COMMON CORE ACHIEVE

Mastering Essential Test Readiness Skills

GED® Test Teacher Supplement

MATHEMATICS

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Introduction

The Common Core Achieve: Mathematics program builds a solid foundation of procedural, conceptual, and problem-solving skills required in the mathematics portion of any of the three high school equivalency tests. *The GED® Test Math Student Supplement* provides students with additional instruction and practice on select key concepts, core skills, and core practices that will help them better prepare for the GED® Test and for college-level math courses.

How to Use This Supplement

The *GED® Test Math Teacher Supplement* contains teaching strategies and activities for each topic in the student supplement. Activities place an increased emphasis on conceptual understanding and reasoning using higher-order thinking skills. Both the student and teacher supplements are designed to support or enhance the lessons in the Core Student Module, Instructor Resource Guide, and Exercise Book. Each topic provides instruction and practice on concepts that may be tested on the GED® Test but go beyond the foundational instruction in the Core Student Module.

About the GED® Mathematical Reasoning Test

The GED® Mathematical Reasoning Test assesses across two content areas: quantitative and algebraic problem solving, with a breakdown of approximately 45% focusing on quantitative problem solving, and approximately 55% focusing on algebraic problem solving. The test is broken down into two parts: a short calculator-prohibited section, and a longer calculator-allowed section. Multiple item types are used on the test including multiple choice, fill-in-the-blank, dropdown, drag-and-drop, and hotspot. All of the item types may utilize graphs, tables, maps, or other information presented visually.

The GED® Mathematical Reasoning Test assesses across the Webb's Depth of Knowledge spectrum, asking students to answer questions that range from recall questions (DOK 1) to strategic thinking questions (DOK 3). The test assesses approximately 20% of its items at the DOK 1 level (recall), and 80% of its items at the DOK 2 (application of concepts) and DOK 3 (strategic thinking) levels.

On test day, students will be allowed to use the calculator provided onscreen for the calculator portion of the test. Students will also be given a formula sheet as well as an erasable note board to write out work by hand. Students will not be allowed to bring their own calculator or scrap paper.

Place Value

OBJECTIVES

- Use place value to read and write whole numbers
- Compare and order whole numbers

CORE SKILLS & PRACTICES

- Apply Number Sense Concepts
- Model with Mathematics

Key Terms

digit
the ten number symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

periods
groups of three digits starting from the right of a number

value
how much a digit represents

whole number
the number system beginning with 0, 1, 2, 3, and so on

Vocabulary

approximate
close to; an estimate

chart
an arrangement of numbers or other information; a diagram that shows information

number line
a list of numbers arranged in order from left to right on a line

Key Concept

Represent, compare, and order whole numbers to better understand the meaning and value of whole numbers.

Overview

Understanding place value is key to working successfully with numbers. Direct students to the place-value chart on page 1. Discuss the place values indicated in the chart, and work with students to explain the total value of each digit.

Pre-Teach Vocabulary

Apply Prior Knowledge

Read the vocabulary words for students, and ask them to raise their hands when they recognize a word. Pause to respond to each show of hands, and invite a volunteer to explain the word. Then, allow other students who raised their hands to support, clarify, or revise the definition. If necessary, write the correct definition for each word and help students resolve discrepancies.

Place Value

Read the first two paragraphs of "Place Value" with students. Direct their attention to the model of a place value chart. Ask questions to help students interpret what they see, such as: *How many hundreds are in this number?*

Guide students through Examples 1 and 2. You may want to draw or project the place-value chart on the board to allow volunteers to walk through the steps with help from the class. After completing both examples, write a new number in the millions on the board. Ask students to identify the value of each digit in the number, referring to the place-value chart in their books, if necessary.

Identify the Main Idea

Tell students that in all subject areas, being able to find the main idea, even what they will find in mathematics, science, and social studies, as well as reading and writing, will help them understand hard concepts.

Read the boxed paragraph on page 2 together as a class. Review which sentence in this paragraph is the main idea. Ask for student volunteers to give tips for finding the main idea in mathematics texts. Write the tips in a numbered list on the board.

Develop Core Skills

Core Skill: Apply Number Sense Concepts

Write the term *number sense* on the board. Point to each word in the term separately, and ask students to explain what it means. Guide them toward understanding that *sense* is an understanding or awareness of meaning.

Therefore, number sense refers to an understanding of the meanings of numbers and their relationships. For example, explain that the symbols 5 and 2 each represent a quantity, and that the symbol + represents an action, or operation. Ask: *What does your number sense tell you about the expression 5 + 2?*

Notes:

Core Practice: Model with Mathematics

Explain to students that there are a variety of tools to help support or explain mathematical thinking. A chart or diagram is a model. Point to the place-value chart that appears in the lesson. Invite students to discuss how a chart can be a helpful tool in understanding math concepts.

Read and Write Whole Numbers

Read the first sentence aloud. Guide students through the steps in Examples 3 and 4. To reinforce understanding, tell students that you are going to read some numbers aloud, and you want them to write what they hear.

Afterward, write the numbers you read aloud on the board and give students time to check their work. Encourage students to ask questions about any problems they may have. Next, write numbers in word form on the board, and challenge students to write them in number form. Invite volunteers to write the answers on the board, and discuss any discrepancies that may occur.

Math Link

Remind students that when a zero appears in a number, it tells the reader that there is no value associated with that place in the number. So, that place is not expressed when a number is written in words. Write the number 345,017 on a board or chart. Ask a volunteer to write the number in words and then read it. Discuss the written and spoken forms as a class.

Compare and Order Whole Numbers

Ask students to identify an example of a mathematical model on the page. Direct their attention to the number lines, and explain that these lines serve as mathematical models to assist in understanding the relationships among numbers. Read the number line for students and then guide them through the steps in the example.

21st Century Skill: Access Information

Give students time to read the text independently. Then invite them to talk about a mathematical idea or process that they would like to know how to do. Ask them where they might go for more information on the topic. Engage students in a discussion about the many kinds of information that are available to them, both in print and online. Encourage students to think of people as resources, too, and understand that it is possible to get information directly from experts.

Math Link

Write the word *equality* on the board, and invite students to suggest a meaning. Next, write the prefix *in* on the board, and ask students what it means. Give students some examples of words that begin with the prefix, such as *incorrect*. Now, add the prefix *in* to the word *equality*, and ask students to define it. Then, read the Math Link and explain that the symbols $<$ and $>$ represent inequalities. They show that one value is either less than or greater than another.

Notes:

Vocabulary Review, Skill Review, and Skill Practice

This section gives students an opportunity to review math skills, check their comprehension of the key terms and vocabulary, and practice the skills taught. Review the concepts and skills with students and provide support as needed.

Engage and Extend

ELL Instruction: State Preferences

Ask: *Which do you think is easier: using a number line to compare numbers or using place value chart to compare numbers? Why?* Have volunteers state their preference and offer reasons for it. Encourage students to use the terms number line, compare, and place value in their responses.

Extension Activity: Relate a Process

Have students write an explanation of a process other students can follow to compare numbers through the billions. Encourage students to share their explanations and test them by having listeners follow the steps to compare two numbers.

Add and Subtract Whole Numbers

OBJECTIVES

- Add whole numbers
- Subtract whole numbers

CORE SKILLS & PRACTICES

- Perform Operations
- Attend to Precision

Key Terms

addition
the combining of two or more numbers

difference
the answer to a subtraction problem

subtraction
deducting, or taking away, an amount from another amount

sum
the total; the answer to an addition problem

Vocabulary

calculate
to find the answer using a mathematical process

operation
one of the mathematical processes: addition, subtraction, multiplication, or division

Key Concept

Addition and subtraction are basic operations in mathematics.

Overview

Addition and subtraction are the two most frequently used operations in mathematics. Ask students to use their own words to define each operation and then describe the strategies they use to complete each operation. For example, some students may draw pictures, use objects they can manipulate, or rely on mental math. Ask students to give examples of addition and subtraction they use every day, such as calculating how much change they will receive after paying for lunch.

Add Whole Numbers

Read the first two paragraphs for students and then, work through Example 1 on page 7 and Examples 2 and 3 on page 8 as a class. If students appear to have difficulty, provide hands-on materials, such as desk supplies, that students can use to represent numbers.

If you find that students understand the concept of addition but cannot align digits by place value, suggest they use a ruler to separate place value columns before they attempt to add. Provide practice problems, and allow students to add two 2-digit numbers without regrouping. Once students demonstrate mastery, provide practice problems that require regrouping. Ask: *What are you doing when you carry numbers over? How are regrouping, or carrying over, and place value related?*

Subtract Whole Numbers

Read the first paragraph with the class. Afterward, ask: *How does the illustration relate to what we have read? What operation does the illustration show us? Which number in the subtraction sentence represents the difference?*

Guide students through the steps in Examples 4 and 5 on page 9. Emphasize the need for special attention to regrouping. For students who appear to struggle, provide objects they can use to represent and manipulate numbers. You may even want to pair struggling students with students who demonstrate proficiency in subtraction with regrouping. Offer practice problems, such as 2,304 – 1,756, take time to discuss the subtraction process, and give students time to find the difference (548). Continue providing practice problems, or invite students to write and solve their own problems while you observe their work.

Finally, guide students in using a calculator to work through Example 6.

Core Practice: Attend to Precision

Write the word *precision* on the board. Tell students that *precision* means a "high level of accuracy." Then write the following examples on the board: An engineer is building a highway; A carpenter is building kitchen cabinets; A clothing designer is cutting a length of fabric. Ask students what the word *precision* has to do with these examples. Explain to students that precision is related to measured values and how close they are to exact. An engineer, for example, must measure precisely to make sure drivers have enough time to slow down before leaving a highway. A carpenter must measure precisely to avoid wasting wood. A clothing designer makes precise measurements so clothes fit well. Invite students to describe personal examples of when precise measurements are critical.

Notes:

Develop Core Skills

Core Skill: Perform Operations

Write the symbols +, −, ×, and ÷ on the board. Ask students if they recognize these symbols. Have volunteers identify the meaning of each symbol and offer an example of a simple problem that represents each operation. Tell students that as they solve problems, it is important to remain aware of symbols and their meanings if they are going to solve problems successfully.

Math Link

Help students recognize that they cannot change the position of numbers within a subtraction problem without changing the results. Write a simple problem such as $5 - 2 = 3$ on the board. Then have students explain the consequences of reversing the order of 5 and 2.

Math Link

Explain that because addition and subtraction are opposite operations, they can be used to check answers. Invite students to think of subtraction as "undoing" addition. Point to the example they just discussed, and then have students work in pairs to practice. Ask one student in each pair to write and solve an addition problem, and have the other student use subtraction to check the sum. Then have them repeat the activity using a subtraction problem, and using addition to check the difference.

Vocabulary Review, Skill Review, and Skill Practice

This section gives students an opportunity to review math skills, check their comprehension of the key terms and vocabulary, and practice the skills taught. Review the concepts and skills with students and provide support as needed.

Engage and Extend

ELL Instruction: Use Models to Talk about Math

Distribute desk supplies or math manipulatives to students. Call out numbers and have students use the materials to represent the numbers. Then assign the operation of either addition or subtraction, and invite students to use their models to complete it. Ask pointed questions to help students explain their thinking as they work. For example, ask: *Why did you move those objects to the tens place after adding the ones?*

Extension Activity: Estimate Numbers

Organize students into pairs. Give each pair a transparent plastic cup that you have marked with a different letter of the alphabet. Have students fill their cups with common objects, such as paper clips. Tell students to count the objects they put in the cups, record the number, and keep it a secret until later. Have pairs exchange cups, record the letter of the cups they receive, estimate the total number of objects in the cups, and write their estimates. Continue the activity until all pairs have estimated the number of objects in each cup. Then, write the letters on the board and beneath them, have pairs write their estimates. Finally, have them compare estimates to exact quantities and determine their differences. Discuss different strategies students used to estimate and calculate the differences between estimates and actual counts.

Multiply and Divide Whole Numbers

OBJECTIVES

- Multiply whole numbers
- Divide whole numbers

CORE SKILLS & PRACTICES

- Core Skill: Find Reverse Operations
- Reading Skill: Draw Evidence from Text

Key Terms

dividend
the number that is divided in a division problem

division
the operation that is used to separate a quantity into parts

divisor
the number that is dividing in a division problem

factor
a number that is multiplied

multiplication
repeated addition

product
the answer to a multiplication problem

quotient
the answer to a division problem

Vocabulary

context
the setting, events, or ideas surrounding something

Key Concept

Multiplication is the operation of adding a certain quantity a set number of times. Division is the operation that is used to separate a quantity into parts.

Overview

Model examples of multiplication as repeated addition, and division as the separation of a whole into parts. Students may draw pictures or use hands-on objects, such as desk supplies, to follow along with the process. Have students share and explain their models. Ask questions to help students. For example, ask: *How does your model demonstrate the relationship between multiplication and repeated addition?*

Pre-Teach Vocabulary

Look for Connections

Have students examine the vocabulary words and discuss possible relationships among them. Encourage students to rely on their prior mathematics knowledge and experience to find connections. Write the words *Multiplication* and *Division* in separate circles on the board and explain the terms, if necessary. Then invite students to add circles to connect examples and ideas to the central circles. Challenge students to make connections between the two operations, too, if they are able.

Multiply Whole Numbers

Read the introductory text with students, and emphasize the boldfaced words. Work through Example 1 as a class. Ask: *When we multiply large numbers, why do we write sets of numbers in the problem vertically instead of horizontally? Why do we write the larger number on top?* As you complete the problem together, point out that the order of the factors doesn't matter, but putting the larger factor first and stacking the factors on top of each other make multiplication easier. For students who appear to have difficulty aligning factors and regrouping, encourage them to draw vertical lines to distinguish place values before they attempt to solve problems.

Have students complete Example 2 on page 12. Organize students into pairs and have pairs compare answers, and if they find discrepancies, have them determine where they might have made a mistake and try again.

Math Link

Explain to students that when they hear or read the term *regrouping* in mathematical operations, they are actually carrying. Also help students see how important it is to write the values they are regrouping in the correct place-value column. Use the problem in Example 1 to demonstrate regrouping and placing all of the regrouped values correctly.

Core Skill: Find Reverse Operations

Explain to students that like addition and subtraction, multiplication and division are also opposite operations. This means they can use multiplication to check division, and division to check multiplication. Each operation "undoes" the other. Have a volunteer demonstrate checking an addition sum using subtraction.

Remind students that in Lesson 2, addition and subtraction were called opposite operations. In this lesson, multiplication and division are called reverse operations. Explain that as they read math texts, they may come across another term that also means opposite or reverse operations. It is *inverse operations*. Whether

Notes:

using the term opposite, reverse, or inverse, the action is the same, and it can be applied to check addition and subtraction, as well as multiplication and division. Ask: *What inverse operation can we use to check our work in Example 3?* Allow a volunteer to demonstrate the process.

Divide Whole Numbers

Point to the division problem represented four different ways. Ask students which formats they have used in the past. Ask: *What are the common elements in each of the representations?*

Guide students through Example 3. Offer additional practice problems that give you time to observe students' skill at finding quotients without remainders. Identify and help students resolve common problems, such as aligning numbers correctly, and applying basic rules.

Guide students through Example 4 on page 13. Point out the remainder and how the remainder is represented in the quotient. Then have students complete Example 5. Afterward, have students use calculators and reverse operations to check the answers in both examples on this page.

Reading Skill: Draw Evidence from Text

Write the word *context* on the board. Explain to students that a context is a setting or location. Give an example, such as: *I read a book about the construction of the Eiffel Tower, which served as the entrance to a world's fair. The context of the book is Paris, France, in the late 1800s.* Then explain that math problems are often set in specific contexts, too, and that students can sometimes get clues from the context to figure out how to solve a problem. Ask students: *How might the context of a math problem help you solve it? What should you look for?*

Read the sidebar as a class. Examine the problem involving Jorgé and ask students to identify words from the problem that tells them how to solve the problem. For example, students might note the expressions "every week," "total," and "at the end of 17 weeks." Explain that students should look for evidence such as this to determine their strategies for solving problems. Repeat the process with the problem involving Keisha. Then have students record words they can look for as evidence of the need to divide to solve a problem.

Vocabulary Review, Skill Review, and Skill Practice

This section gives students an opportunity to review math skills, check their comprehension of the key terms and vocabulary, and practice the skills taught. Review the concepts and skills with students and provide support as needed.

Engage and Extend

ELL Instruction: Model Operations

Ask students to use pictures or objects to demonstrate and explain the processes of multiplication and division. Students may want to model original problems or use examples from the lesson. Ask questions to encourage them to talk about their thinking and understanding as they progress.

Extension Activity: Draw Conclusions Based on Factors

Organize students into small groups. Randomly assign five different digits to each group. Have groups work together to use their digits to create two factors, one with two digits and a second with three digits. Tell students that their goal is to find two factors with the greatest product. Encourage students to share and justify their work.

Perpendicular and Parallel Lines

OBJECTIVES

- Define parallel lines
- Define perpendicular lines
- Use slope to identify parallel and perpendicular lines and solve geometric problems
- Determine the equation of a parallel line from a point not on a given line to that line
- Determine the equation of a perpendicular line from a point not on a given line to that line

CORE SKILLS & CORE PRACTICES

- Model with Mathematics

Key Terms

parallel lines
lines in a plane which do not intersect

perpendicular lines
lines in a plane that intersect at a 90° angle

Vocabulary

plane
a flat two-dimensional surface that extends infinitely far

slope
the rate of change of a line

Key Concept

Determine and compare the slopes of lines to identify if they are perpendicular or parallel.

Overview

Lines can be determined if they are parallel or perpendicular by comparing the slopes of the lines. Draw parallel and perpendicular lines on the same coordinate plane. Determine the slopes of the lines and compare them, showing that parallel lines have the same slope and that perpendicular lines have slopes that are negative reciprocals of each other. Students may individually draw lines to follow along with the process. Have students share and explain how the slopes of lines can be used to determine if they are parallel or perpendicular. Ask questions to help students. For example, ask: *How does the slopes of lines determine if the lines are parallel or perpendicular?*

Evidence-Based Reading Support

Write the word *parallel* on the board. Review with students that math problems are often set in specific contexts. Give an example, such as: *The initial drop of roller coaster A looks parallel to the initial drop of roller coaster B.* Explain to students that math problems are often set in specific contexts and that students can sometimes get clues from the context to figure out how to solve a problem. Ask students: *How might the use of the word, parallel, be used to compare the speed of the roller coasters?*

Accessing Prior Knowledge

Have students examine the vocabulary words and discuss possible relationships among them. Encourage students to rely on their prior knowledge and experience to find connections. Write the words *line, slope, parallel,* and *perpendicular* in separate circles on the board and explain the terms, if necessary. Then invite students to add circles to connect examples and ideas to the central circles. Challenge students to make connections between the terms, too, if they are able.

Parallel and Perpendicular Lines

In this concept, students will learn how to use slope to identify parallel and perpendicular lines.

Arrange students into small groups and assign each group one of the following sets of three equations.

$y = \frac{1}{3}x - 2, y = \frac{1}{3}x + 1, y = -3x + 2$ $\qquad$ $y = -2x + 3, y = -2x - 1, y = \frac{1}{2}x + 1$

$y = -3x, y = -3x + 2, y = \frac{1}{3}x$ $\qquad$ $y = \frac{1}{2}x - 1, y = \frac{1}{2}x + 3, y = -2x + 1$

Instruct groups to graph their three equations on the same coordinate plane, identify the slope of each line, and determine which lines are parallel and which are perpendicular. Invite a member from each group to share what they discovered about the slopes of parallel and perpendicular lines. Encourage the class to use all of the examples to generalize what is true about the slopes of all parallel and all perpendicular lines.

Notes:

Vocabulary Review, Skill Review, and Skill Practice

This section gives students an opportunity to review math skills, check their comprehension of the key terms and vocabulary, and practice the skills taught. Review the concepts and skills with students and provide support as needed.

ELL Instruction:

Ask students to use pictures or objects to demonstrate and explain the processes of determining if lines are parallel or perpendicular. Students may want to model original problems or use examples from the lesson. Ask questions to encourage them to talk about their thinking and understanding as they progress.

Extension Activity:

Organize students into small groups. Have each group create a new problem to determine if two linear equations are perpendicular or parallel. Ask questions to encourage them to talk about their thinking and understanding as they progress. Groups may exchange problems and solve them if time permits.