ANSWERS

1. 11
2. 98
3. 46,656
4. 325
5. 47 and 52
6. 2, 4
7. L = 8m W = 8m
8. 20 ft
9. 1

The answers given are not the only ones

10. $4 \times 4 \div (4 + 4)$
11. $(4 + 4 + 4) \div 4$
12. $(\sqrt{4} \times \sqrt{4}) \div 4 \times 4$
13. $(\sqrt{4} \times \sqrt{4}) + 4 \div 4$
14. $(4 + \sqrt{4}) \times (4 \div 4)$
15. $4 + 4 - (4 \div 4)$
16. $(4 + 4) \times (4 \div 4)$
17. $4 + 4 + 4 \div 4$
18. $4 + 4 + 4 \div \sqrt{4}$
19. $44 \div (\sqrt{4} \times \sqrt{4})$
20. $4 \times 4 - (\sqrt{4} \times \sqrt{4})$

BASIC MATH

The Complete Course
Lesson Twenty Eight

Problem Solving Techniques

KA8428

Teaching Guide & Worksheet

HOW TO USE THE VIDEO AND TEACHING GUIDE

1. The "STOP TO THINK" signal means pause to think.
2. The "STOP TO WORK" signal means work the problem(s).
3. Rewind the tape and watch the lesson again if the concept is not clear.
4. Use “Learning Strategies” section of the Teachers Guide as memory aids and topics for classroom discussion.
5. Students should complete the exercises on the worksheet to confirm their understanding of this lesson.

LEARNING STRATEGIES

USING A CHART AS A PROBLEM-SOLVING TOOL

A. A farmer has 100 animals, some are cows and some are chickens
B. All together the animals have 372 legs
C. The problem is to find the number of cows and the number of chickens
D. Rather than using trial and error, we create a chart to organize our search
   1. The headings for the chart are COWS, COW LEGS, CHICKENS, CHICKEN LEGS, and TOTAL LEGS
   2. We start by considering the maximum number of cows, which would be 100, yielding 400 legs; this is too many
   3. If we consider 0 cows, the number of legs is 200; this is insufficient
   4. We try 50 cows, yielding a total of 300 legs
   5. We know that the number of cows is between 50 and 100
   6. Sixty cows yield 320 legs, and 61 cows yield 322 legs
   7. It is apparent that each cow we add causes the number of legs to increase by two because adding the cow means reducing the number of chickens by one
   8. Because we need 372 legs, which is fifty more than 322, we need 25 more cows than the 61
   9. Eighty-six cows and 14 chickens yield a total of 372 legs

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SOLVING A PROBLEM BY MAKING IT SIMPLER

A. A school has 1000 students and 1000 lockers
B. On the first day of school the students line up in alphabetical order
C. Student #1 opens all the lockers
D. Student #2 closes all the lockers whose locker number is a multiple of two
E. Student #3 reverses the situation for each locker whose locker number is a multiple of three
F. This continues until student #1000 has completed the task
G. The problem is to find which lockers are now open
H. We reduce the size of the problem by considering only the lockers numbered one through ten
   1. Analysis reveals that lockers one, four, and nine are the only ones of the first ten left open
   2. These are all square numbers so locker sixteen is investigated and found to be open after student #16 has finished
   3. A look at the pattern of factors of square and non-square numbers provides proof that only lockers with numbers that are square will be open

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EXPANDING THE LIMITS OF VISUALIZATION

A. A cylindrical cake is to be sliced using three cuts
B. The cake is to be cut into eight equal pieces
C. People typically visualize cutting the cake from the top down, but the cake can also be cut parallel to the top of the cake

CONSIDERING POSSIBLE CASES

A. A cubic cake is frosted on the top and the four sides
B. The cake is then sliced so that there are twenty-seven equal cubic pieces
C. The problem is to identify how many pieces have a particular number of sides frosted
D. It can be shown that no more than three sides of any piece can be frosted
E. The only possible cases are:
   1. Three sides frosted
   2. Two sides frosted
   3. One side frosted
   4. No sides frosted
F. The total must be twenty-seven

WORKSHEET STRATEGIES

1. Today Tom is twice as old as Mary. If Tom was 15 three years ago, how old will Mary be when Tom is 20?

2. What is the biggest two-digit number that has 7 as a factor?

3. If one foot = 12 inches and one yard = 3 feet, how many cubic inches in a cubic yard?

4. How many arrangements of letters can be made from the letters A, B, C, D, and E [examples of arrangements are B, CD, CD, ABED, etc.]?

5. Two numbers have a sum of 99. One number is five more than the other. What are these two numbers.

6. Find the numbers "A" and "B" so that $A^B = B^A$ where A and B are different numbers

7. A rectangle has a perimeter of 32 m. The length and width are whole numbers. Find the length and width that maximize the rectangle's area

8. A rectangle has an area of 24 square feet. If length and width are whole numbers. What is the minimum perimeter?

9. Find the number which when added to its reciprocal has the minimum sum.

For the following use four 4's and whatever arithmetic operations are needed (+, -, x, ÷, ( ), $\sqrt{\ }$) to obtain the given number, e.g. $(4 + 4) \div (4 + 4) = 1$

10. 2

11. 3

12. 4

13. 5

14. 6

15. 7

16. 8

17. 9

18. 10

19. 11

20. 12