational Exponents
- Solving Contextual Exponential Equations Using Common Bases

Transformations of Exponential Functions

- Introduction to Transforming Exponential Functions
- Vertically Translating Exponential Functions
- Horizontally Translating Exponential Functions
- Reflecting and Dilating Exponential Functions Using Graphs
- Transforming Exponential Functions Using Tables
- Multiple Transformations of Exponential Functions

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How to support your student as they learn

MATH MYTH
I'm not smart.

The word *smart* is tricky because it means different things to different people. For example, would you say a baby is *smart*? On the one hand, a baby is helpless and doesn't know anything. But on the other hand, a baby is insanely *smart* because she is constantly learning new things every day.

This example is meant to demonstrate that *smart* can have two meanings. It can mean "the knowledge that you have," or it can mean "the capacity to learn from experience." When someone says he or she is "not smart," are they saying they do not have much knowledge, or are they saying they lack the capacity to learn? If it's the first definition, then none of us are smart until we acquire that information. If it's the second definition, then we know that is completely untrue because everyone has the capacity to grow as a result of new experiences.

#mathmythbusted

Talking Points

Discuss With Your Student

Your student is learning about exponential functions. You can further support your student's learning by asking questions about the work they do in class or at home.

Questions to Ask

1. *How does this problem look like something you did in class?*
2. *Can you show me the strategy you used to solve this problem? Do you know another way to solve it?*
3. *Does your answer make sense? How do you know?*
4. *Is there anything you don't understand? How can you use today's lesson to help?*

KEY TERMS

exponential function
An exponential function is a function of the form $f(x) = a \cdot bx$, where a and b are real numbers, and b is greater than 0 but is not equal to 1.

horizontal asymptote
A horizontal asymptote is a horizontal line that a function gets closer and closer to, but never intersects.

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End of Topic Test:

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CARNEGIE LEARNING

How to support your student as they learn about
Using Exponential Equations

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when encountering new concepts in this topic.

Where are we?

MODULE 3
Investigating Growth and Decay

TOPIC 1
Introduction to Exponential Functions

TOPIC 2
Using Exponential Equations

In this MATHbook topic, students explore strategies for distinguishing exponential functions representing growth versus those that represent decay and methods for solving exponential equations. They graph and write equations for simple and compound interest. Students then examine the structure of the exponential equations. Finally, they solve real-world problems that exponential functions can model.

Where have we been?

Students know the rules of exponents and are familiar with the structure of exponential functions. Their previous work has prepared them to make sense of real-world scenarios modeling in this topic. Students understand what it means to determine a solution for an equation.

Where are we going?

This topic represents students' first deep dive into solving equations that represent nonlinear functions. As students gain proficiency in solving increasingly complex equations, they model more interesting and complex real-life phenomena.

MATHia

Encourage your students to work through the sequence of MATHia assigned to them. These workspaces deepen their understanding and provide practice with the concepts of ***Using Exponential Equations***.

Exponential Equations for Growth and Decay

- Recognizing Linear and Exponential Models
- Calculating and Interpreting Average Rate of Change
- Recognizing Growth and Decay
- Comparing Exponential Functions in Different Forms

Solving Exponential Equations

- Modeling Equations with a Starting Point of 1
- Modeling Equations with a Starting Point Other Than 1
- Solving Exponential Equations Using a Graph
- Transforming Exponential Expressions

Modeling Using Exponential Functions

- Relating the Domain to Exponential Functions
- Exploring Exponential Regressions

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How to support your student as they learn

MATH MYTH
Faster = smarter

In most cases, speed has nothing to do with how smart you are. Why is that? Because it largely depends on how familiar you are with a topic. For example, a bike mechanic can look at a bike for about 8 seconds and tell you details about the bike that you probably didn't even notice (e.g., the front tire is on backward). Is that person smart? Sure! Suppose, instead, you show the same bike mechanic a car. Will they be able to report the same amount of detail as they did for the bike? No!

It's easy to confuse speed with understanding. Speed is associated with the memorization of facts. Understanding, on the other hand, is a methodical, time-consuming process. Understanding is the result of asking lots of questions and seeing connections between different ideas. Many mathematicians who won the Fields Medal (i.e., the Nobel prize for mathematics) describe themselves as extremely slow thinkers. That's because mathematical thinking requires understanding over memorization.

#mathmythbusted

Talking Points

Discuss With Your Student

Your student is learning about exponential equations. You can further support your student's learning by asking questions about the work they do in class or at home.

Questions to Ask

1. *How does this problem look like something you did in class?*
2. *Can you show me the strategy you used to solve this problem? Do you know another way to solve it?*
3. *Does your answer make sense? How do you know?*
4. *Is there anything you don't understand? How can you use today's lesson to help?*

KEY TERMS

simple interest

In a simple interest account, a percent of the starting balance is added to the account at each interval. The formula for simple interest is $I = Prt$, where P represents the starting amount, or principal, r represents the interest rate, t represents time, and I represents the interest earned.

compound interest

In a compound interest account, the balance is multiplied by the same amount at each interval.

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