

**University of South Carolina**  
**Math 221: Math for Elementary Educators**  
**Instructor: Austin Mohr**  
**Section 001**  
**Spring 2010**

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**Final Exam**

Do not write your answers on the test paper. You may select any one numbered problem (including all its subparts) to be omitted from your grade. Indicate on the test page which question you want omitted by crossing out its number. If you do not indicate a problem, no question will be dropped.

**Modeling Word Problems**

For each of the following completely true facts about sharks, use words and pictures to model the setup and solution of the problem. In the course of your solution, include the related arithmetic sentence. For example, “one shark and two more sharks is three sharks” is expressed by “ $1 + 2 = 3$ ”.

1. Sharks hunt alone, except for when they are fighting wars with killer whales. In wartime, sharks will organize into squadrons of four sharks each in order to maximize their killing efficiency. How many squadrons can be formed by 20 sharks?
2. Specially-trained shark assassins use sharksteel daggers to eliminate key targets. Each dagger requires  $1\frac{1}{3}$  pounds of sharksteel to forge. How many daggers can be forged out of five pounds of sharksteel? (Include the fractional part in your answer. For example, if you can make  $2\frac{1}{2}$  daggers, your answer should be  $2\frac{1}{2}$ , not 2.)
3. Intelligence shows that whales are smuggling  $\frac{3}{4}$  ton of sharksteel out of the capital city of Sharktavia. The sharks raid the caravan and manage to secure  $\frac{2}{3}$  of the cargo. How many tons of sharksteel did the shark warriors obtain?
4. Sometimes, when I can't think of anything to put here, sharks multiply integers. How can a shark determine the value of  $-3 \cdot -2$ ? (You may not directly use the fact that two negatives cancel each other. Rather, you should demonstrate this fact in your picture.)

## Computation

Work each problem. Show all your work.

1. For the following problems, round your answers to the nearest cent.
  - a. Last spring break, I contemplated purchasing a \$250 bottle of Johnnie Walker Blue Label Scotch Whiskey. Suppose the bottle costs 16% of my monthly income. How much money do I make in a month?
  - b. Suppose I have only \$75.50 left this month and decide to blow a full 80% of that on alcohol. How much money can I spend?
2. You survey some of your friends about incredible music and find that:
  - 18 like Nine Inch Nails
  - 16 like Tool
  - 7 like both Nine Inch Nails and Tool

Let  $N$  be the set of people who like Nine Inch Nails and  $T$  be the set of people who like Tool.

- a. Is  $N$  a subset of  $T$ ? Why or why not?
  - b. What kinds of people belong to the set  $T - N$ ?
  - c. Draw a Venn Diagram to represent the results of the survey.
3. The next two statements are false. For each one, state the negation and prove that the negation is true.
    - a. Every even number is divisible by 4.
    - b. The number  $\frac{1}{2}$  is both a rational number and an integer.
  4. Use the fact that  $12,600 = 2^3 \times 3^2 \times 5^2 \times 7$  to solve each part.
    - a. Is 210 a divisor of 12,600? How do you know? (Hint: Find the prime factorization of 210.)
    - b. Is 52,920 a multiple of 12,600? How do you know? (Hint:  $52,920 = 2^3 \times 3^3 \times 5 \times 7^2$ )
    - c. Reduce the fraction  $\frac{12600}{52920}$  as much as possible.
  5. Evaluate each of the following in base 5.
    - a.  $323_5 - 134_5$
    - b.  $24_5 \times 34_5$

### **True or False**

Decide whether each statement is true or false. If it is false, give a *specific* example showing when it can be false. If it is true, explain why it is true.

1. The fraction  $\frac{75}{99}$  is bigger than  $\frac{75}{999}$ .
2. A number is divisible by 21 whenever it is divisible by both 3 and 7.
3. An implication and its converse always have the same truth value.
4. Every real number can be written as a fraction.

### **Short Answer**

Give a short (two or three sentences) response to each of the following prompts.

1. Explain, in terms of fraction tiles, why a common denominator is needed to add and subtract fractions.
2. Why must you line up the decimal point to add and subtract decimals?
3. Explain, using a division model of your choice, why  $0 \div 1$  is defined, but  $1 \div 0$  is undefined.