MULTIPLYING AND DIVIDING 2

Name: Key Date:_____ Period:_____

SECTION 2.3 LINEAR MODEL FOR DIVISION

VOCABULARY

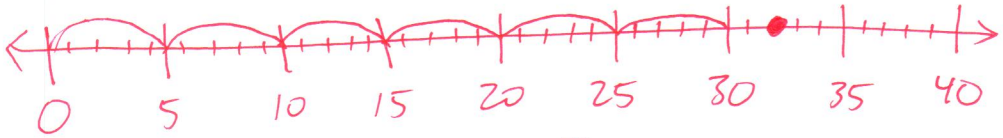
DEFINITION	EXAMPLE
Divisor: what you divide a number by	$18 \div 2 = 9$
Quotient: the result of division	$18 \div 2 = 9$
Dividend: a number that is divided	$18 \div 2 = 9$
Factor: if the dividend is evenly divided by the divisor, the divisor is a factor	$16 \div 8 = 2$ $8 \cdot 2 = 16$
Missing Factor Model: reverse of multiplication, find "what times the divisor equals the dividend"	$x \cdot 3 = 15$ $5 \cdot 3 = 15$ so $15 \div 3 = 5$
Remainder: the part left over after dividing	$12 = 5 \cdot 2 + 2$ $12 \div 5$ has a remainder 2. remainder

Big Idea: How do we use the linear model to perform division?

EXPLORATION 1: BIG WATER BOTTLE

A 32-ounce bottle of water needs to be evenly distributed among 5 students. How many whole number of ounces of water will each student get, and how much water will be left over?

Begin by drawing a number line to show the number of ounces in the big water bottle. Use the Linear Model by skip counting by the number of students in order to distribute the water evenly.



EXPLORATION 1: CONTINUED

a. Each student will receive 6 ounces of water (a whole number).

b. There will be 2 ounces of water remaining

c. Notice when using the remainder, the solution is $32 = 5 \cdot 6 + 2$

EXPLORATION 2: MR. GARZA'S CANDY

Mr. Garza has 20 pieces of candy. He wants to divide the candy equally among 6 children. How should he distribute the candy?

One way to distribute the candy is to think of this process in steps. In step 1, give each child 1 piece of candy. This means Mr. Garza has $20 - 6 = 14$ pieces of candy left. In step 2, Mr. Garza gives each child a second piece of candy. He now has $14 - 6 = 8$ pieces of candy left. In step 3, Mr. Garza gives each child a third piece of candy. He now has $8 - 6 = 2$ pieces of candy left. He can no longer give an equal number of pieces to each of the 6 children, so he stops. It took 3 steps to equally distribute as many pieces of candy as Mr. Garza could. That means each child received 3 candies. Write this as $20 = 3 \cdot 6 + 2$. Picture this as a linear model by skip counting to divide 20 by 6, which corresponds to the counting 3 skips of length 6: $3 \cdot 6 = 18$, 2 units short of 20.

In division, the problem involves the dividend and the divisor, and the task is to compute the quotient. In the linear model, the dividend is the total length. There are two possible cases:

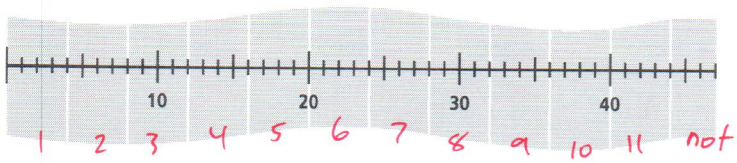
(1) Know the length of each jump and call it the divisor. Find the quotient, which in this case is the number of jumps that equal the total length.

(2) Know the number of jumps and call it the divisor. Find the quotient, which in this case is the length of each jump.

In multiplication, the problem starts with the length of each jump and the number of jumps. The answer is the accumulated length of all the jumps. Again, division is the reverse of the multiplication process.

EXAMPLE 1:

Robin has 47 feet of ribbon on a roll. She wants to cut this roll of ribbon into 4-foot strips for decorations. How many 4-foot strips of ribbon can she make? How much ribbon will be left over, if any?



11 4-foot strips with 3 feet left over

Notice when using the remainder, the solution is 47 = 4 · 11 + 3

PROBLEMS:

1. Evaluate the following, and write the associated multiplication fact. Use the linear model or long division, if needed. The first one is done for you. (Hint: Think Fact Families!)

   a. 56 ÷ 7 = 8 because 8 · 7 = 56

   b. 72 ÷ 12 = 6 because 6 · 12 = 72

   c. 238 ÷ 7 = 34 because 34 · 7 = 238

   $$\begin{array}{r} {\scriptstyle 2}\,34 \\ \times\ \ 7 \\ \hline 238 \end{array}$$

   d. 192 ÷ 8 = 24 because 24 · 8 = 192

   $$\begin{array}{r} {\scriptstyle 3}\,24 \\ \times\ \ 8 \\ \hline 192 \end{array}$$

2. Write the associated multiplication fact, making the remainder as small as possible. The first one is done for you.

a. $53 \div 6 =$ 8 R 5 because $53 = 6 \cdot 8 + 5$ (48)

b. $84 \div 9 =$ 9 R 3 because $84 = 9 \cdot 9 + 3$ (81)

c. $39 \div 7 =$ 5 R 4 because $39 = 7 \cdot 5 + 4$ (35)

d. $87 \div 14 =$ 6 R 3 because $87 = 14 \cdot 6 + 3$ (84)

e. $104 \div 33 =$ 3 R 5 because $104 = 33 \cdot 3 + 5$ (99)

f. $456 \div 9 =$ 50 R 6 because $456 = 9 \cdot 50 + 6$ (450)

3. Rachel, Sarah, and Sophia are texting their friends during summer vacation. If together they sent 2,112 messages, and all 3 girls sent the same number of texts, how many texts did each girl send?

704 texts

$$\begin{array}{r} 704 \\ 3\overline{)2112} \\ -21 \\ \hline 012 \\ -12 \\ \hline 00 \end{array}$$

OR

4	700
3 | 12	2100

(based on multiplication in Section 2.2)

OR count the jumps by extending the number line

4. There are 16 children in Mrs. Marques' math camp class. One day she comes to class with freshly baked cookies to share. She gives each student an equal number of cookies and discovers that she has 9 left over. She knows she started with less than 5-dozen cookies.

$5 \cdot 12 = 60$

a. What is the largest number of cookies Mrs. Marques could have had originally?

$9 + 16 \cdot \_\_ < 60$

educated guess and check:

$9 + 16 \cdot 2 = 9 + 32 = 41$ (could have one more 16 before going over 60)

$9 + 16 \cdot 3 = 57$ and $57 < 60$

b. How many cookies would she have given each student in that case?

3 cookies to each student

c. What other possible solutions could this problem have?

$9 + 16 \cdot 0 = 9$ cookies, each student gets 0

$9 + 16 \cdot 1 = 25$ cookies, each student gets 1

$9 + 16 \cdot 2 = 41$ cookies, each student gets 2

5. Rewrite the following using three different symbols for division:

a. 15 divided by 7 $15 \div 7$ $\frac{15}{7}$ $7\overline{)15}$

b. 22 divided by x $22 \div x$ $\frac{22}{x}$ $x\overline{)22}$

c. y divided by 25 $y \div 25$ $\frac{y}{25}$ $25\overline{)y}$

SUMMARY (What I learned in this section)