

Instructions:

You must show ALL your work in ALL questions. You will be graded on your methods, not just your answers. Use only the space provided for each question. Any usage of calculators is prohibited during the exam.

You will have EXACTLY 60 minutes for the exam, which consists of problems numbered 1 – 11. Request a new copy of the exam if any of the problems are missing or hard to read.

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1) (2 points each) Fill in the blanks using the correct terminology in their full form:

a) The fraction rule for multiplication states that:

For each \_\_\_\_\_ .

b) The mixed number  $3\frac{2}{7}$  is equal to the improper fraction \_\_\_\_\_ .

c) A factory has 100 workers. There are 40 men and the rest are women. How many percent more women than men are there?

In the above problem, the whole unit is the number of \_\_\_\_\_ .

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2) (2 points) Complete the following definition: (Hint: The space provided is sufficient!)

A *proportion* is a \_\_\_\_\_ .

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3) (2 points each) True or False:

a) Ratios can be subtracted in a consistent manner. T F

b) The numerator of a fraction represents the number of fractional units. T F

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4) (2 points each) Show how the following can be calculated *mentally*, without converting to fractions.

a) Ten *times* “two and one fifth”:

b) “Six fifths” *divided by* three:

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5) (3 points each) Show (clearly but briefly) how to compute the following using Mental Math. Write down the intermediate steps, and state the properties/techniques used.

a)  $36 \times 9 \frac{7}{12} =$

b)  $2 \cdot \frac{7}{11} + 2 \cdot \frac{4}{11} =$

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6) (5 points) Illustrate the multiplication  $\frac{4}{5} \times \frac{2}{3}$  using an area model in two steps.

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7) (8 points) For two fractions  $\frac{a}{b}$  and  $\frac{c}{d}$  with  $b, d \neq 0$ ,  $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$ .

Prove the above statement using the arithmetic properties and fraction rules, stating them when they are used in the steps.

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8) (10 points) Use fraction arithmetic to simplify. State the rules or properties used at each step.

$$\frac{3}{8} \cdot \left( \left( \frac{5}{6} - \frac{1}{2} \right) \div \frac{5}{2} \right) =$$

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9) (10 points each) Give full Teacher Solutions for the following problems.

a) (Use bar diagrams)

Tony spent  $\frac{2}{5}$  of his money on a pair of shoes. He also bought a coat which cost \$6 less than the shoes.

He had \$37 left. How much money did he have at first?

b) (Use algebra)

Sally and Susan had the same amount of money initially. After Sally spent \$15 and Susan spent \$24, the ratio of Sally's money to Susan's was 4 : 3. How much money did each girl have at first?

c) (Use the unitary method)

In a class of 40 students, 40% are boys. 50% of the girls wear glasses. How many girls wear glasses?

10) Consider the partitive interpretation (PD) of the division  $\frac{2}{3} \div \frac{7}{5}$ .

- a) (3 points) What is the interpretive question?
- b) (4 points) Make up a short word problem for this division and interpretation.
- c) (4 points) Draw the bar diagram and find the solution using the bar diagram.
- d) (4 points) Show how the diagram and the solution lead to the “invert and multiply” rule.

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11) (10 points) For two fractions  $\frac{a}{b}$  and  $\frac{c}{b}$  with the same denominator  $b \neq 0$ ,  $\frac{a}{b} + \frac{c}{b} = \frac{a+c}{b}$ .

Show how the above rule follows only from the Fractional Unit Property and the Distributive Property, stating them when they are used in the steps.