Questions on the third third of the class
Math 130

Please answer these under exam conditions. It is designed to take 75 minutes so it would be beneficial if you timed yourself. However, all of the questions are important, so if you have difficulty with some of the topics, please come get help before the final!

1. Present a Teacher's Solution to the following problem. Your solution should be aimed at an average sixth grader who is not comfortable with algebra.

   In a basket, there are apples, oranges and pears. The ratio of the number of apples to the number of oranges is $1 : 3$. The ratio of the number of apples to the number of pears is $2 : 9$. Express the number of oranges as a fraction of the total number of pears in the basket. Write your answer in lowest terms.

2. Present a Teacher's Solution to the following problem.

   Sam buys a box of Easter candy the day before Easter. Due to high demand, it was marked up 25%. He then buys another box of the same candy the day after Easter. Now, it is on sale for 75% off! If he spent \$60 altogether, how much does one of the boxes of candy cost if it's not marked up or on sale?

3. Solve the following problem. You do **not** need to present a Teacher's Solution (although it would be impressive if you did) but your work does need to be clear and organized, as in any math class.

   A machine shop polishes small metal parts using two polishing machines. When both machines work together, they take $\frac{3}{4}$ hour to polish a ton of parts. One week Machine A breaks, and Machine B alone takes $1\frac{1}{2}$ hour to polish a ton of parts. How many tons of parts per hour can Machine A polish alone?

4. Solve the following problems using mental math. This means that you should try to be clever and solve the problem in a few easy steps. If you just do the standard algorithm, you will receive zero points.

   Hint: A lot of the tricks are just properties of arithmetic.
   Hint^2: Mental math is not the same as speed math. Think about the problems for a long time, you will think of the trick eventually.

   (a) $2 \times (-5) - 3 \times (-5)$

   (b) $(17 - (-9)) - 7$

   (c) $343 + (-44)$

5. Use two different models to explain why $5 - (-2) = 7$. Neither of your explanations should come down to "because I said that's how it works", in other words, your explanations should refer to strategies and/or models that worked for whole numbers which extend naturally to include negative numbers. You may assume familiarity with the number line.

6. Write a word problem that models the operation $3 \times (-10) = -30$. Write it in the context of the temperature.

7. Perform the following operations:

   (a) $2.3 - 1.89$

   (b) 2.3×1.89

   (c) $14.52 \div 0.24$

8. (a) Explain the multiplication

$$\begin{array}{cccccc} & & & 5. & 1 & 2 \\ \times & & & & 2. & 3 \\ \hline & & 1 & 5 & 3 & 6 \\ & 1 & 0 & 2 & 4 & \\ \hline 1 & 1. & 7 & 7 & 6 & \end{array}$$

   using partial products (it may help to draw a diagram, but it is not necessary).

   (b) Identify the part(s) of the partial products results that contribute to the numbers 1536 and the 1024 which appear in the standard algorithm.

   (c) In the answer, the decimal point goes after the 11. Explain why this must be the case – do not describe the procedure "count the numbers after the decimal places", but instead refer to place value. You may reference your answer in part (a) if you wish.

9. (a) Give an example of a rational number and one of an irrational number.

   (b) Give a precise definition for what it means for a number to be rational.

   (c) Describe (at an advanced elementary school level, i.e. 5^{th} or 6^{th} grade) what rational and irrational numbers look like as decimals.