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Three Squirrels and a Pile of Nuts

Subject: Math
Grade Level: Middle School
Required Software: Microsoft® Excel 97, Microsoft® Word 97, or Microsoft® Publisher97

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Teaching Guide

Summary
Students learn to solve story problems using a spreadsheet in combination with various problem-solving strategies.

Objectives
To provide students with an engaging opportunity to exercise problem-solving skills, to demonstrate Microsoft Excel as a problem-solving tool, and to provide a model for solving and constructing story problems.

Prerequisite Skills
Familiarity with various problem solving strategies, including trial and error and basic understanding of how to use Excel.

Time Alloted
One or two class periods

How to Begin
Review problem-solving strategies, then pose a simple story problem. For example: Sami has twice as many CDs as Maria. Jamal's CD collection is one-and-a-half times the size of Sami's and three times as big as Maria's. If Maria could load her 6-CD changer three times without repeating, how many CDs does Jamal have?

Ask the class: What are the unknowns? What information does the problem give us?

$$s=2m \quad j=1.5s \quad m=6 \times 3$$

With your class, set up algebraic equations based on the problem's unknowns and givens; for example: $j=1.5 \times (2m)$. Have half the class solve the problem algebraically, while the other half uses trial and error, plugging in and testing out numbers for different variables. (Answer: Jamal has 54 CDs.)

Now tell students they are about to tackle a much trickier story problem, but that they can use the computer and Excel software to help them find solutions. Note that you also have manipulatives (in this case, nuts) for hands-on problem solving.

Divide your class into teams of three, and give each team a copy of the

Student Activity pages. Assign one third of your teams to start with Strategy X (trial-and-error; see answer key below), one third with Strategy Y (algebra), and the last third with Strategy Z (hands-on).

	A	B	C	D
1		No. of nuts in pile	No. of nuts after s/he eats 1	No. of nuts s/he leaves behind
2	Squirrel 1	?	=B2-1	=(C2/3)*2
3	Squirrel 2	=D2	=B3-1	=(C3/3)*2
4	Squirrel 3	=D3	=B4-1	=(C4/3)*2

Here are the formulas students should figure out. One answer for B2 is 25.

Student Activity

Description

How many ways can three sneaky squirrels divvy up one pile of nuts? The story problem below will give you a chance to find out. It will also give you practice using different strategies for solving problems, and show you how you can use the computer and Excel to help solve them. In the end, you'll have a chance to make up and trade fun story problems of your own.

DID YOU HEAR THE ONE ABOUT THREE SQUIRRELS AND A PILE OF NUTS?

It goes like this...

Three squirrels gather a pile of nuts, and store the pile outside their house overnight. At night, however, one of the squirrels wakes up hungry to steal one-third of the pile. ("I'm only taking my fair share for myself.") But he has to eat one of the nuts in order to take exactly one-third. He leaves two-thirds of the nuts behind and goes back to bed. The next night, the second squirrel wakes up, and exactly the same thing happens. The third squirrel, who wakes up, eats one of the nuts, steals exactly one-third of the pile that's left, and goes back to bed.

STEP 1 Analyzing the Problem

SOFTWARE: None

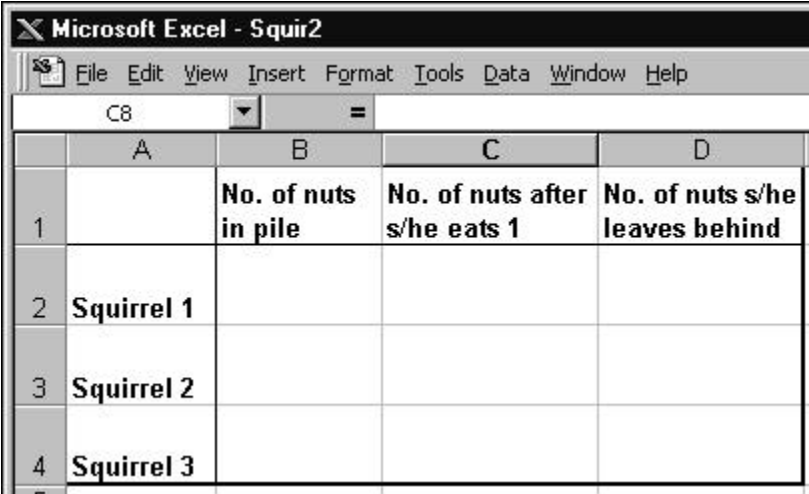
WHAT TO DO: Your first step in solving any story problem is to analyze it - in other words, take it apart, and make sure you understand all of its pieces. Look carefully at the "Three Squirrels and a Pile of Nuts" problem below, and have one member of your team read it out loud. Then:

1. Take turns stating the problem in your own words. If you and your teammates have different ideas about what the problem is asking for, talk it over until you can agree.
2. On a piece of scrap paper, jot down the unknowns in this problem. What don't you know? What is the problem asking for?
3. Next, write down any bits of specific information the problem may give you. What do you know?

Now you're ready to move on to a problem-solving strategy. All the teams in your class will be trying Strategies X, Y, and Z, but not necessarily in that order. Ask your teacher which strategy you should start with.

Strategy X**SOFTWARE: Microsoft Excel**

WHAT TO DO: In this step, you'll be setting up a spreadsheet that will let you try out various combinations of numbers to solve the problem.



	A	B	C	D
1		No. of nuts in pile	No. of nuts after s/he eats 1	No. of nuts s/he leaves behind
2	Squirrel 1			
3	Squirrel 2			
4	Squirrel 3			

1. Following the sample below, label your rows for Squirrel 1, Squirrel 2, and Squirrel 3. Label your columns "No. of nuts in pile," "No. of nuts after s/he eats 1," and "No. of nuts s/he leaves behind."
2. Highlight cells B1:D1, go to the Format menu, choose Cells, click on the Alignment tab, and check Wrap Text. Then adjust the cell width so the text fits on two lines.
3. Now, figure out formulas for all the cells that will let you plug in and test out numbers. Remember to make each cell relative to the others, so that a number you plug into one cell's formula will affect the rest. Here are a few hints:
 - The formula in cell C2 should be =B2-1, because the squirrel eats one nut from the pile in B2.
 - The formula for D2 is =(C2/3)*2, because Squirrel 1 leaves two-thirds of the pile behind.
 - The formula for B3 is =D2, because Squirrel 2 finds the pile the way Squirrel 1 leaves it.

- Once all your formulas are in place, test out your spreadsheet by plugging a number into B2. You may end up with a lot of weird-looking fractions - and you know these squirrels aren't going to settle for anything less than whole nuts! Keep trying numbers until you find one that gives you whole numbers throughout. What patterns do you see?
- Print your spreadsheet twice, once showing the formulas and once with your whole-number solution in place. (Ask Office Assistant for help if you need it.) Then move on to another strategy.

Strategy Y

Algebra Power

SOFTWARE: Microsoft Excel

WHAT TO DO: With this problem-solving strategy, you'll be setting up an algebra equation to solve.

	A	B	C	D
1		No. of nuts in pile	No. of nuts after s/he eats 1	No. of nuts s/he leaves behind
2	Squirrel 1			
3	Squirrel 2			
4	Squirrel 3			
5	<i>x = nuts in original pile</i>			
6	<i>y = number of nuts each squirrel gets in the end</i>			

- Open the Excel worksheet used for Strategy X, go to the Edit menu, and choose Move or Copy sheet, and click Create A Copy. In your new worksheet, highlight B2:D4 and press Delete, leaving the column and row headings. Now you have plenty of room to create a table for defining your variables (see sample, next page).
- The variables you most need to solve for are:
 x = nuts in original pile
 y = number of nuts each squirrel gets in the end.

Record these at the bottom of your worksheet.

- Here are some hints: Put in x as Squirrel 1's "No. of nuts in pile." When it comes to solving for y , remember that it is one-third of however many nuts are left in the end, so $y=1/3$ (last entry in table).
- After you fill in your table, put together an equation. You can type this in your worksheet below your table. Show steps for simplifying the equation. Then test it out with several numbers.
- Make sure your worksheet shows all the steps you followed to write and solve the equation. Then move on to another strategy.

Strategy Z

Hands-On Thinking

SOFTWARE: Microsoft Word**PLUS: 3 Dozen Nuts**

WHAT TO DO: With this strategy, you'll be solving the problem the way a squirrel would - one nut at a time!

1. Count out the number of nuts your group would like to start with (not necessarily all you have). Put these in your starter pile. Open a Word document and make a note of the number.
2. Make one member of your team Squirrel 1, and have him or her tackle the pile of nuts the way the first squirrel in the story did.
Warning: No fractions of nuts allowed! Let Squirrel 1 take several tries until she or he ends up with whole amounts after each step. Record these numbers.
3. Now the teammate who's playing Squirrel 2 should work through the steps. Again, no fractions - so both Squirrel 1 and 2 may need to go back and adjust their piles. Record the numbers that work.
4. Finally, Squirrel 3 should take his or her turn. Adjust as needed, and record the results in your Word document.
5. When Squirrel 3 is through, divide the nuts that are left. If the pile doesn't divide by three, adjust all the way back through the problem. Record your tries and your final answers.
6. From all your notes, write several sentences (with pictures if you'd like) describing the steps and numbers that finally gave you the right answer. Then move to another strategy (by the end of this activity, you will have tried all three!).

STEP 2 *Create a Problem!***SOFTWARE: Microsoft Publisher or Microsoft Word**

WHAT TO DO: Here's your chance to make up a story problem as tricky as "Three Squirrels and a Pile of Nuts." With your team, think of a problem that has at least three steps and requires at least two of the four basic math operations (addition, subtraction, multiplication, division). Create a story to go with the problem. For extra zip, use your classmates' names and some familiar settings, like your classroom or school cafeteria. Solve the problem on a separate sheet of paper, and check your work.

Launch Microsoft Publisher, choose the Flyer PageWizard, and type in your problem. (As an alternative, you can use Word.) Add graphics and a few hints to help people solve the problem. Print and proofread. Make a separate flyer with the solution. Print it and proof it, then hide it away! Exchange problems with another team. Stump or be stumped!

