

THE \$20 BILL

Teaching Guidelines

Subject: Mathematics

Topics: General Skills (Problem Solving), Decimals

Grades: 4 - 6

Knowledge and Skills:

- Can solve complex, multi-step problems
- Can add and subtract decimal numbers
- Can multiply and divide decimal numbers

Materials: None

Procedure: Distribute the handout on page. This activity is best done in teams.

For younger or less advanced students, you may wish to review the problem with the class as a whole, making sure that they understand what the problem is before they begin to work on it in their teams.

For older or more advanced students, try letting them study the handout on their own, circulating to give help as needed to each team separately.

Here are two approaches to solving the problem #1:

a) Algebraic thinking: If you cut the borders off of the dollar bill, how long will it be then? Since that is the width of all four pictures added together, how would you find the width of just one of the pictures?

b) Guess and check: If the pictures were each 1 inch wide, then all four pictures together would be 4 inches, plus the two borders would be $4 + .125 + .125 = 4.25$ inches. The actual bill is longer than that, so try a larger width.

With either approach, students may use calculators, or not. If they do use calculators, remind them always to estimate their answers so as to provide a check on the calculator's result.

Similar problem-solving approaches apply to problem #2.

A good approach to problem #3 is to eliminate the borders (the width of the bill minus the borders is $6.35 - .175 - .175 = 6.0$ inches). Then choose a width for the outside pair of pictures (say, 1 inch), and eliminate those ($6 - 1 - 1 = 4$ inches left). The remainder (4 inches) will be the width of the two center pictures together, so the width of one will be half that amount (2 inches).

Note: In checking student results keep in mind the fact that the outside pictures must be less than 1.5 inches in width each, as otherwise they will be wider than the inside pictures.

For further discussion: why are bills usually rectangular and coins circular? (Some answers: Rectangular shape makes bills easier to print, stack, and fold. If coins had corners they would probably wear away.)

The \$20 Bill

Eddie has a new design for a \$20 bill that he thinks would be hard to counterfeit. He knows that he has to give exact measurements in his design.

He has decided to make his bill exactly 6.35 inches long and 3.15 inches high. His bill will have four pictures on it, all the same size.

But he has not decided how big to make the pictures or the border on his bill.

Help Eddie by answering these questions:

- 1) If the border is 0.125 inches wide, how wide will his pictures be?
- 2) If he decides to make the pictures all 1.462 inches wide, how wide can the borders be?
- 3) Suppose Eddie wants to make the two pictures in the middle a little wider than the two on the outside, and have a border of .175 inches. Give Eddie three different choices for the widths of his pictures.

