

NAME _____

Math 130: Arithmetical Problem Solving
Midterm 2 – Monday, November 20, 2006

Instructions: You have 90 minutes for this exam. You may not use any book, notes, or calculator. If any problem seems unclear to you, ask. Do not simply solve problems; explain your solutions as well!

1. (5 pts each)

(a) State the definition of *algorithm*.

(b) State the *distributive property*.

(c) State what it means for a number A to be a *multiple* of a number B .

2. (5 pts each) Write a short, simple word problem that can be solved by performing the given operation. (You do not have to solve the problems you write, but doing so might help you check your work....)

(a) $\frac{1}{2} - \frac{1}{5}$

(b) 1.1×7.37

(c) $\frac{2}{3} \times \frac{3}{8}$

3. (8 pts) Show how to calculate $495 + 573$ using the standard algorithm for addition. Explain *why* this procedure gives the correct answer to the problem.

4. (4 pts) In the following calculation, label each step that uses one of our three properties of arithmetic (commutative, associative, or distributive).

$$\begin{aligned} 27 + (89 + 13) &= 27 + (13 + 89) \\ &= (27 + 13) + 89 \\ &= 40 + 89 \\ &= 129 \end{aligned}$$

5. (6 pts each) Now write similar strings of equations to show how to solve each of the problems below using mental math. Again, label each step where one of the properties is used.

(a) $683 - 196$

(b) 16×51

6. (8 pts) State the commutative property of multiplication, and explain why it is true.

7. (10 pts) Draw a tree diagram for the following problem, and use your diagram to explain why the problem can be solved using multiplication.

Johnny has a toy train set with a locomotive and four cars: a red car, a yellow car, a green car, and a blue car. In how many different orders can Johnny line up the cars in his train, if the locomotive has to go in the front?

8. (8 pts) Explain *why* multiplying by 10 is easier than multiplying by smaller numbers such as 7 or 9. (Do not merely state a rule; explain why the rule works for 10 and not for other numbers.)

9. (10 pts) If in-state tuition at the UW costs 75% less than out-of-state tuition, then what percent more does out-of-state tuition cost than in-state tuition? Clearly explain how you solve this problem.

10. (10 pts) Here is an old mental math trick for remembering the squares of whole numbers ending in 5:

If you want to square a number ending in 5, just take the part of the number before the 5, multiply it by the next higher number, and put 25 at the end.

For example, to calculate 35^2 , you would multiply the 3 by the next higher number, which is 4, to get 12. Then writing 25 after the 12 gives the answer, 1225. Or, to calculate 115^2 , you would first find $11 \times 12 = 132$, and then put 25 after this number to obtain the answer 13,225.

Use your knowledge of the properties of arithmetic to explain why this trick always works. (*Hint: Thinking about FOIL might help. So might drawing a picture.*)