4 + 3

1. Draw a picture representing this operation using the *set model*.

2. Write a word problem resulting in this calculation best illustrated by the set model.

3. Draw a picture representing this operation using the *measurement model*.

4. Write a word problem resulting in this calculation best illustrated by the measurement model.

5. Illustrate, using either model, the fact that the above sum is the same as 3+4. What is this property called?

8 - 5

1. Illustrate this difference using the *take-away approach* in the set model.

2. Write a word problem resulting in this calculation that best illustrates the take-away approach in the set model.

3. Illustrate this difference using the *measurement model*.

4. Write a word problem resulting in this calculation that best illustrates the take-away appraoch in the measurement model.

5. Illustrate this difference using a *comparison approach* in the set model.

6. Write a word problem resulting in this calculation that best illustrates the use of the comparison approach.

8 - 5

7. Write down the addition expression related to this difference via the *missing addend* model.

8. Write a word problem resulting in this calculation that best illustrates the use of the missing addend model.

9. Using the same numbers as in the given expression, illustrate why the whole numbers are not closed under the operation of subtraction.

3×4

1. Illustrate this product using the *repeated addition approach* in the measurement model.

2. Write a word problem resulting in this computation that best illustrates the repeated addition approach.

3. Illustrate this product using rectangular arrays.

4. Write a word problem resulting in this computation that best illustrates the use of rectangular arrays.

5. Write a word problem resulting in this computation using the cartesian product model.

4×3

1. Illustrate this product using the repeated addition approach in the set model.

2. Illustrate this product using trees.

3. Write a word problem resulting in this computation that best illustrates the use of trees.

4. Draw a picture illustrating why the product on the previous page and the product on this page are equal. What is this property called?

5. Draw a picture to illustrate $3 \times (2 + 4) = 3 \times 2 - 3 \times 4$. What is this property called?

6. Explain why $3 \times (2 \times 4)$ is not $(3 \times 2) \times (3 \times 4)$.

$18 \div 5$

1. Write two word problems resulting in this computation, for which only whole number answers are appropriate, and for which the whole number answers are different.

2. Do the computation using the repeated subtraction model, showing the remainder.

3. Write the division algorithm for this problem.

4. Write a *measurement approach* word problem resulting in this computation for which a remainder is appropriate. Interpret the remainder.

5. Write *partitive approach* word problem resulting in this computation for which a remainder is appropriate. Interpret the remainder.

$0 \div 5$

1. Write a measurement approach word problem for this computation. Use the missing factor approach to solve your problem.

$5 \div 0$

2. Write a partitive approach word problem for this computation. Use the missing factor approach to solve your problem.

$0 \div 0$

3. Write a word problem resulting in this computation. Is your approach partitive or measurement? Use the missing factor approach to solve your problem. Interpret your answer in the context of your word problem.

ORDER

1. I have 24 tiles that I want to form into 3×2 rectangles. Write an expression using the numbers 24, 3, and 2 that evaluates to the correct answer to this word problem.

2. I have 14 teddy bears. My little brother took three in one hand and four in the other, and ran away with them. How many teddy bears do I have left? Write an expression using the numbers 14, 3, and 4 that is faithful to the scenario presented and evaluates to the correct answer to the word problem.

3. Reflect on the usefulness of the mnemonic PEMDAS in light of the two previous questions.

$2^3 \times 2^3$

1. Write this expression using the repeated multiplication definition of exponents.

2. Rewrite the expression using a single exponent.

3. Rewrite the expression as an exponential expression raised to a further power.

4. Write down rules of exponents illustrated by problems 2 and 3.

5. Evaluate 2^{3^2}.

6. Give a definition of 2^0, and show your definition is reasonable in two ways.

MATH EVENS THE ODDS

1. Write a definition of "even number". Make sure it's not just a test for when a number is even. What does "even" mean?

2. Write a definition of "odd number".

3. Is zero even, odd, or neither? How do you know?

4. Fill in the blanks, and justify your answers with illustrations.

   a. The sum of two even numbers is ____________.

   b. The sum of two odd numbers is ______________.

   c. The sum of an odd number and an even number is ______________.

d. The product of two even numbers is ________________.

e. The product of two odd numbers is ________________.

f. The product of an even number and an odd number is ________________.

THREEVEN

Call a whole number “threeven” if it can be broken exactly into groups of three.

1. Write down the first twelve threeven numbers.

2. A number is “throdd” if it is not “threeven”. Write down the first twelve throdd numbers.

3. Now write the first ten threeven numbers in base three. What is an easy test for threevenness, in base three?

4. Is the product of two threeven numbers threeven? Illustrate.

5. Is the product of two throdd numbers throdd? Illustrate.

6. Draw a base ten long block. Circle groups of three units on the long block. What is left?

7. Draw a base ten flat block. Circle groups of three units on the flat block. What is left?

8. The base blocks represent powers of ten. What is the remainder when you divide a power of ten by three?

9. If I had seven long blocks, and wanted to form groups of three units, with the rule that I can't combine units from different longs, how many units would I have left over?

10. If I had six flat blocks, and wanted to form groups of three units, with the rule that I can't combine units from different flats, how many units would I have left over?

11. Suppose I had the number 774 represented in base blocks. Form groups of three units from the longs and the flats like in the last questions. Now how many blocks are uncircled? Can you make a rule for checking threevenness? Try some other numbers of your own.

1.4 + 0.75

1. Rewrite this problem as a sum of fractions of the form *a*/*b*.

2. Add your fractions in part 1, using a common denominator of 100 (note: this is not the least common denominator.

3. Write your answer in decimal form.

1.4 – 0.75

1. Why is 1.4 the same as 1.40?

2. How many hundredths is one tenth worth?

3. Compute 1.4 – 0.75 using the standard algorithm.

1.4×0.75

1. Rewrite this problem as a sum of fractions of the form *a*/*b*, using denominators that are powers of ten

2. Multiply the fractions from part 1. Write your answer in decimal form.

3. Write, in complete sentences, a rule for multiplying decimals, based on what you observed in the previous problem.

$4 \div 5$, $4.6 \div 5$

1. Draw a picture explaining why $4 \div 5 = \frac{4}{5}$.

2. Use the result of part one and the standard algorithm for division to convert 4/5 to decimal.

3. Write a whole number division problem equivalent to $4.6 \div 5$.

4. Use the standard algorithm to compute $4.6 \div 5$.

$4.6 \div 0.5$

1. Convert the displayed computation to fractions and solve mentally.

2. Write down a whole number division problem equivalent to the displayed computation.

3. Use the standard algorithm to perform the displayed computation.

4. Write out in words the process used to divide a number by a non-whole decimal number, and justify.

3:1 + 1:3?

1. My Math 4010 class has three times as many women as men. My Math 1050 class has three times as many men as women. One day, they all met together. How did the number of women compare to the number of men?

2. OK. What if I have 24 students in my Math 4010 class and 100 students in my Math 1050 class?

3. What if both classes have the same number of students?

4. Did you just add fractions by adding numerators and adding denominators? Are ratios fractions?

5. I have twice as many women as men in my Math 3100 class. There are twelve total students. How many are men?

6. Four out of five dentists recommend sugar-free gum. How many times as many dentists recommend sugar-free gum as don't?

7. A cake made with four eggs serves 8 people. How many eggs do I need to make enough cake for 20 people? Don't “cross-multiply”.

BEST DEALS

1. Brand X Baked Beans cost sixty cents for a sixteen ounce can. Brand Y Baked Beans cost forty-six cents for a twelve ounce can. Which is a better deal? Try not to use decimals.

2. What is the best deal: 60 ounces for 29 cents, or 84 ounces for 47 cents? Can you do this without any long division?

3. 11 ounces of beans cost $1.76. How much is a pound?

%

1. 196 is 200 % of ____________

2. 25% of 244 is ____________

3. 39 is ______ % of 78

4. 40 is ______ % of 32

5. 40% of 355 is ____________

6. 15% of 40 is __________

7. 15% of 50 is __________

8. 15% of $25 is __________

9. 12½ % of 400 is ___________

10. 33 $\frac{1}{3}$ % of 168 is __________

11. ¼% of 400 is __________

PERCENTS

1. A basketball team loses 105 games, which is 70% of the games played. How many games were played?

2. A manager marks down the price on a toaster oven by 20%. He then decided to raise the price by marking up the new price by 20%. What is the difference between the original price and the current price?

3. Dinner cost $40. I want to leave a 15% tip. How much do I pay in total?

4. I paid $25.30 for dinner. This includes a 15% tip. What was the bill without the tip?

5. I have \$20. My friend has \$25. I say I have 20% less than my friend. She says she has 25% more than me. Who is right?

6. A thrift store marked down all clothing 25%. After the sale, the leftover items were marked down 15% off the sales price. I have a coupon good for 20% off the sales price of any item. What percent of the original price is saved when I use the coupon to buy a sweater?

$5 - 7$

1. Illustrate this problem in the set model with black and red chips.

2. Illustrate this problem in the measurement model.

3. Write a word problem leading to this calculation.

4. Which whole number calculation has the answer to this problem as its opposite?

$5 - (-3)$

1. Illustrate this problem in the set model with black and red chips.

2. Illustrate this problem in the measurement model.

3. Write a word problem leading to this calculation.

$3 \times (-4)$, $(-3) \times 4$, $(-3) \times (-4)$

1. Draw a picture of $3 \times (-4)$ using chips.

2. What does $(-3) \times 4$ mean? What are "negative three copies" of four?

3. Use the distributive property of multiplication to compute $(-3) \times (-4) + 3 \times (-4)$.

4. Compute $(-3) \times (-4)$. Draw pictures in the set model and measurement model.

$(-9) \div 3$, $(-9) \div (-3)$, $9 \div (-3)$

1. Illustrate $(-9) \div 3$ using chips. Does your picture reflect the partitive or measurement approach to division?

2. Illustrate $(-9) \div (-3)$ using chips. Does your picture reflect the partitive or measurement approach to division?

3. It is hard to illustrate dividing a positive by a negative. Find some way to compute (with justification) $9 \div (-3)$.