Content-Area Strategies
Mathematics

WALCH PUBLISHING

GRADES 5–6

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Introduction

The goal of *Content-Area Strategies: Mathematics* is simple: to give students tools to communicate effectively. This book addresses math in terms of a set of integrated skills and strategies that work together to help students read, write, speak, and think critically for success in school and beyond. *Content-Area Strategies: Mathematics* is divided into three instructional sections: Vocabulary, Reading, and Writing.

Vocabulary

The building blocks of language are words. With this program, students begin by analyzing words, then synthesize what they have learned to develop strategies for comprehending new words. The Vocabulary section begins by introducing vocabulary strategies such as recognizing word parts, looking for word groups, and looking for context clues. Students then practice the strategies in a series of activities based on appealing short readings. Building vocabulary and learning how to figure out new words enhances reading, writing, speaking, listening, and thinking critically, giving students a broad base of language to draw on in classroom and real-life communication.

Reading

The second section presents reading strategies. Here, students acquire tools that help them read to learn. The transition from learning to read to reading to learn is vital to success in school and in life, and this section helps students broaden their expectations about text. Familiar patterns of narratives—stories with a beginning, a middle, and an end—are replaced by organizational constructs tailored to convey information. In this section, the act of reading is broken down into a process of steps. Students learn concrete strategies to read informational texts efficiently, to comprehend what they read, and to retain the information they have learned. The graphic organizers for the Reading section help students connect new information to their existing schemata, increasing their ability to recall and to take ownership of what they read. The reading strategies give students a way to "see" what they read—a great asset to visual learners. Organizing and writing what they read also cements information and concepts in students' minds and helps them retain it.

Writing

The Writing section is the third instructional part of *Content-Area Strategies: Mathematics.* In this section, students review the writing process and study models of good writing. Students learn to recognize common writing patterns and employ them themselves to write strong essays. The graphic organizers for the Writing section address each explicit step in the writing process. Breaking the process of writing an essay into a series of manageable steps makes the assignment easier to tackle and demystifies the act of writing.

Classroom Management

Content-Area Strategies: Mathematics is easy to use. Each lesson is self-contained and may be used in class or as homework. You may want to model the strategies used in each lesson, showing students that all readers and writers—including teachers—use tools and follow processes to communicate and comprehend. The blank graphic organizers may be photocopied for use in other assignments beyond this book. Students who need more support may benefit from more modeling or from completing some activities and graphic organizers in small groups. Metacognition—talking and writing about learning—can provide structure that supports new information and makes it easier to access. *Content-Area Strategies: Mathematics* transforms the abstract idea of learning into a concrete process that all students can master.

Vocabulary Strategies

Lesson 1
Prefixes and Suffixes

A helpful way to learn a new word is to break it into its basic parts. The root is the base of the word. Prefixes and suffixes are added to the root to form a word with a new meaning. You can often figure out the meaning of an unfamiliar word by examining the root, its suffixes, and prefixes.

What Are Prefixes?

Prefixes are word parts added to the beginning of a word. For instance, look at the word *pretest.* The root is test, which means "evaluate." The prefix *pre-* means "before." Adding the prefix and the root gives the meaning "evaluate before."

What Are Suffixes?

Suffixes are word parts added to the end of a word. For instance, look at the word *careless.* The root is *care,* which means "close attention." The suffix *-less* means "without or lacking."Adding the root and the suffix gives the meaning "without close attention."

Common Prefixes

Here is a list of common prefixes and their meanings.

Prefix	Meaning
ambi-	both
anti-	against
auto-	self
de-	from/down
dis-	opposite
in-, ir-	not
inter-	between
intro-, intra-	in, into, inside

Prefix	Meaning
mis-	bad, wrong
multi-	many
non-	not
pre-	before
pro-	forward
re-	again
tele-	distant, far
un-	not

Prefixes and Suffixes *(continued)*

Common Math Prefixes

Below is a list of prefixes whose meanings have to do with numbers.

Prefix	Meaning
bi-	two
centi-	hundred
deci-	ten
giga-	billion
hex-	six
milli-	thousands
mono-	one

Prefix	Meaning
nano-	billionth
non-	nine
oct-	eight
quad-	four
quint-	five
tera-	trillion

Common Suffixes

Here is a list of common suffixes and their meanings.

Suffix	Meaning
-able, -ible	able to be done
-ac, -al, -an, -en, -ic, -ine, -ish, -ive, -ous, -ious	of, like, relating to, being
-ance, -ence	state or condition, act, quality
-ed	past tense verbs
-en	make, become, cause to have
-er	comparative
-est	superlative
-ful	full of
-hood, -ness	state of, quality, condition
-ion, -tion, -ity	state, quality, act of
-ism	quality, doctrine, theory, system
-ment	act, state
-ship	state, quality, condition
-ular	of, relating to, or resemblinge

Prefixes and Suffixes *(continued)*

Prefixes and Suffixes in Action

Read the paragraph below. Look at the underlined words. As you read, decide what each word means. Then read one student's thought process to define these words.

The student is using a mirror to determine the number of lines of reflection in each shape. The equilateral triangle has three lines of reflection. The irregular hexagon has none. The square has four lines of reflection.

The word *reflection* is easy to define using suffix clues. I know the word *reflect* means "to give back or show an image." The suffix *-ion* means "state, quality, or act of." So, *reflection* means "the act of reflecting or the state of being reflected."

The word *irregular* has the root *regular.* This means "customary, usual, ordinary." The prefix *-ir* means "not." Putting those two meanings together, *irregular* means "not usual."

Application

Read the article below. Use prefixes, suffixes, and roots to figure out the meanings of the underlined words. Then complete the activity that follows the reading.

In the seventeenth century, John Graunt studied the social problems of his time. He made the first life tables showing seasonal patterns of deaths in several English cities. He found that accidents happened in about the same numbers every year.

Graunt was one of the first men to study epidemiology. This is the study of disease in human populations. These studies often lead to cures or help people find disease prevention strategies.

In 1854, a London doctor, John Snow, used epidemiology to stop the spread of the disease cholera. Thousands of people were dying. Snow analyzed the water supply in the hardest-hit area. At that time, many people did not have water in their homes. They got water from pumps in the street. He found that one water pump supplied many of the homes where people fell sick. Nearly 500 cases of cholera were reported within a few blocks of this pump. Snow found a sewer pipe near the well that fed the pump. He reasoned that the pipe was

Prefixes and Suffixes *(continued)*

contaminating the well and the pump water. The disease was first reported in August 1854. The pump handle was removed on September 8. After that, the number of deaths declined quickly. The use of data helped Snow figure out how to stop the spread of the disease. It also helped prevent numerous deaths.

Read each sentence below. Choose the word from the box that best completes each sentence. Write it on the line provided.

analyzed	declined	numerous	supplied
contaminating	epidemiology	prevention	

1. The study of health and disease in human populations is called_____.

2. The number of cholera cases _____ after people stopped drinking contaminated water.

3. Leslie applied for over 20 jobs and received _____ job offers.

4. The doctor carefully _____the patient's health records before suggesting surgery.

5. Chemicals from a factory were _____ the soil.

6. Allen _____ chips and pizza for the party.

7. The doctor encouraged patients to have yearly checkups. She believed strongly in disease _____.

Lesson 2
Word Roots

In Lesson 1, you learned that breaking words down often makes it easier to define them. You learned some prefixes and suffixes. Now you will learn about word roots. These parts carry the main meaning of a word.

Below is a list of common roots and their meanings. Many of these words are often used in mathematics.

Root	Meaning
act	do
alt	high
angle	corner, turn
aqua	water
aster, astro	star
bio	life
chron, chrono	time
cit	stir up
congru	come together
dia	across
dem	people
equ	equal
fract	break
gon	angle
holo	whole

Root	Meaning
line	line
mag, maj	big
micro	small
mid, medi	middle
meter, metr, metry	measure
milli	thousand
min	smaller
poly	many
prin, prim, prior	first
radi, radic	root
semi	half
sept	seven
tele	far
tetr	four
un	one

Roots in Action

Read the paragraph below. Look at the underlined word. Use your knowledge of roots to define the word. Then read another reader's approach to defining this word.

Geometry students studying circles must learn several new words. The distance around a circle is the circumference. The distance from the center of the circle to any point on the circumference is the radius. Students find the <u>diameter</u> by doubling the radius.

Word Roots *(continued)*

The word diameter is simple to define when you know the meanings of its parts. *Dia-* means "across" and *meter* means "measure." Diameter means "the measure or distance across."

Application

The following reading tells about how measuring devices have changed over time. Look at the underlined words. Use your knowledge of roots, prefixes, suffixes, and context clues to figure out their meanings. Then complete the activity that follows.

Early humans traveled by using the stars as a guide. Today, we travel to the stars. Along the way, different measuring tools have been developed to help explorers keep track of where they are.

One of the earliest of these tools was the astrolabe. This device consisted of a circular plate of metal and a rotating arm. Degrees were marked around the edge of the disk. With practice, the astrolabe could be used to find latitude. It became an important tool for sailors in the 1400s. They used it to set a course when they could not see land.

During the eighteenth century, the sextant came into use. This device consisted of one sixth of a circle and a movable arm. Degrees were marked along the curved edge. The sextant, still in use today, could be used to find latitude and longitude. These two measurements told a sailor where his ship was.

However, measuring longitude at sea was not easy. The user had to know just what time it was. And early clocks were not accurate at sea. Finally, in the eighteenth century, a clockmaker solved this problem. He created an accurate chronometer to be used on board ships.

Another measuring tool important to travelers is the altimeter. This device measures height above sea level. Today's altimeters use pressure to find altitude. This measurement tells an airplane pilot how high in the sky the plane is flying.

Word Roots *(continued)*

Complete the crossword puzzle, using the words in the box.

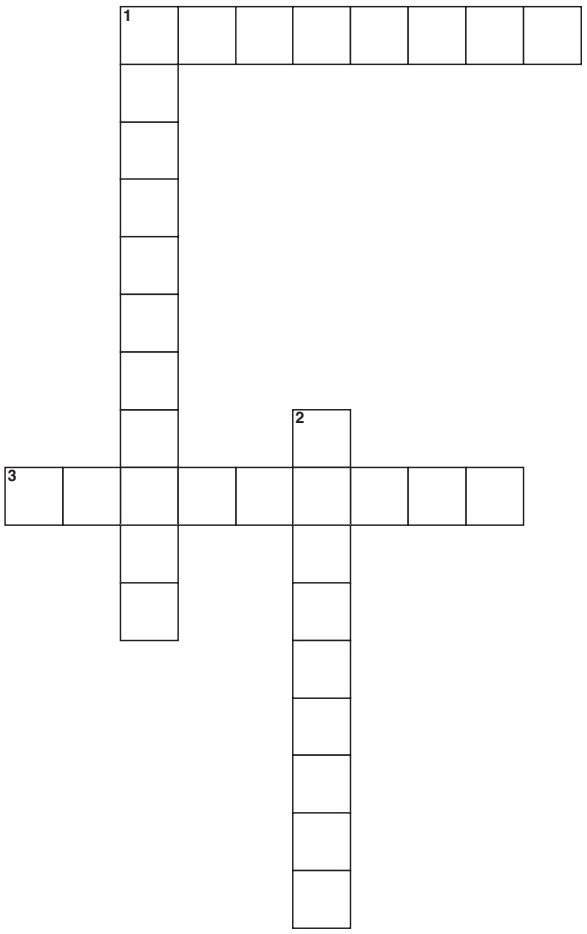
altimeter	chronometer
astrolabe	circular

Across

1. The root of this word means "round," and the suffix means "relating to or resembling."
3. The root of this word means "star" or "heavenly body."

Down

1. The roots of this word mean "time" and "measure."
2. The roots of this word mean "high" and "measure."



Lesson 3
Using Context Clues

Have you ever noticed that people who read a lot often have large vocabularies? How do you think they learn so many new words? They do not look up every unfamiliar word they come across. They use context clues to figure out new words.

Context Clues

Context clues are the words or sentences around a word that give clues about meaning. There are four basic types of context clues.

- **Definition/Explanation.** Sometimes a word's meaning is given immediately after the word.

  Example: A *tessellation* is a pattern made from flat shapes that fit together exactly without leaving any gaps or overlapping.

- **Restatement/Synonym.** A challenging word or phrase may be rewritten using simpler words.

  Example: John looked carefully at the outer edge of the circle and decided that the *circumference* was about 4 inches.

John was looking "at the outer edge of the circle." We can guess that the circumference is the distance around the outer edge.

- **Contrast/Antonym.** Sometimes a word or phrase is defined by saying what the word is unlike.

  Example: Unlike the mean, which gives the average of a group of data, the *median* is the data point in the middle of the data.

From the context clue, we know that the median is not the same as the average. It is the data point in the middle of the data.

- **Inference.** Often a word is not defined within the same sentence. The reader must look at the sentences around the unknown word and draw conclusions based on the information found there.

  Example: Andrew made several *Platonic solids.* He noticed something special about these three-dimensional shapes. All the faces in each Platonic solid were exactly the same.

From context clues we know that Platonic solids are "three-dimensional shapes" and that "the faces in each Platonic solid were exactly the same."

Using Context Clues *(continued)*

Context Clues in Action

Read the passage below. Notice the underlined words. After the reading, one reader's approach to understanding these words is shown.

The Legend of the Ancient Tower of Hanoi

Imagine a time long ago in ancient Vietnam. A ruler called together a group of conscientious monks. They were known for their hard work and attention to detail. He told them that 64 sacred disks had to be moved from one location to another. The disks were arranged in a stack, with the largest at the bottom and the smallest at the top. When the disks were moved, a larger disk could never rest on top of a smaller disk. There was only one other location where the disks could be placed temporarily during the move.

The monks pondered the problem for days. They tried to figure out how to move the disks in the fewest number of moves. One sagacious monk decided to start with a similar, simpler problem. He put 3 books in a stack, with the largest on the bottom and the smallest on the top. He chose three locations where the books could be placed. One at a time, he moved the books, following the rules laid out for the sacred disks. He found that it would take 7 moves to shift the books from one place to another.

Then the monk put 4 books in a stack and worked out how many moves it would take to move them. It would take 15 moves.

One monk was an astute mathematician. He was known throughout the kingdom for his wisdom. He wrote a formula to show how many moves it would take to move different numbers of disks. The formula was $2^n - 1$, where n stands for the number of disks to be moved.

The monk who designed the book problem used the formula to check his answers. If there were three books, it took 7 moves.

$$2^3 - 1 = 7$$

Then he checked his second example using 4 books. It took 15 moves.

$$2^4 - 1 = 15$$

His answers were both correct!

The monks shared their discovery with the ruler. He asked them how many moves it would take to transport 64 disks. The monk quickly did the math: $2^{64} - 1 =$ 18,446,744,073,709,551,615 moves.

As legend tells, when the monks reported their results, the ruler had devastating news. He said that when the last disk was placed in its final location, the temple would turn to dust. It would be the end of the world.

Using Context Clues *(continued)*

conscientious. Directly after the word, a **restatement/synonym** clue appears: "known for their hard work and attention to detail."

pondered. By **inference,** this word means "thought about."

sagacious. By **inference,** this means "having good judgment."

astute. The **restatement/synonym** clue that follows this word suggests it means "known for wisdom."

devastating. The **contrast/antonym** clue says that *devastating* is very different from *good.* The inference in the rest of the paragraph connects *devastating* and "the end of the world." Combining these clues suggests that this word means "terrible, awful."

Application

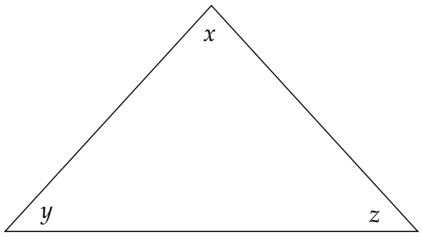
Read the following article. As you read, look at the underlined words. Use context clues to find their meanings. Then answer the questions that follow.

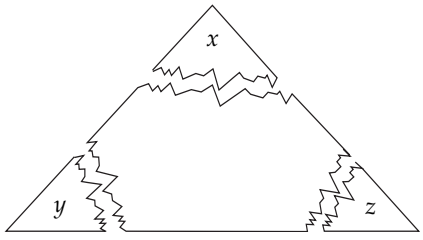
Triangles come in all sizes and shapes, but they all have three sides and three angles. The sum of the measures of the interior angles of a triangle is always the same. Interior angles are the angles inside a shape. To ascertain the sum, follow these steps.

Use a ruler to draw a large triangle on a sheet of paper. Cut it out.

Label the angles with the letters *x, y,* and *z.*

Tear off each angle of your triangle. Make sure you can still see the letters you used to label each angle.





Align the three torn pieces so that the angles meet at a common point and are adjacent, or next to each other.

What do you notice? The three angles form a straight, 180° angle. You have shown that the sum of the interior angles of a triangle is 180°.

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Using Context Clues *(continued)*

Now let's try something similar with a quadrilateral. Unlike a triangle, a quadrilateral is a four-sided figure. The sum of the four interior angles of a quadrilateral is also always the same. Let's find out what that measurement is.

Use a ruler to draw a large quadrilateral on paper. Cut it out.

Label each angle with the letters *a, b, c,* and *d.*

Tear off each angle of your quadrilateral. Make sure you can still see the letters you used to label the angles.

Align the four torn pieces so that the angles meet at a common point and are adjacent, or next to each other.

What do you notice? The four angles form a complete turn, or 360°. You have shown that the sum of the interior angles of a quadrilateral is 360°.

Each word below was used in the article you just read. Use context clues from the article to write your own definition for each word.

1. triangle

_____

_____

2. interior angles

_____

_____

3. ascertain

_____

_____

4. quadrilateral

_____

_____

Lesson 4
Counting and Arithmetic

Activity 1: Introducing Vocabulary in Context

Read the following article. Notice the words in bold type. Use context clues to figure out the meaning of these words.

Can you imagine a time when there was no **counting system,** or way to count and record numbers? There would have been no way to communicate how many baskets of grain a person had or how many animals someone owned. We know from artifacts that some early number concepts were used over 30,000 years ago. However, only in the past 6,000 years were actual calculations made in writings.

Many early counting systems were based on the number 10. The Egyptian number system was one of them. For the numbers 1 to 9 they used single lines. For the number 10 they used an arch. For the number 100 they used a rope with a loop. The number 122 looked like this:

The Egyptians had symbols for thousand, ten thousand, hundred thousand, and so on. This means the order of the numbers did not matter. For instance, look at the two Egyptian numbers that follow. They both represent the number 343.

or

One of the biggest breakthroughs in mathematics was the invention of **zero.** The word zero, written 0, comes from the Arabic word *sifr.* It means "empty" or "nothing." Zero is very important; here's why.

In our number system, order is important. If someone gave you $931 instead of $139, it would make a big difference! Our number system uses **place value.** Each place a number occupies has a set value. If the number 5 is in the tens place, it is worth 5 tens. In the hundreds place it is worth 5 hundreds.

So why is zero so important? In our counting system, where place value is important, we need a placeholder. When we write the number 901, we really mean

(continued)

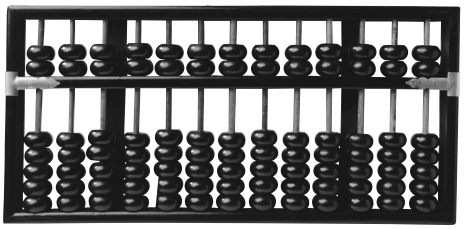
Counting and Arithmetic *(continued)*

$(9 \times 100) + (0 \times 10) + (1 \times 1)$. Without the number zero, we wouldn't be able to tell the numbers 91, 901, 9100, and 901,000 apart.

These two concepts, place value and the number zero, changed how people counted. By using just the digits 1 to 9 and zero, they could write any number. This also makes it easy to do calculations.

The Babylonians and Egyptians used a tool to count and do basic calculations 5,000 years ago: the **abacus.** Versions of this tool have been used by people around the world. The Chinese abacus is still used today. It consists of a rectangular frame with beads strung on parallel wires and a bar across the middle. There are two beads on the top section. They represent five units each. There are five beads on the bottom section. They represent one unit each. Each wire represents place value units. The first wire represents ones, the second one tens, the third shows hundreds, and so on. Some abacus frames include decimals. A **decimal** is a number used to name a whole quantity and/or its fractional part. This type of abacus included a decimal point and a section for recording tenths, hundredths, thousandths, and so on.

For centuries people tried to solve problems using their number systems. Many methods were developed. The Greeks developed a system called **arithmetic,** which means "the art of numbers." The system used four basic operations: addition, subtraction, multiplication, and division. **Addition** is a method of combining numbers to make bigger numbers. **Subtraction** is a method of taking things away; it is the opposite of addition.



Abacus

Multiplication is a method used to find the total when putting together groups of equal size. It was also known as repeated addition. **Division** is a method to find how an amount can be separated into an equal number of groups, or into groups of equal size. It is the opposite of multiplication and a quick way of doing repeated subtraction. These operations are the same ones we use today.

It is hard to imagine how different our world would be if the number zero had never been invented, or if we were still using unordered symbols as numbers. Banking, measurement, computer technology—almost everything would be different.

Counting and Arithmetic *(continued)*

Activity 3: Extending Vocabulary Strategies

Choose two vocabulary words or phrases from the box. Put each word or phrase in the center oval of one of the webs. First define each term. Then use each word or phrase in a sentence, and show an example of the concept or method.

abacus	decimal	place value
addition	division	subtraction
arithmetic	multiplication	zero
counting system