COMMON CORE ACHIEVE

Mastering Essential Test Readiness Skills

GED® Test Student Supplement

MATHEMATICS

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To the Student

Congratulations! If you are using this book, it means that you are taking a key step toward achieving an important new goal for yourself. You are preparing to take the GED® Test in order to earn your high school diploma, one of the most important steps in the pathway toward career, educational, and lifelong well-being and success.

Common Core Achieve: Mastering Essential Test Readiness Skills is designed to help you learn or strengthen the skills you will need when you take the GED® Test. The *GED® Test Math Student Supplement* provides you with additional instruction and practice of the key concepts, core skills, and core practices required for success on test day and beyond.

How to Use This Supplement

This supplement is designed to support or enhance the lessons in the Core Student Module 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. Understanding these concepts will help you better prepare for the GED® Test and for college-level math courses.

At the back of this supplement, you will find the answer key. The answer to each question in the supplement is provided along with a rationale for why the answer is correct. If you get an answer incorrect, please return to the appropriate page to review the specific concept again.

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

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.

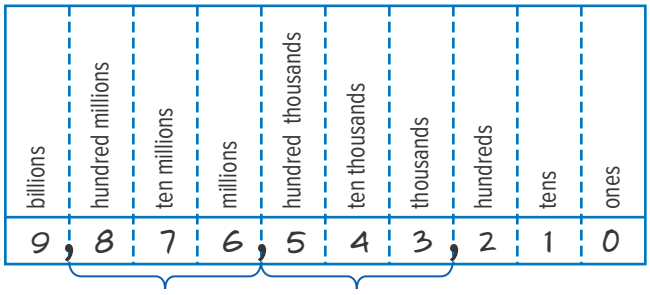
1. What number is 1 more than 8?
2. What number is 1 less than 73?
3. What number is 10 more than 60?
4. What number is 10 less than 45?

Place Value

Digits are the ten number symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. A number is an arrangement of digits in a particular order. The numbers beginning with 0, 1, 2, 3, and so on are the set of **whole numbers**. The position of a digit in a number determines its **value**, or how much it represents.

Starting from the ones place, commas are inserted every third number to separate a number into groups of three, called **periods**.

Place-Value Chart



Example 1: Use a Place-Value Chart

In the number 137,258,406, which digit is in the ten millions place?

Step 1: Locate the ten millions place in the place-value chart. A chart is an arrangement of numbers or other information.

Step 2: Find the digit in 137,258,406 that is in that position. The 3 is in the ten millions place.

Example 2: Determine the Value of the Digits

What is the value of each digit in the number 105?

Step 1 1 is in the hundreds place. Its value is 1 hundred or 100.

Step 2 0 is in the tens place. No tens are in the number 105.

Step 3 The 5 is in the ones place. Its value is 5 ones, or 5.

CORE PRACTICE

Model with Mathematics

Charts, which are diagrams that show information, can help you understand place value. In the place value chart on the previous page, for example, the place value is shown for each digit in the number, and periods are indicated. In a notebook, write a sentence explaining how the value of each digit in the number 5,555 changes as the digits move from the right of the number to the left.

MATH LINK

Remember that zeros hold a position and should not be ignored. When writing numbers, write a zero for each place that is not expressed in words.

Think about Math

Directions: Identify the value of the underlined digit.

1. 6,<u>1</u>25 _____
2. 4<u>3</u>,203,670 _____
3. 227,<u>5</u>19,078 _____
4. <u>4</u>,655,540,232 _____
5. 9,7<u>8</u>2,460,246 _____

Identify the Main Idea

Most of the material you read both at home and in school contains a **main idea**. The main idea tells what the paragraph, article, or lesson is about. The other sentences support the main idea.

The main idea is not always found in the first sentence or even in the first paragraph of a passage. It might be found almost anywhere within a passage. Sometimes the main idea is not even stated directly.

To identify the main idea ask: *What is this passage about?*

Read the following paragraph and identify the main idea.

(1) For some problems, an exact answer is not needed. (2) An estimate (an **approximate**, or "about," answer) will be sufficient. (3) It is also good to estimate an answer, then solve the problem, and finally check the solution by comparing the estimate to the exact answer.

Sentence 1 is a general suggestion that exact answers are not always needed. Sentence 2 explains what an estimate is and states that it may be all that is needed to answer a math problem. Sentence 3 states the usefulness of making an estimate first, finding an exact solution, and then comparing the two. Sentences 1 and 3 support Sentence 2. Sentence 2 states the main idea.

Read and Write Whole Numbers

In general, we read whole numbers in words and use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 to write them.

Example 3: Read Whole Numbers

Read the number 28,304.

Step 1 Begin at the left of the number. Read the number in each period, and replace the comma with the name of the period.

So, the number 28,304 means 28 thousands, 3 hundreds, 0 tens, 4 ones.

Step 2 Read the number 28,304 as "twenty-eight thousand, three hundred four."

When reading whole numbers, remember to concentrate on each period and the positions of all the digits.

Example 4: Write Whole Numbers

Write the number *six million, two hundred ninety-one thousand, fifty* as a whole number.

Step 1 Six million becomes 6,000,000.

Two hundred ninety-one thousand becomes 291,000.

Fifty becomes 50.

Step 2 Combine the whole number parts.

6,000,000 + 291,000 + 50 = 6,291,050

When you write whole numbers, think about the place-value chart. Remember to insert zeros as needed.

Think about Math

Directions: Match the number to its name in words.

_____	**1.** ten million, five hundred thousand	**A.**	420,000
_____	**2.** eighty-one thousand, nine hundred	**B.**	33
_____	**3.** seven thousand, two hundred fifteen	**C.**	10,500,000
_____	**4.** thirty-three	**D.**	7,215
_____	**5.** four hundred twenty thousand	**E.**	81,900

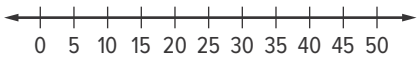
21ST CENTURY SKILL

Access Information

You obviously learn math from your textbook and teacher. But in this Information Age, your math education can be enriched if you explore other ways to master the subject. You can join an online Math Club, for example, where like-minded students share what they have learned in their own exploration of the mysteries of math. Your teacher can also provide you with books that would further your math education.

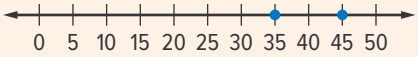
Compare and Order Whole Numbers

Compare numbers by using a **number line**. A number line is a list of numbers arranged in order from left to right on a line. The numbers are larger the farther right they are on the number line.



Example 5: Use a Number Line to Compare Numbers

Which is greater, 35 or 45?



Step 1 Locate each number on the number line.

Step 2 45 is to the right of 35, so 45 is greater than 35. Write this as 45 > 35 (45 is greater than 35) or 35 < 45 (35 is less than 45).

MATH LINK

When using the inequality symbols < and >, remember that the pointed end of the symbol always points to the smaller number.

Example 6: Use Place Value to Compare Numbers

Compare. Write < or > in the blank to make a true statement.

12,358 _____ 12,421

Step 1 To compare, align the numbers by place value.

12,358
12,421

Step 2 Start at the left. Compare the digits until they differ.

12,358
12,421

The digits in the hundreds place are different. 3 is less than 4, so 12,358 < 12,421.

Example 7: Order Whole Numbers

Write the set of numbers in order from greatest to least.

4,134,805 5,883,081 4,147,001

Step 1 Align the numbers by place value. Start at the left and compare digits.

4,134,805
5,883,081
4,147,001

Step 2 5 > 4, so 5,883,081 is the greatest number. Continue comparing the other numbers until the digits differ.

4,134,805
4,147,001

4,147,001 > 4,134,805

So, 5,883,081 > 4,147,001 > 4,134,805.

Think about Math

Directions: Answer the following.

1. How would you use place value to compare 187,710 and 187,285?

_____

_____

2. Place the numbers below in order from least to greatest.

229,465 229,378 230,052

_____

Vocabulary Review

Directions: Complete the sentences below using one of the following words.

approximate **digits** **number line** **periods** **value** **whole numbers**

1. The position of a digit in a number determines its _____.
2. The set of numbers beginning with 0, 1, 2, 3, and so on is the set of _____.
3. Starting from the ones place, insert commas every third place to separate a number into groups of three called _____.
4. The number system used today is based on the _____ 0 through 9 arranged in a particular pattern.
5. Antonia did not need an exact answer, so she found an _____ answer.
6. Numbers can be compared by using a _____.

Skill Review

Directions: Write the value of each digit based on the place-value chart.

millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones
8	6	9	3	2	5	4

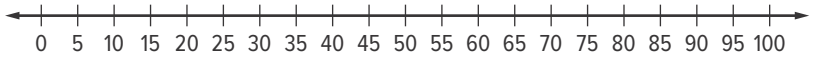
1. 8 _____
2. 6 _____
3. 9 _____
4. 3 _____
5. 2 _____
6. 5 _____
7. 4 _____

Directions: Create a place-value chart for each number below.

8. 3,182
9. 6,428,910

Skill Review (continued)

Directions: Locate each point on a number line. Then compare the numbers.



10. 47, 5 **11.** 12, 33 **12.** 63, 82 **13.** 31,29

Directions: Identify the main idea of the passage.

14. A number line is a straight line with numbers that are positioned from the lowest value to the highest values. The numbers are usually shown on specially marked points evenly spaced on the line. The number line is a tool that can be used to aid in determining the answers to basic arithmetic operations such as addition, subtraction, multiplication, and division.

15. The number system that is commonly used today includes the digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The digit at the far right of a number has a place value of one. Other digits in a number have a place value of ten times the digit that is located on its right. Therefore, numbers with more digits will be larger than numbers with fewer digits.

Skill Practice

Directions: Choose the best answer to each question.

1. What is the place value of the digit 7 in the number 327,465?
- A. hundred thousands
- B. ten thousands
- C. thousands
- D. hundreds

2. Padma wrote a check for $196 to pay her electricity bill. How did she write this number in words on the check?
- A. one hundred nine-six
- B. one hundred ninety
- C. one hundred ninety-six
- D. one ninety six

3. In which of the answer choices below are the numbers arranged from least to greatest?
- A. 8,120,032; 8,019,765; 8,018,811
- B. 21; 19; 17
- C. 1,061; 1,059; 1,063
- D. 465; 474; 483

4. Hamilton checked the prices on four cell phones he was thinking about buying. Which cell phone was the most expensive?
- A. Phone A: $249
- B. Phone B: $241
- C. Phone C: $199
- D. Phone D: $228

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

MATH LINK

Numbers in an addition problem can be added in any order.

$5 + 6 = 11$ $6 + 5 = 11$

Key Concept

Addition and subtraction are basic operations in mathematics.

Write each number in words.

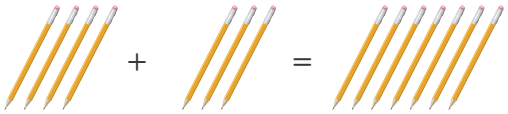
1. 37 _____
2. 1,008 _____
3. 152 _____
4. 32,000 _____

Use a less than (<), greater than (>), or equal to (=) symbol to compare each pair of numbers.

5. 15 ☐ 39
6. 301 ☐ 108
7. 222 ☐ 44
8. 1,234 ☐ 1,324

Add Whole Numbers

The most basic of all **operations**, or processes, in mathematics is **addition**. Addition is the combining of two or more numbers. Suppose you have two sets of pencils: 4 in one set and 3 in the other. Find the total number of pencils by combining the two sets or adding 4 + 3.



4 + 3 = 7

The answer to an addition problem is called the **sum**, or total. So the sum of 4 and 3 is 7.

Example 1: Add Two-Digit Numbers

Find the sum of 32 and 47.

Step 1 To **calculate** means to find the answer using a mathematical process. To calculate the sum of an addition problem, line up the digits with ones under ones, tens under tens, and so on.

$$\begin{array}{r} 32 \\ +\ 47 \\ \hline 79 \end{array}$$

Step 2 Add the ones column.

Step 3 Add the tens column.

CORE PRACTICE

Attend to Precision

In mathematics, the words ***accuracy*** and ***precision*** are related to measurement. Accuracy refers to how close an answer is to a true, or real, value. For example, consider the problem 18 + 15. Say that three people find three sums: 32, 33, 34. The accurate sum is the one that comes closest to the true value of 18 + 15, which is 33. The answer 33 is accurate, and it takes only one process or calculation to find the value.

Now consider precision. Precision usually refers to the extent that more measurements or calculations give the same results. In other words, if you use a process to add 18 + 15 and then use a calculator to check your answer, the result is the same. If you ask a friend to solve the problem, the answer is also the same. It is a precise answer, or one that remains the same in multiple trials.

Work with a partner, and take turns posing addition problems. Solve the problems by hand and again by using a calculator to apply both accuracy *and* precision.

Example 2: Column Addition

Add: 248 + 36 + 1,987

Step 1 Line up the digits by place value.

Step 2 Add the digits in the ones column and write the sum at the bottom. If the sum has more than one digit, carry the left digit to the next column.

Step 3 Repeat until all columns have been added.

```
  1 1 2
    2 4 8
      3 6
+ 1 9 8 7
  2,2 7 1
```

Example 3: Add Whole Numbers on a Calculator

Use a calculator to find the sum of 2,179 + 873.

Press 

Press 

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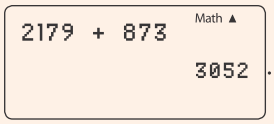
The display should read 

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Think about Math

Directions: Solve each problem.

1. 27 + 65 **2.** 43 + 19 **3.** 22 + 283 + 145

Subtract Whole Numbers

Subtraction is deducting, or taking away, an amount from another amount. To find how many objects remain in a set of objects after some of them are removed, use subtraction. Suppose you have 8 pencils in a set and take away 5 of them. Find the number of pencils by performing the operation 8 – 5.

The answer to a subtraction problem is called the **difference**. The difference between 5 and 8 is 3. Subtraction is also used to compare one amount to another: for example, the question, "How many more people registered to vote this year than last year?"

MATH LINK

The order of the numbers in subtraction cannot be changed. For example, $5 - 2$ is not the same as $2 - 5$.

MATH LINK

Addition and subtraction are opposite operations. Subtraction can be used to check a sum.

To check $7 + 3 = 10$, use $10 - 7 = 3$.

Addition can be used to check a difference.

To check $15 - 9 = 6$, use $6 + 9 = 15$.

Example 4: Subtract Numbers Without Regrouping

Subtract 254 from 497.

Step 1 The sentence translates to $497 - 254$. In order to calculate the difference, write the digits in the ones under ones, tens under tens, and so on. Start with subtracting the ones, $7 - 4$.

Step 2 Subtract the digits in the tens and then the hundreds columns.

$$\begin{array}{r} 497 \\ -\ 254 \\ \hline 243 \end{array}$$

Example 5: Subtract Numbers with Regrouping

Find $2{,}754 - 657$.

Step 1 Begin in the ones column. Since you cannot subtract 7 from 4, regroup a ten as 10 ones. Subtract.

Step 2 Move to the tens column. Since you cannot subtract 5 from 4, regroup a hundred as 10 tens. Subtract.

Step 3 Move to the hundreds column. Subtract.

Step 4 Bring down the 2 in the thousands place.

$$\begin{array}{r} {\scriptstyle 14} \\ 2,7\not{5}\not{4} \\ -\ \ 657 \\ \hline 2,097 \end{array}$$

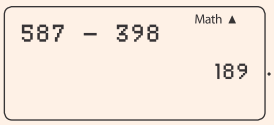
Example 6: Subtract Whole Numbers on a Calculator

Use a calculator to find the difference of $587 - 398$.

Press [on]

Press [5] [8] [7] [−] [3] [9] [8] [enter].

The display should read



Think about Math

Directions: Solve each problem.

1. $75 - 39$ **2.** $1{,}755 - 624$ **3.** $363 - 84$

Vocabulary Review

Directions: Complete each sentence with the correct word.

calculate **difference** **operations** **sum**

1. The result in subtraction is called the _____.
2. To _____ is to find an answer using a mathematical process.
3. The answer to an addition problem is its _____.
4. Addition and subtraction are basic _____ in mathematics.

Skill Review

Directions: Identify the context clue for each word problem. Then solve the problem.

1. Elena's salary last year was $42,325. This year her salary was $47,639. How much more did she earn this year than last year?
2. Shawn has $1,274 in his bank account. He pays a medical bill of $386. How much money is left in his bank account?
3. Ravi's total pay for the month is $2,635. If his deductions come to $689, what is his net pay for the month?
4. Yesterday, 6,482 people attended the game at Riverhead Stadium. Today, attendance was up by 2,205. How many people attended the game today?
5. Brattleboro Bagels sold 4,356 bagels last week, and 3,829 bagels this week. How many bagels were sold in the two weeks together?
6. Rikki bought a car for $13,550. After 3 years, the car had lost some of its value. It had depreciated $4,875. How much is the car worth now?
7. Patrons took out 754 books from the library on Saturday, and 649 books on Sunday. How many books in total did patrons take out over the weekend?

Skill Practice

Directions: Choose the best answer to each question.

1. A specialty knapsack manufacturer produced 18,235 knapsacks last year, and 37,110 this year. How many more knapsacks did the company produce this year?
   A. 55,345
   B. 18,875
   C. 18,235
   D. 1,823

2. On a trip across the country, Susana and her friends drove 522, 368, 514, 489, and 427 miles on 5 different days. How many miles did they drive in all?
   A. 2,320
   B. 2,230
   C. 2,220
   D. 2,180

3. The school librarian did an inventory of books on the nonfiction shelves. He counted 238 books in one bookcase, 264 in another, and 322 in a third. How many books in total were on the shelves?
   A. 560
   B. 586
   C. 724
   D. 824

4. A start-up company earned $962,500 last year. This year they have a goal of earning $1,500,000. How much more do they aim to make this year?
   A. $62,500
   B. $500,000
   C. $537,500
   D. $2,462,500

OBJECTIVES

- Multiply whole numbers
- Divide whole numbers

CORE SKILLS & PRACTICES

- Find Reverse Operations
- 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.

Add.

1. $4 + 8$
2. $57 + 13$
3. $142 + 89$
4. $909 + 111$

Subtract.

5. $86 - 53$
6. $718 - 81$
7. $100 - 54$
8. $21 - 9$

Multiply Whole Numbers

The answer to a **multiplication** problem is called the **product**. The numbers that are multiplied are the **factors**.

$$\text{factor} \times \text{factor} = \text{product}$$

An × or a dot (•) can be used to show multiplication. Here are two ways to write 3 times 9 equals 27.

$$3 \times 9 = 27 \qquad 3 \cdot 9 = 27$$

Example 1: Multiply Two Numbers

Multiply 736×45.

Step 1 Line up the digits you want to multiply with ones under ones, tens under tens, and so on. Put the number with more digits on top. Multiply each digit in 736 by the digit 5 in 45 to find the first partial product.

$$\begin{array}{r} 736 \\ \times\ 45 \\ \hline 3,680 \end{array}$$

Step 2 Multiply each digit in 736 by the digit 4 in 45. Start writing the second partial product so the last digit is under the 8.

Step 3 Add the partial products.

$$\begin{array}{r} 736 \\ \times\ 45 \\ \hline 3680 \\ 29440 \\ \hline 33,120 \end{array}$$

MATH LINK

In multiplication, the product of two single-digit numbers can be a double-digit number. In such cases, place the ones digit of the number in the partial product, and carry the tens digit over to the next multiplication. In the first step of Example 1 ($5 \times 6 = 30$), for example, the 0 is placed in the ones place. Then add (or carry) 3 to the next product, $5 \times 3 = 15$, to get 18. Now place 8 in the tens place, and carry and add 1 to the next product, $5 \times 7 = 35$, to get 36. The final product is 3,680. In most multiplication problems, some carrying to the next place value is needed.

CORE SKILL

Find Reverse Operations

You learned that addition and subtraction and also multiplication and division are reverse operations. This is not simply a "fun fact." A reverse operation allows you to check an answer that you came up with when solving a problem. Consider this division problem: Divide 25 by 5. You come up with the answer 20. You can check the answer by using the reverse operation. You turn the original divisor and the quotient in your solution into factors, and after multiplying the two numbers, you check the product against the original dividend. As soon as you do so, you see that your original answer was wrong, because $5 \times 20 \neq 25$. You didn't divide; you subtracted when solving the problem.

After you complete the Skill Practice questions for this section, check your answers by using the reverse operation in each case.

Example 2: Multiply Whole Numbers on a Calculator

Use a calculator to find the product of 489×15.

Press [on]

Press [4] [8] [9] [×] [1] [5] [enter].

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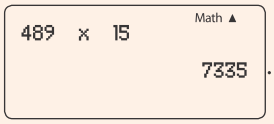


Think about Math

Directions: Find the product.

1. 6×22
2. 34×8
3. 260×5
4. 472×51
5. 638×41
6. $26 \cdot 17$
7. $31 \cdot 88$
8. 39×412
9. 363×500
10. $1{,}251 \times 46$

Divide Whole Numbers

The answer to a **division** problem is called the **quotient**. The number that is divided is the **dividend**, and the number that is dividing it is the **divisor**. There are several ways to show division.

dividend ÷ divisor = quotient			quotient / divisor)dividend
24 ÷ 8	8)24	24/8	$\frac{24}{8}$

Example 3: Divide Two Numbers

Divide: $372 \div 6$

Step 1 Find the largest number that you can multiply the divisor by to get a product that is less than or equal to the dividend. Since you cannot divide 6 into 3, start this problem by dividing 6 into 37.

$$6\overline{)372}$$

Step 2 Multiply $6 \times 6 = 36$, and subtract $37 - 36 = 1$. Continue to multiply, subtract, and bring down the next number. Divide 6 into 12.

$$\begin{array}{r} 6 \\ 6\overline{)372} \\ -36 \\ \hline 12 \end{array}$$

Step 3 Multiply and subtract.

$$\begin{array}{r} 62 \\ 6\overline{)372} \\ -36 \\ \hline 12 \\ -12 \\ \hline 0 \end{array}$$

READING SKILL

Draw Evidence from Text

Context is the setting, events, or ideas surrounding something. In reading, context is the surrounding words and sentences that help explain the meaning of a certain word. In math word problems, context clues can help the reader determine which operation to use in a word problem. Phrases such as *product* and *times* indicate multiplication. Phrases such as *quotient*, *split*, and *divided* mean division.

Sometimes a little more detective work is needed to determine the operation(s) that will solve a problem. Read the following word problems.

Jorgé puts $20 in his savings every week. What is the total he will have saved at the end of 17 weeks?

Keisha has a case of 100 granola bars. She eats five bars every week. How many weeks will the case of granola bars last?

Both problems contain the words *every week*. The first problem gives the number of weeks and is asking for a *total*, so multiplication is indicated. The second problem tells the total number of granola bars in a case and is asking for *how many weeks*, so division is the best choice.

In a notebook, make a list of phrases that are clues to using multiplication and another list of clues to using division.

Example 4: Divide

Divide: $4\overline{)2{,}374}$

Step 1 Divide 4 into 23.

Step 2 Multiply, subtract, and bring down the next number.

Step 3 Divide 4 into 37.

Step 4 Multiply, subtract, and bring down the next number.

Step 5 Divide 4 into 14.

Step 6 Multiply and subtract. There are no more numbers to bring down. The number 2 is the remainder.

$$\begin{array}{r} 593\ \text{R2} \\ 4\overline{)2{,}374} \\ -20 \\ \hline 37 \\ -36 \\ \hline 14 \\ -12 \\ \hline 2 \end{array}$$

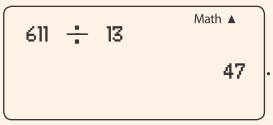
Example 5: Divide Whole Numbers on a Calculator

Use a calculator to find the quotient of 611 ÷ 13.

Press [on]

Press [6] [1] [1] [÷] [1] [3] [enter].

The display should read



Think about Math

Directions: Find the quotient.

1. $57 \div 4$
2. $225 \div 5$
3. $22\overline{)880}$
4. $17\overline{)5{,}123}$
5. 3,900/13
6. $1{,}274 \div 15$
7. $750 \div 25$
8. $31\overline{)656}$
9. $8\overline{)783}$
10. 534/21

Vocabulary Review

Directions: Write each word next to its meaning.

dividend **division** **divisor** **factor** **multiplication** **product** **quotient**

_____ **1.** the number by which the dividend is being divided

_____ **2.** one of the numbers in a multiplication problem

_____ **3.** the answer to a multiplication problem

_____ **4.** the number being divided

_____ **5.** repeating a quantity a set number of times

_____ **6.** the answer to a division problem

_____ **7.** separating a quantity into parts

Skill Review

Directions: Write the words or phrases that give a context clue to the correct operation. Solve the problem.

1. The local Little League had a total of 156 players register to play baseball. There are 12 teams planned for the league. How many players will each team have if the players are assigned evenly to the teams?

2. The local theater sold out each of the first five showings of a newly released movie. The theater has a total 224 seats. How many total tickets did the theater sell for the first five showings?

3. Heidi spent a total of $210 for gas for her car during the last 14 weeks. She spent the same amount each week. How much did she pay each week for gas?

4. Angelica is planning a dinner party. She plans to have a total of 54 guests. She plans to divide the guests evenly at nine tables. How many guests will be seated at each table?

5. Josh sells "Design Your Own" custom shirts. He has a total of nine boxes of plain shirts ready for customizing. Each box contains eight shirts. How many shirts does Josh currently have in inventory?

6. A paper towel package contains six rolls of paper towels. Each roll contains 48 sheets. How many total sheets of paper towels are in the entire package?

7. Christopher bought eight cases of soda. Each case contains 24 cans. How many total cans of soda did Christopher buy?

Skill Practice

Directions: Choose the best answer to each question.

1. A poultry farm is packing the day's eggs in cartons that hold 24 eggs each. How many cartons will be needed for 564 eggs?

A. 20 B. 23, with 12 eggs left over
C. 588 D. 13,536

2. Shawna has a goal of running 550 miles every month. To meet her goal, how many miles would she have to run in a year?

A. 45 B. 45, with a remainder of 10
C. 5,500 D. 6,600

3. The community center fund-raiser earned $2,844 from ticket sales. If tickets were $12 each, how many did they sell?

A. 214 B. 225, with a remainder of $15
C. 237 D. 521

4. A school orders 8 new computers, which cost $919 each. What is the total cost of the computers?

A. $927 B. $1838
C. $7,280 D. $7,352

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 & 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.

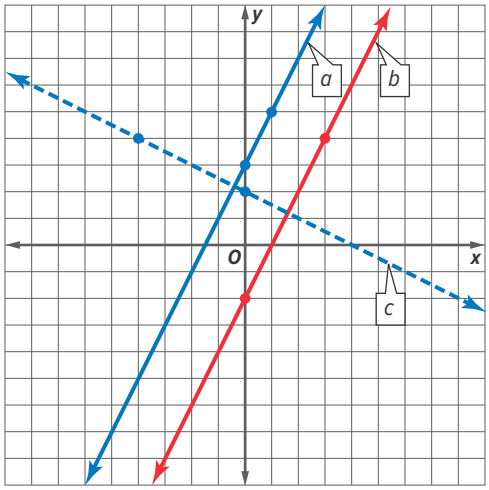
Parallel and Perpendicular Lines

Remember that a linear function has a constant rate of change, and so changes by equal differences over equal intervals. A linear function can be modeled by the equation $y = mx + b$, where m is the **slope** of the line and b is the point that the linear function crosses the y-axis on the coordinate plane. The slope is also referred to as the rate of change. The slope indicates if the line rises or falls and the "steepness" of the rise or fall.

Parallel lines are lines on a **plane** that never intersect. Lines can be determined if they are parallel by examining their slopes (m). If the slopes are equal, then the lines are parallel.

Perpendicular lines intersect to form right angles (90°). The slopes of perpendicular lines have a particular relationship to each other. If one line has a slope m, the slope of a line perpendicular to it will have a slope that is the negative reciprocal ($-1/m$).

Examine the three different lines drawn on the same coordinate plane. Lines a and b are parallel, and line c is perpendicular to both a and b.



Here are the equations of each line, written in slope-intercept form, $y = mx + b$.

Line	Slope	y-intercept	Equation
a	2	(0, 3)	$y = 2x + 3$
b	2	(0, −2)	$y = 2x - 2$
c	$-\frac{1}{2}$	(0, 2)	$y = -\frac{1}{2}x + 2$

Do you notice any patterns? The parallel lines, a and b, have the same slope. This makes sense because lines that have the same slope have exactly the same slant. But since they have different y-intercepts, they pass through different points. That means they will never intersect.

Rule: Two lines are parallel if they have the same slope.

How is the slope of line c different from the slopes of a and b? The slope of line c is negative, while a and b have positive slopes. Also notice that ½ is the reciprocal of 2. So, the slope of line c, −½, is the negative reciprocal of the slopes of lines a and b, 2.

Rule: Two lines are perpendicular if one slope is the negative reciprocal of the other.

Example 1: Identifying Lines

Determine whether the graphs of the equations $-7x + 2y = 8$ and $14x - 4y = 3$ are parallel.

Step 1 Rewrite both equations in slope-intercept form.

$-7x + 2y = 8$

$2y = 7x + 8$

$y = \frac{7}{2}x + 4$

$14x - 4y = 3$

$-4y = -14x + 3$

$y = \frac{-14}{-4}x - \frac{3}{4}$

$y = \frac{7}{2}x - \frac{3}{4}$

Step 2 Compare the slopes of both equations.

Both equations have a slope of $\frac{7}{2}$. Since the slopes are equal, the lines are parallel.

Think about Math

Directions: Answer the following questions.

1. Which equation has a graph that is parallel to the line with equation $2x - 4y = 8$?

A. $y = -\frac{1}{2}x + 2$

B. $y = \frac{1}{2}x + 2$

C. $y = 2x - \frac{1}{2}$

D. $y = -2x + 2$

2. The equation of the line n is $y = 4x + 5$. Line p is perpendicular to line n and passes through (4, −2). What is the equation of line p?

A. $y = 4x - 5$

B. $y = 5x + 5$

C. $y = -\frac{1}{4}x + 3$

D. $y = -\frac{1}{4}x - 1$

Vocabulary Review

perpendicular lines **parallel lines** **slope** **plane**

1. Lines in a plane that do not intersect are _____
2. A flat surface that extends indefinitely is a _____
3. _____ lines intersect at a 90° angle.
4. The _____ of a line is the rate of change.

Skill Review

1. Determine whether the graphs of the equations $-2x + 3y = 9$ and $4x - 6y = 3$ are parallel, perpendicular, or neither parallel or perpendicular.
   A. parallel
   B. perpendicular
   C. neither parallel or perpendicular

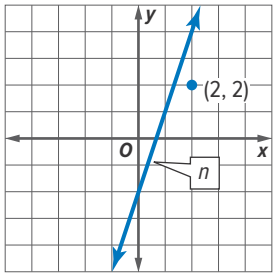
2. Determine whether the graphs of the equations $4x + 5y = 20$ and $3x + 2y = 6$ are parallel, perpendicular, or neither parallel or perpendicular.
   A. parallel
   B. perpendicular
   C. neither parallel or perpendicular

3. Determine whether the graphs of the equations $-5x + 2y = 10$ and $2x + 5y = -10$ are parallel, perpendicular, or neither parallel or perpendicular.
   A. parallel
   B. perpendicular
   C. neither parallel or perpendicular

4. Which linear function has a graph that is parallel to the line with the equation $4x + 2y = 6$?
   A. $y = -3x + 2$
   B. $y = \frac{1}{2}x + \frac{2}{3}$
   C. $y = 2x - \frac{1}{2}$
   D. $y = -2x + 2$

5. Which linear function has a graph that is perpendicular to the line with the equation $x + 2y = 6$?
   A. $y = \frac{1}{2}x - 6$
   B. $y = 2x - 3$
   C. $y = \frac{1}{4}x + 12$
   D. $y = -2x + 4$

6. Line p is parallel to line n shown in the graph below and passes through point (2, 2). What is the equation of line p?



Skill Practice

1. Determine whether the graphs of the equations $-3x + 2y = 8$ and $2x - 3y = 4$ are parallel, perpendicular, or neither parallel or perpendicular.

A. parallel
B. perpendicular
C. neither parallel or perpendicular

2. Determine whether the graphs of the equations $3x - 5y = 1$ and $5x + 3y = -6$ are parallel, perpendicular, or neither parallel or perpendicular.

A. parallel
B. perpendicular
C. neither parallel or perpendicular

3. Determine whether the graphs of the equations $-14x + 7y = 21$ and $-10x + 5y = -35$ are parallel, perpendicular, or neither parallel or perpendicular.

A. parallel
B. perpendicular
C. neither parallel or perpendicular

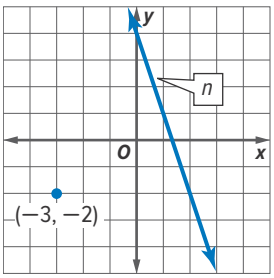
4. Which linear function has a graph that is parallel to the line with the equation $8x + 4y = -12$?

A. $y = 8x - 12$
B. $y = \frac{1}{2}x + \frac{2}{3}$
C. $y = -2x - \frac{1}{2}$
D. $y = -4x + 12$

5. Which linear function has a graph that is perpendicular to the line with the equation $3x - 9y = 18$?

A. $y = 3x - 6$
B. $y = \frac{1}{3}x - 3$
C. $y = -\frac{1}{9}x + 18$
D. $y = -3x - 6$

6. Line p is perpendicular to line n shown in the graph below and passes through point $(-3, -2)$. What is the equation of line p?



Lesson 1 Place Value

Key Concept, page 1

1. 9
2. 72
3. 70
4. 35

Think About Math, page 2

1. 1 hundred or 100
2. 3 millions or 3,000,000
3. 5 hundred thousands or 500,000
4. 4 billions or 4,000,000,000
5. 8 ten millions or 80,000,000

Think About Math, page 3

1. C.
2. E.
3. D.
4. B.
5. A.

Think About Math, page 4

1. Compare the digits of the numbers, going from left to right, until you find digits in the same column that are different. The digits in the hundreds place, 7 and 2, are not the same. Compare those digits. 187,710 > 187,285
2. 229,378; 229,465; 230,052

Vocabulary Review, page 5

1. value
2. whole numbers
3. periods
4. digits
5. approximate
6. number line

Skill Review, page 5–6

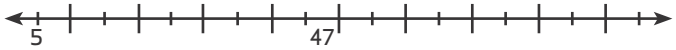
1. 8 millions or 8,000,000
2. 6 hundred thousands or 600,000
3. 9 ten thousands or 90,000
4. 3 thousands or 3,000
5. 2 hundreds or 200
6. 5 tens or 50
7. 4 ones or 4

8.

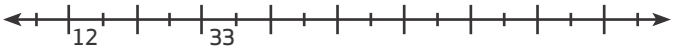
thousands	hundreds	tens	ones
3	1	8	2

9.

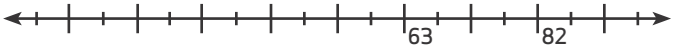
millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones
6	4	2	8	9	1	0

10. 

5 < 47 or 47 > 5

11. 

12 < 33 or 33 > 12

12. 

63 < 82 or 82 > 63

13. 

29 < 31 or 31 > 29

14. The number line is a tool that can be used to aid in determining the answers to basic arithmetic operations such as addition, subtraction, multiplication, and division.
15. Therefore, numbers with more digits will be larger than numbers with fewer digits.

Skill Practice, page 6

1. C. 7 is in the thousands place.
2. C. Answer (B) written as a standard number is 190; Answers (A) and (D) write out 196 in words incorrectly.
3. D. Answers (A) and (B) are in order from greatest to least; Answer (C) is not in order.
4. A. 199 < 228 < 241 < 249 so Phone A, which costs $249, is the most expensive.

Lesson 2 Add and Subtract Whole Numbers

Key Concept, page 7

1. thirty-seven
2. one thousand eight
3. one hundred fifty-two
4. thirty-two thousand
5. <
6. >
7. >
8. <

Think About Math, page 8

1. 92
2. 62
3. 450

Think About Math, page 9

1. 36
2. 1,131
3. 279

Vocabulary Review, page 10

1. difference
2. calculate
3. sum
4. operations

Skill Review, page 10

1. How much more; $5,314.
2. How much . . . is left; $888.
3. total pay, net pay; $1,946.
4. was up by, How many; 8,687 people.
5. How many . . . together; 8,185 bagels.
6. lost value, How much . . . now; $8,675
7. How many . . . in total; 1,403 books.

Skill Practice, page 10

1. B. Subtract 18,235 from 37,110 to *find how many more.*
2. A. Add all five numbers to find *how many miles in all.*
3. D. Add 238, 264, and 322 to find the number of books *in total.*
4. C. Subtract $962,500 from $1,500,000 to find *how much more.*

Lesson 3 Multiply and Divide Whole Numbers

Key Concept, page 11

1. 12
2. 70
3. 231
4. 1,020
5. 33
6. 637
7. 46
8. 12

Think About Math, page 12

1. 132
2. 272
3. 1,300
4. 24,072
5. 26,158
6. 442
7. 2,728
8. 16,068
9. 181,500
10. 57,546

Think About Math, page 13

1. 14 R1
2. 45
3. 40
4. 301 R6
5. 300
6. 84 R14
7. 30
8. 21 R5
9. 97 R7
10. 25 R9

Vocabulary Review, page 14

1. divisor
2. factor
3. product
4. dividend
5. multiplication
6. quotient
7. division

Skill Review, page 14

1. "total of 156 players" and "assigned evenly" — 13 players per team
2. "each of the first five showings" and "total tickets" — 1120 total tickets
3. "total of" and "spent the same amount each week" — $15 each week
4. "total of 54 guests" and "divide the guests evenly" — 6 guests per table
5. "total of 9 boxes" and "each box contains" — 72 shirts
6. "each roll" and "total sheets" — 288 total sheets
7. "each case contains" and "total cans" — 192 cans of soda

Skill Practice, page 14

1. B. Divide the number of eggs by the number of eggs each holds.
2. D. Multiply 550 miles times the 12 months in a year.
3. C. Divide the earnings of $5,214 by the ticket price of $12.
4. D. Multiply the cost of one computer, $919, times 8 computers.

Lesson 4 Perpendicular and Parallel Lines

Think About Math, page 16

1. B. **2.** D.

Vocabulary Review, page 17

1. Parallel lines **3.** Perpendicular

2. Plane **4.** Slope

Skill Review, page 17

1. Answer A. parallel. The lines have the same slope, $\frac{2}{3}$.

$-2x + 3y = 9$ $\quad$ $4x - 6y = 3$

$3y = 2x + 9$ $\quad$ $-6y = -4x + 3$

$\frac{3y}{3} = \frac{2x}{3} + \frac{9}{3}$ $\quad$ $\frac{-6y}{-6} = \frac{-4x}{-6} + \frac{3}{-6}$

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

2. Answer C. neither parallel or perpendicular. The lines have different slopes, $-\frac{4}{5}$ and $-\frac{3}{2}$.

$4x + 5y = 20$ $\quad$ $3x + 2y = 6$

$5y = -4x + 20$ $\quad$ $2y = -3x + 6$

$\frac{5y}{5} = \frac{-4x}{5} + \frac{20}{5}$ $\quad$ $\frac{2y}{2} = \frac{-3x}{2} + \frac{6}{2}$

$y = -\frac{4}{5}x + 4$ $\quad$ $y = -\frac{3}{2}x + 3$

3. Answer B. perpendicular. The slope of the first line, $\frac{5}{2}$, is the negative reciprocal of the slope of the second line, $-\frac{2}{5}$.

$-5x + 2y = 10$ $\quad$ $2x + 5y = -20$

$2y = 5x + 10$ $\quad$ $5y = -2x - 10$

$\frac{2y}{2} = \frac{5x}{2} + \frac{10}{2}$ $\quad$ $\frac{5y}{5} = \frac{-2x}{5} - \frac{10}{5}$

$y = \frac{5}{2}x + 5$ $\quad$ $y = -\frac{2}{5}x - 2$

4. Answer D, $y = -2x + 2$, has the same slope and is parallel to the line.

$4x + 2y = 6$

$2y = -4x + 6$

$\frac{2y}{y} = \frac{-4x}{2} + \frac{6}{2}$

$y = -2x + 3$

5. Answer B, $y = 2x - 3$, has a slope that is the negative reciprocal to the line and is perpendicular.

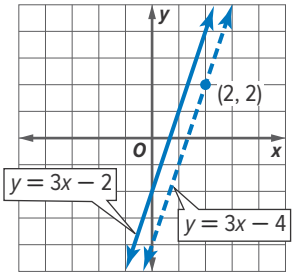
$x + 2y = 6$

$2y = -x + 6$

$\frac{2y}{2} = \frac{-x}{2} + \frac{6}{2}$

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

6. Line n has the equation $y = 3x - 2$ and has the same slope as the parallel line $y = 3x - 4$, which passes through the point (2, 2).



Skill Practice, page 18

1. Answer C. neither parallel or perpendicular. The lines have different slopes, $\frac{3}{2}$ and $\frac{2}{3}$.

$-3x + 2y = 8$ $\quad$ $2x - 3y = 4$

$2y = 3x + 8$ $\quad$ $-3y = -2x + 4$

$\frac{2y}{2} = \frac{3x}{2} + \frac{8}{2}$ $\quad$ $\frac{-3y}{-3} = \frac{-2x}{-3} + \frac{4}{-3}$

$y = \frac{3}{2}x + 4$ $\quad$ $y = \frac{2}{3}x - \frac{4}{3}$

2. Answer B. perpendicular. The slope of the first line, $\frac{3}{5}$, is the negative reciprocal of the slope of the second line, $-\frac{5}{3}$.

$3x - 5y = 1$ $\quad$ $5x + 3y = -6$

$-5y = -3x + 1$ $\quad$ $3y = -5x - 6$

$\frac{-5y}{-5} = \frac{-3x}{-5} + \frac{1}{-5}$ $\quad$ $\frac{3y}{3} = \frac{-5x}{3} - \frac{6}{3}$

$y = \frac{3}{5}x - \frac{1}{5}$ $\quad$ $y = -\frac{5}{3}x - 2$

3. Answer A. parallel. The lines have the same slope, 2.

$-14x + 7y = 21$ $\quad$ $-10x + 5y = 35$

$7y = 14x + 21$ $\quad$ $5y = 10x + 35$

$\frac{7y}{7} = \frac{14x}{7} + \frac{21}{7}$ $\quad$ $\frac{5y}{5} = \frac{10x}{5} + \frac{35}{5}$

$y = 2x + 3$ $\quad$ $y = 2x + 7$

4. Answer C, $y = -2x - \frac{1}{2}$, has the same slope and is parallel to the line.

$8x + 4y = -12$

$4y = -8x - 12$

$\frac{4y}{4} = \frac{-8x}{4} - \frac{12}{4}$

$y = -2x - 3$

5. Answer D, $y = -3x - 6$, has a slope that is the negative reciprocal to the line and is perpendicular.

$3x - 9y = 18$

$-9y = -3x + 18$

$\frac{-9y}{-9} = \frac{-3x}{-9} + \frac{18}{9}$

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

6. Line n has the equation $y = -3x + 4$ and has the negative reciprocal slope of the parallel line $y = \frac{1}{3}x - 1$, which passes through the point $(-3, -2)$.