Lesson 1-5
Problem-Solving Strategies

Interactive Study Guide

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- Getting Started
- Real-World Link
- Notes

Essential Question

How can you use numbers and symbols to represent mathematical ideas?

Common Core State Standards

Content Standards
7.NS.3, 7.EE.3

Mathematical Practices
1, 3, 4, 8

Vocabulary

look for a pattern
guess, check, and revise
make a table
work backward

What You'll Learn

- Use problem-solving strategies to solve nonroutine problems.
- Select an appropriate strategy.

Real-World Link

Movie Snacks Nothing goes better with a movie than popcorn! When you buy snacks at the movie theater, you can receive your change in several different combinations. You can use different problem-solving strategies to determine how you will receive your change.

Use Problem-Solving Strategies

There are many problem-solving strategies in mathematics. One common strategy 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 one number to the next. Then use the rule to extend the pattern and find a solution.

Example 1

Ramon got a text from Angela. After 10 seconds, he forwarded it to 2 of his friends. After 10 more seconds, those 2 friends forwarded it to 2 more friends. If the text was forwarded like this every 10 seconds, how many people received Angela's text after 40 seconds?

Look for a pattern in the data and extend the pattern.

Time (s)	People Getting Text
0	1
10	2
20	4
30	■
40	■

1, 2, 4, ■, ■
×2 ×2 ×2 ×2

To continue the pattern, multiply each term by 2.

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

So, $1 + 2 + 4 + 8 + 16$ or 31 people received the text.

Got It? Do this problem to find out.

1. Tamiko makes a necklace by stringing beads with the following colors: red, yellow, blue, red, yellow, blue, ... If she continues in this way, what will be the color of the 50th bead?

To solve other 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, check, and revise**.

Example 2

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?

Make a guess to find the number of bones in each part of the hand.

Wrist	Palm (wrist − 3)	Fingers (wrist + 6)	Total Bones (27)	Correct?
5	5 − 3 = 2	5 + 6 = 11	5 + 2 + 11 = 18	This is too low.
7	7 − 3 = 4	7 + 6 = 13	7 + 4 + 13 = 24	This is too low.
9	9 − 3 = 6	9 + 6 = 15	9 + 6 + 15 = 30	This is too high.
8	8 − 3 = 5	8 + 6 = 14	8 + 5 + 14 = 27	This is correct. ✓

There are 8 bones in the wrist, 5 bones in the palm, and 14 bones in the fingers.

Watch Out!
Make sure you answer the entire question that is asked in a problem. This problem asks for the number of bones in each part of the hand, so you must give the number of bones in the wrist, the palm, and the fingers.

Got It? Do this problem to find out.

2. Colin sold student tickets and guest tickets to a school play. He sold a total of 154 tickets in all. He sold 8 more student tickets than guest tickets. How many of each type of ticket did he sell?

Another strategy for solving problems is to **make a table**. A table allows you to organize information in an understandable way.

Example 3

A vending machine accepts dollars, and each item in the machine costs 65 cents. If the machine gives back only nickels, dimes, and quarters, what combinations of those coins are possible as change for one dollar?

The machine will give back $1.00 − $0.65 or 35 cents in change in a combinations 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.

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

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

3a.

#1	#2	Product 36	Sum
1	36	36	37
2	18	36	20
3	12	36	15
4	9	36	13
6	6	36	12

Got It? Do these problems to find out.

MULTIPLICATION

3a. The product of two whole numbers is 36. What are the possible values for the sum of the two numbers?

ADDITION

3b. Zane paid for a DVD with a $20 bill. The price of the DVD was $19.50. How many combinations of nickels, dimes, and quarters are possible as change for $0.50?

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 **work backward** strategy can be used to solve problems like this.

To use the work backward strategy, start with the end result and *undo* each step.

Example 4

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 in the morning?

Strategies
Other problem-solving strategies include:
- draw a diagram
- make a model
- solve a simpler problem
- use logical reasoning

Start with the end result, $1.50, and work backward to find Kendrick's starting amount.

Kendrick now has $1.50. → $1.50

Undo the $1 he loaned to his friend. → +1.00
$2.50

Undo the half he spent for lunch. → × 2
$5.00

The amount Kendrick started with was $5.00.

Check Kendrick started with $5. If he spent half of that on lunch and loaned his friend $1.00, he would have $1.50 left. The solution is correct. ✓

Got It? Do this problem to find out.

4. Some passengers boarded a bus at the bus station. At the first stop, 9 more passengers boarded the bus. At the second stop, half of the passengers exited the bus. This left 12 passengers on the bus. How many passengers boarded the bus at the bus station?

Guided Practice

Use a strategy to solve each problem.

1. The figures below are made with toothpicks. Make a table that relates the perimeter to the figure number. Then find the perimeter of the twelfth figure. (Example 1)

Figure 1 Perimeter = 6 | Figure 2 Perimeter = 8 | Figure 3 Perimeter = 10

2. The product of two consecutive non-negative odd integers is 783. What are the integers? (Example 2)

3. 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? (Example 3)

4. Tia used half of her allowance to buy a ticket to the class play. Then she spent $1.75 for ice cream. Now she has $2.25 left. How much is her allowance? (Example 4)