

Start Smart!

As you gear up to study mathematics, you are probably wondering, "What will I learn this year?" There are three focal points this year:

- Use basic principles of algebra to analyze and represent proportional and nonproportional linear relationships,
- Apply operations with rational numbers, and
- Use probability and statistics to make predictions.

Along the way, you'll learn more about problem solving, how to use the tools and language of mathematics, and how to THINK mathematically.

Let's Get Started!



Get Ready To Solve Problems

Problem-Solving Strategy: Look for a Pattern

Real-World Problem Solving

Tuning musical instruments is a science that also involves mathematics. All music is caused by vibrations. The number of vibrations per second is called the *frequency*. There is a pattern in the frequencies: the frequency of any note is 1.059 times the frequency of the note that is one-half step lower.



There are many problem-solving strategies in mathematics. One of the most common is to **look for a pattern**. To use this strategy, analyze the first few numbers in a pattern and identify a rule that is used to go from the first number in the pattern to the second, and then to the third, and so on. Then use the rule to extend the pattern and find a solution.

Real-World EXAMPLE

E-MAIL Ramon got an E-mail from his friend Angela. After 10 minutes, he forwarded it to 2 of his friends. After 10 more minutes, those 2 friends forwarded it to 2 more friends. If the message was forwarded like this every 10 minutes, how many people received Angela's E-mail message after 40 minutes?



EXPLORE *What are you trying to find? Restate the problem in your own words. Use as few words as possible.*
You need to find the total number of people who received the E-mail.

What other information do you need? Do you think you'll need any additional information such as a formula or a measurement conversion?

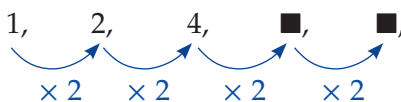
You do not need any additional information.

2 PLAN

Organize the data in a table. Look for a pattern in the data. Then extend the pattern.

Time (min)	People Receiving Message
0	1
10	2
20	4
30	■
40	■

3 SOLVE



To continue the pattern, multiply each term by 2.

$$4 \times 2 = 8 \qquad 8 \times 2 = 16$$

So, $1 + 2 + 4 + 8 + 16$ or 31 people got the message.

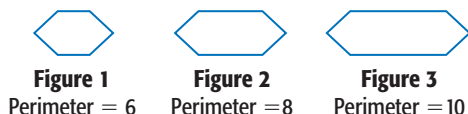
4 CHECK

In the 40th minute, 16 people received the E-mail. Half as many received it each time before that. So, it is reasonable that the total will be less than 16×2 or 32. ✓

Practice

Solve each problem by looking for a pattern.

- List the first five common multiples of 3, 4, and 6. Write an expression to describe all common multiples of 3, 4, and 6.
- Two workers can make two chairs in two days. How many chairs can 8 workers working at the same rate make in 20 days?
- Courtney travels south on her bicycle riding 8 miles per hour. One hour later, her friend Horacio starts riding his bicycle from the same location. If he travels south at 10 miles per hour, how long will it take him to catch Courtney?
- What is the perimeter of the twelfth figure?



- A ball bounces back 0.6 of its height on every bounce. If a ball is dropped from 200 feet, how high does it bounce on the fifth bounce? Round to the nearest tenth.
- A forest fire spread to 41 acres in 10 hours. Each hour the fire spreads to four more acres than the previous hour. How many acres were consumed during each hour of the fire?



Problem-Solving Strategy: Make a Table or List

One strategy for solving problems is to **make a table or list**. A table allows you to organize information in an understandable way. When you make a list, use an organized approach so you do not leave out important items.



Real-World EXAMPLE

A fruit machine accepts dollars, and each piece of fruit costs 65 cents. If the machine gives only nickels, dimes, and quarters, what combinations of those coins are possible as change for a dollar?

The machine will give back $\$1.00 - \0.65 or 35 cents in change in a combination of nickels, dimes, and quarters.

Make a table showing different combinations of nickels, dimes, and quarters that total 35 cents. Organize the table by starting with the combinations that include the most quarters.

quarters	dimes	nickels
1	1	0
1	0	2
0	3	1
0	2	3
0	1	5
0	0	7

The total for each combination of the coins is 35 cents. There are 6 combinations possible.

Practice

Solve each problem by making a table or list.

- How many ways can you make change for a half-dollar using only nickels, dimes, and quarters?
- A number cube has faces numbered 1 to 6. If a red and a blue cube are tossed and the faces landing up are added, how many ways can you roll a sum less than 8?
- A penny, a nickel, a dime, and a quarter are in a purse. How many amounts of money are possible if you grab two coins at random?
- The three counters at the right are used for a board game. If the counters are tossed, how many ways can at least one counter with Side A turn up?
- How many ways can you receive change for a quarter if at least one coin is a dime?
- Jorge had 55 football cards. He traded 8 cards for 5 from Elise. He traded 6 more for 4 from Leon and 5 for 3 from Bret. Finally, he traded 12 cards for 9 from Ginger. How many cards does Jorge have now?

Counters	Side 1	Side 2
Counter 1	A	B
Counter 2	A	C
Counter 3	B	C

Problem-Solving Strategy: Work Backward

In most problems, a set of conditions or facts is given and an end result must be found. However, some problems start with the result and ask for something that happened earlier. The strategy of **working backward** can be used to solve problems like this. To use this strategy, start with the end result and *undo* each step.

Real-World EXAMPLE

Kendrick spent half of the money he had this morning on lunch. After lunch, he loaned his friend a dollar. Now he has \$1.50. How much money did Kendrick start with?

Start with the end result, \$1.50, and work backward to find the amount Kendrick started with.

Kendrick now has \$1.50.	→	\$1.50	
<i>Undo</i> the \$1 he loaned to his friend.	→	+1.00	Add \$1.00 to undo giving his friend \$1.00.
		\$2.50	
<i>Undo</i> the half he spent for lunch.	→	$\begin{array}{r} \times 2 \\ \hline \$5.00 \end{array}$	Multiply by 2 to undo spending half the original amount.

The amount Kendrick started with was \$5.00.

CHECK Kendrick started with \$5.00. If he spent half of that, or \$2.50, on lunch and loaned his friend \$1.00, he would have \$1.50 left. This matches the amount stated in the problem, so the solution is correct.

Practice

Solve each problem by working backward.

1. Tia used half of her allowance to buy a ticket to the class play. Then she spent \$1.75 for an ice cream cone. Now she has \$2.25 left. How much is her allowance?
2. Lawanda put \$15 of her paycheck in savings. Then she spent one-half of what was left on clothes. She paid \$24 for a concert ticket and later spent one-half of what was then left on a book. When she got home, she had \$14 left. What was the amount of Lawanda's paycheck?
3. A certain number is multiplied by 3, and then 5 is added to the result. The final answer is 41. What is the number?
4. Mr. and Mrs. Delgado each own an equal number of shares of a stock. Mr. Delgado sells one-third of his shares for \$2700. What was the total value of Mr. and Mrs. Delgado's stock before the sale?
5. A certain bacteria doubles its population every 12 hours. After 3 full days, there are 1600 bacteria in a culture. How many bacteria were there at the beginning of the first day?
6. To catch a 7:30 A.M. bus, Don needs 30 minutes to get dressed, 30 minutes for breakfast, and 15 minutes to walk to the bus stop. What time should he wake up?

Problem-Solving Strategy: Guess and Check

To solve some problems, you can make a reasonable guess and then check it in the problem. You can then use the results to improve your guess until you find the solution. This strategy is called **guess and check**.



Real-World EXAMPLE

The product of two consecutive even integers is 1088. What are the integers?

The product is close to 1000.

Make a guess. Let's try 24 and 26. $\longrightarrow 24 \times 26 = 624$ \longleftarrow This product is too low.

Adjust the guess upward.

Try 30 and 32. $\longrightarrow 30 \times 32 = 960$ \longleftarrow This product is still too low.

Adjust the guess upward again.

Try 34 and 36. $\longrightarrow 34 \times 36 = 1224$ \longleftarrow This product is too high.

Try between 30 and 34.

Try 32 and 34. $\longrightarrow 32 \times 34 = 1088$ \longleftarrow This is the correct product.

The integers are 32 and 34.

Practice

Use the *guess-and-check* strategy to solve each problem.

- The product of two consecutive odd integers is 783. What are the integers?
- Brianne is three times as old as Camila. Four years from now she will be just two times as old as Camila. How old are Brianne and Camila now?
- Rafael is burning a CD for Selma. The CD will hold 35 minutes of music. Which songs should he select from the list to record the maximum time on the CD without going over?

Song	A	B	C	D	E	F	G	H	I	J
Time	5 min 4 s	9 min 10 s	4 min 12 s	3 min 9 s	3 min 44 s	4 min 30 s	5 min 0 s	7 min 21 s	4 min 33 s	5 min 58 s

- Each hand in the human body has 27 bones. There are 6 more bones in the fingers than in the wrist. There are 3 fewer bones in the palm than in the wrist. How many bones are in each part of the hand?
- The Science Club sold candy bars and soft pretzels to raise money for an animal shelter. They raised a total of \$62.75. They made 25¢ profit on each candy bar and 30¢ profit on each pretzel sold. How many of each did they sell?
- Odell has the same number of quarters, dimes, and nickels. In all he has \$4 in change. How many of each coin does he have?
- Anita sold tickets to the school musical. She had 12 bills worth \$175 for the tickets she sold. If all the money was in \$5 bills, \$10 bills, and \$20 bills, how many of each bill did she have?

Problem-Solving Strategy: Solve a Simpler Problem

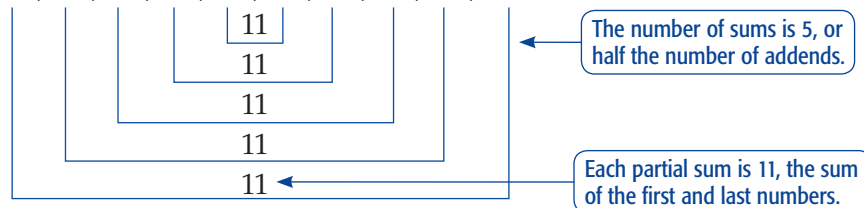
One of the strategies you can use to solve a problem is to **solve a simpler problem**. To use this strategy, first solve a simpler or more familiar case of the problem. Then use the same concepts and relationships to solve the original problem.

Real-World EXAMPLE

Find the sum of the numbers 1 through 500.

Consider a simpler problem. Find the sum of the numbers 1 through 10. Notice that you can group the addends into partial sums as shown below.

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55$$



The number of sums is 5, or half the number of addends.

Each partial sum is 11, the sum of the first and last numbers.

The sum is 5×11 or 55.

Use the same concepts to find the sum of the numbers 1 through 500.

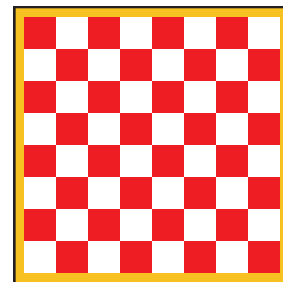
$$\begin{aligned} 1 + 2 + 3 + \dots + 499 + 500 &= 250 \times 501 \\ &= 125,250 \end{aligned}$$

Multiply half the number of addends, 250, by the sum of the first and last numbers, 501.

Practice

Solve each problem by first solving a simpler problem.

- Find the sum of the numbers 1 through 1000.
- Find the number of squares of any size in the game board shown at the right.
- How many links are needed to join 30 pieces of chain into one long chain?
- Three people can pick six baskets of apples in one hour. How many baskets of apples can 12 people pick in one-half hour?
- A shirt shop has 112 orders for T-shirt designs. Three designers can make 12 shirts in 2 hours. How many designers are needed to complete the orders in 8 hours?
- Stamps for postcards cost \$0.24, and stamps for first-class letters cost \$0.39. Diego wants to send postcards and letters to 10 friends. If he has \$3.15 for stamps, how many postcards and how many letters can he send?



Problem-Solving Strategy: Draw a Diagram

Another strategy for solving problems is to **draw a diagram**. There will be times when a sketch or diagram will give you a better picture of how to tackle a mathematics problem. Adding details like units, labels, and numbers to the drawing or sketch can help you make decisions on how to solve the problem.



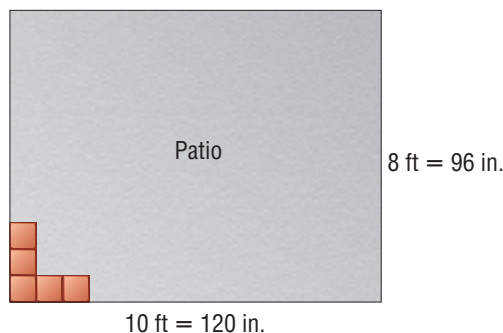
Real-World EXAMPLE

Imani is trying to determine the number of 9-inch tiles needed to cover her patio. The rectangular patio measures 8-feet by 10-feet. What is the minimum number of 9-inch tiles Imani should purchase?

First, draw a diagram of the situation. Express the measurement of the patio in inches.

If each tile is 9 inches square, the minimum number of tiles for the width of the patio is $96 \div 9 \approx 10.7$ or 11 tiles.

The minimum number of tiles for the length of the patio is $120 \div 9 \approx 13.3$ or 14 tiles.



So, the minimum number of tiles Imani needs to cover the patio is 11×14 or 154 tiles.

Practice

Solve each problem by drawing a diagram.

1. The area of a rectangular flower bed is 48 square feet. If the sides are whole number dimensions, how many combinations of lengths and widths are possible for the flower bed? List them.
2. Kevin was hired to paint a mural on a wall that measures 15 feet by 20 feet. Starting from the center of the wall, he will paint a square that measures 3 feet. The dimensions of the next square will be 1.5 times greater than and centered on the previous square. How many squares can Kevin paint on the wall?
3. A 500-gallon bathtub is being filled with water. Eighty gallons of water are in the bathtub after 4 minutes. How long will it take to fill the bathtub?
4. It takes 42 minutes to cut a 2-inch by 4-inch piece of wood into 7 equally-sized pieces. How long will it take to cut a similar 2-by-4 into 4 equally-sized pieces?
5. Find the number of line segments that can be drawn between any two vertices of an octagon.
6. How many different teams of 3 players can be chosen from 8 players?

Problem-Solving Strategy: Act It Out

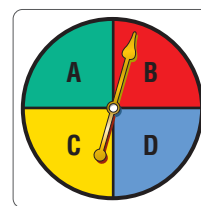
There are problem situations where acting the problem out will provide you with a visual image and provide direction for solving the problem. To **act it out**, you could use real people, models of the real objects, or manipulatives like tiles and cubes, which will help you visualize the problem and make decisions about how to proceed with solving the problem.

Real-World EXAMPLE

A quiz has 5 multiple-choice items each with choices A, B, C, and D. Is spinning a spinner with 4 equal sections to decide the answers a good strategy for taking the quiz?

First, make a spinner with 4 equal sections and use it to act out taking the quiz. Each section represents one of the choices A, B, C, and D for each question.

Suppose the correct answers to the quiz are D, D, B, C, and A. Do 5 trials.



Answers	D	D	B	C	A	Number Correct
Trial 1	Ⓓ	A	D	B	C	1
Trial 2	C	B	C	A	B	0
Trial 3	B	C	D	A	Ⓐ	1
Trial 4	B	Ⓓ	A	Ⓒ	B	2
Trial 5	Ⓓ	A	Ⓑ	A	D	2

The experiment only produces 1 or 2 correct answers. So, spinning a spinner is not a good strategy to use to answer a multiple-choice quiz with 4 choices.

Practice

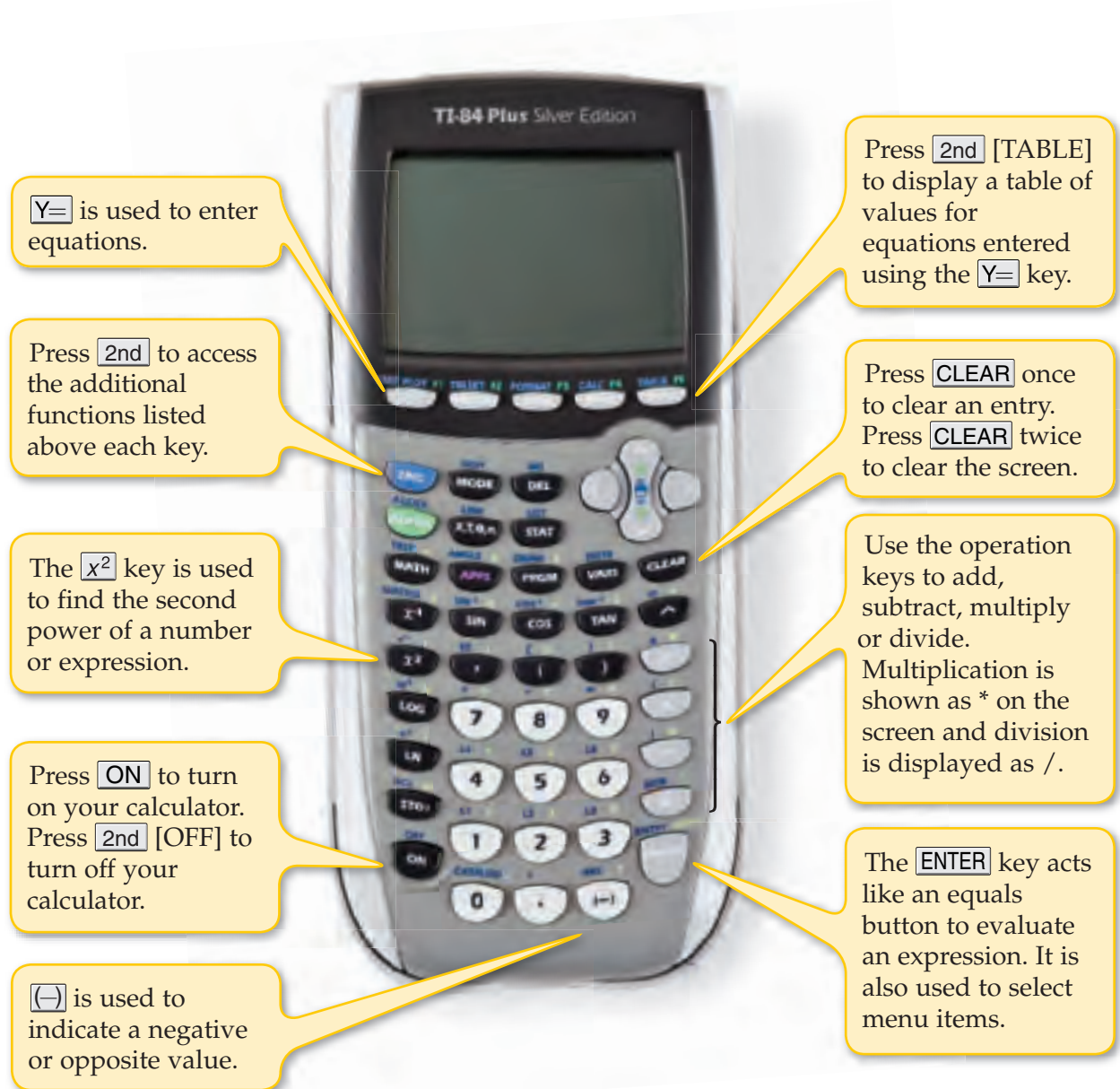
Solve each problem by acting the problem out.

1. A test has 10 true-false questions. Is tossing a coin to decide the answers a good strategy for taking the test? Explain.
2. A pizza parlor has thin crust and deep dish, 2 different cheeses, and 4 toppings. How many different one-cheese and one-topping pizzas can be ordered?
3. A field hockey conference has four teams. In how many ways can first, second, and third place be awarded at the end of the season?
4. Waban makes 2 out of every 3 free throws he attempts. How many would you expect him to make in his next 25 attempts?
5. A gumball machine has an equal number of red, yellow, and orange gumballs. If it costs \$0.25 per gumball, how much would you have to spend to get at least one gumball of each color?

Tools for Problem Solving

The Graphing Calculator

This year, you may use an exciting tool to help you solve problems—a graphing calculator. Graphing Calculator Labs have been included in your textbook so you can use technology to explore concepts. These labs use the TI-83 Plus or TI-84 Plus calculator. A graphing calculator does more than just graph. You can also use it to calculate.



$Y=$ is used to enter equations.

Press 2^{nd} to access the additional functions listed above each key.

The x^2 key is used to find the second power of a number or expression.

Press ON to turn on your calculator. Press 2^{nd} [OFF] to turn off your calculator.

$(-)$ is used to indicate a negative or opposite value.

Press 2^{nd} [TABLE] to display a table of values for equations entered using the $Y=$ key.

Press $CLEAR$ once to clear an entry. Press $CLEAR$ twice to clear the screen.

Use the operation keys to add, subtract, multiply or divide. Multiplication is shown as * on the screen and division is displayed as /.

The $ENTER$ key acts like an equals button to evaluate an expression. It is also used to select menu items.

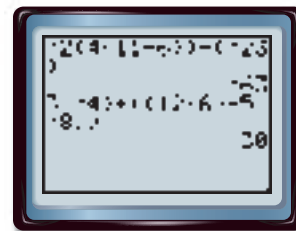
EXAMPLE Entering and Evaluating Expressions

1 Evaluate each expression.

a. $-2[4(11 - 6)] + (-23)$

KEYSTROKES: $\boxed{-} \boxed{2} \boxed{[} \boxed{4} \boxed{[} \boxed{11} \boxed{-} \boxed{6} \boxed{]} \boxed{+} \boxed{[} \boxed{(-)} \boxed{23} \boxed{]} \boxed{ENTER}$

b. $3(-4) + [(12 \div 6) - 5(-8)]$

KEYSTROKES: $\boxed{3} \boxed{[} \boxed{(-)} \boxed{4} \boxed{]} \boxed{+} \boxed{[} \boxed{[} \boxed{12} \boxed{\div} \boxed{6} \boxed{]} \boxed{-} \boxed{5} \boxed{[} \boxed{(-)} \boxed{8} \boxed{]} \boxed{]} \boxed{ENTER}$ 

Evaluate each expression.

1. $8 + [7(12 \div 4)]$

2. $5[(5 + 14) - 2(7)]$

3. $[6(8 \div 12)] \times 3$

4. $5 + [(8 \times 2) - 7]$

5. $4[3(21 - 17) + 3]$

6. $7[5 + (13 - 4) \div 3]$

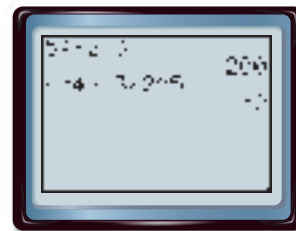
EXAMPLE Powers and Exponents

1 Evaluate each expression.

a. $5^2 \times 2^3$

KEYSTROKES: $\boxed{5} \boxed{x^2} \boxed{\times} \boxed{2} \boxed{\wedge} \boxed{3} \boxed{ENTER}$

b. $(-4)^3 \div 2^5$

KEYSTROKES: $\boxed{[} \boxed{(-)} \boxed{4} \boxed{]} \boxed{\wedge} \boxed{3} \boxed{\div} \boxed{2} \boxed{\wedge} \boxed{5} \boxed{ENTER}$ 

Evaluate each expression.

7. 3^8

8. $2 \cdot 6^3$

9. $4^3 \cdot 2^7$

10. $5^4 - 3^3$

11. $3 \cdot 2^5 \cdot 4^5$

12. $3 \cdot 5^3 + 4 \cdot 2^5$

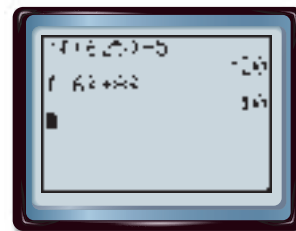
EXAMPLE Roots

1 Evaluate each expression.

a. $-\sqrt{625} + 5$

KEYSTROKES: $\boxed{(-)} \boxed{2nd} \boxed{[\sqrt{]} \boxed{625} \boxed{]} \boxed{+} \boxed{5} \boxed{ENTER}$

b. $\sqrt{6^2 + 8^2}$

KEYSTROKES: $\boxed{2nd} \boxed{[\sqrt{]} \boxed{6} \boxed{x^2} \boxed{+} \boxed{8} \boxed{x^2} \boxed{ENTER}$ 

Evaluate each expression.

13. $\sqrt{144} + 26$

14. $\sqrt{324} - 12$

15. $\sqrt{225} + 6$

16. $\sqrt{169} - 3$

17. $\sqrt{32} + 7$

18. $\sqrt{142} + 27$

Techniques for Problem Solving

Choose the Best Method of Computation

Solving problems is more than using paper and pencil. Follow the path to choose the best method of computation.



Practice

Choose the best method of computation to solve each problem. Then solve.

1. Kimi paid \$677.48, including tax, for a surfboard. She then decided to have a protective spray applied to her board for \$47.98. What was the total cost of the surfboard and the spray?
2. An average-sized orca whale eats about 551 pounds of food a day. How many pounds of food will an orca whale eat in one year?

For Exercises 3-5, use the information in the table that shows the sales of Café Mocha's coffee of the month.

Coffee of the Month Sales	
Month	Number of Cups Sold
January	850
February	765
March	587
April	500
May	387

3. How many more cups of this kind of coffee did Café Mocha sell in January than in April?
4. If Café Mocha charges \$1.98 for each cup of coffee, about how much money did Café Mocha earn in March?
5. In the month of May, Café Mocha had to raise their prices for each cup of coffee to \$2.25. How much money did Café Mocha earn in the month of May?
6. The Student Council is making pizzas to sell at the football game on Friday. Each pizza needs $2\frac{1}{4}$ cups of cheese. If the student council members make 25 pizzas, how many cups of cheese will they need?
7. The length of Fun Center's go-kart track is 843 feet. If Nadia circled the track 9 times, about how many feet did she travel?
8. Use the table below to find the total area of the Great Lakes.

Great Lakes	
Great Lake	Area (mi ²)
Lake Superior	31,698
Lake Huron	23,011
Lake Michigan	22,316
Lake Erie	9,922
Lake Ontario	7,320

Source: worldatlas.com

9. Music Megastore was having a sale on blank CDs and DVDs. Ivan bought a package of 300 blank CDs for \$39 including tax. What is the individual cost of each CD?
10. An art supply store sells 5 different sized canvases. The surface area of the middle-size canvas is 3.5 times larger than the surface area of the extra-small canvas. If the surface area of the extra-small canvas is 81 square inches, what is the surface area of the middle-sized canvas?

How to Use Your Math Book

Reading Your Math Book

Why do I need my math book? Have you ever been in class and not understood all of what was presented? Or, you understood everything in class, but at home, got stuck on how to solve a couple of problems? Maybe you just wondered when you were ever going to use this stuff?

These next few pages are designed to help you understand everything your math book can be used for ... besides homework problems!

Before you read, have a goal.

- What information are you trying to find?
- Why is this information important to you?
- How will you use the information?

Have a plan when you read.

- Read the Main IDEA at the beginning of the lesson.
- Look over photos, tables, graphs, and opening activities.
- Locate words highlighted in yellow and read their definitions.
- Find Key Concept and Concept Summary boxes for a preview of what's important.
- Skim the example problems.


Keep a positive attitude.

- Expect mathematics reading to take time.
- It is normal to *not* understand some concepts the first time.
- If you don't understand something you read, it is likely that others don't understand it either.



Doing Your Homework

Regardless of how well you paid attention in class, by the time you arrive at home, your notes may no longer make any sense and your homework seems impossible. It's during these times that your book can be most useful.

- Each lesson has example problems, solved step-by-step, so you can review the day's lesson material.
-  has extra examples at tx.pre-alg.com to coach you through solving those difficult problems.
- Each exercise set has **HOMEWORK HELP** boxes that show you which examples may help with your homework problems.
- Answers to the odd-numbered problems are in the back of the book. Use them to see if you are solving the problems correctly. If you have difficulty on an even problem, do the odd problem next to it. That should give you a hint about how to proceed with the even problem.

Look For ...

- Math Online with Personal Tutor and Extra Examples
- Homework Help boxes
- Selected Answers starting on page R24

Studying for a Test

You may think there is no way to study for a math test! However, there *are* ways to review before a test. Your book can help!

- Review all of the new vocabulary words and be sure you understand their definitions. These can be found on the first page of each lesson or highlighted in yellow in the text.
- Review the notes you've taken on your **FOLDABLES** and write down any questions that you still need answered.
- Practice all of the concepts presented in the chapter by using the chapter Study Guide and Review. It has additional problems for you to try as well as more examples to help you understand. You can also take the Chapter Practice Test.
- Take the Self-check Quizzes at tx.pre-alg.com.



Scavenger Hunt

Let's Get Started

Use the Scavenger Hunt below to learn where things are located in each chapter.

1. What is the title of Chapter 1?
2. How can you tell what you'll learn in Lesson 1-1?
3. What is the key concept presented in Lesson 1-2?
4. List the new vocabulary words that are presented in Lesson 1-3.
5. In the margin of Lesson 1-3, there is a Vocabulary Link. What can you learn from that feature?
6. How many examples are presented in Lesson 1-3?
7. What is the web address where you could find extra examples?
8. Suppose you're doing your homework on page 38 and you get stuck on Exercise 19. Where could you find help?
9. What is the title of the feature in Lesson 1-5 that tells you how to read the \neq symbol?
10. What is the title of the feature in Lesson 1-6 that tells you about the units on the x - and y -axes?
11. Sometimes you may ask "When am I ever going to use this"? Name a situation that uses the concepts from Lesson 1-7.
12. There is a Real-World Career mentioned in Lesson 1-7. What is it?
13. What is the web address that would allow you to take a self-check quiz to be sure you understand the lesson?
14. On what pages will you find the Study Guide and Review for Chapter 1?
15. Suppose you can't figure out how to do Exercise 35 in the Study Guide on page 72. Where could you find help?