University of South Carolina
Math 221: Math for Elementary Educators
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Section 001
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Test 1

Help Prime Minister Mittens govern Talking Cat Island by analyzing the following three word problems. For each problem

a. tell what operation is involved ($+$, $-$, $\times$, or $\div$),
b. give the name of an appropriate model for the problem, and
c. draw a picture demonstrating the solution.

1. Talking Cat Island is home to 15 thousand cats. If a district contains 5 thousand cats, how many districts are required? (Hint: Work with the numbers 15 and 5, not 15,000 and 5,000.)

2. Every second, 7 saucers of milk are consumed by the citizens of the island. How many saucers do they drink in 10 seconds?

3. It takes one crew of catstruction workers 11 hours to build a scratching post, while it takes another crew only 8 hours to build the same post. How much longer does the first crew require than the second?

[2] 4. Describe the following sets of numbers.

a. Natural Numbers
b. Whole Numbers
c. Integers
d. Rational Numbers
e. Real Numbers

5a. Convert 234_5 to base 10.
5b. Convert 146_{10} to base 5.

[2] 6. Evaluate each of the following expressions using the specified method.

a. $241_5 + 132_5$ using the partial sums method
b. $322_5 - 213_5$ using the equal addends method
c. $22_5 \times 13_5$ using the partial products method
d. $103_5 \div 4_5$ using the standard algorithm

7. Short Answer

a. Consider the set of odd whole numbers $\{1, 3, 5, 7, \cdots\}$. Is this set closed under addition? Is it closed under subtraction? Explain.

b. Why do we say that, for example, $0 \div 1 = 0$ (and so is defined) but $1 \div 0$ is undefined?

c. Prove with a picture that $(x + y)^2 = x^2 + 2xy + y^2$. (Hint: Remember that $(x + y)^2$ is the same as $(x + y)(x + y)$. Now, think about the area model of multiplication to make your picture.)