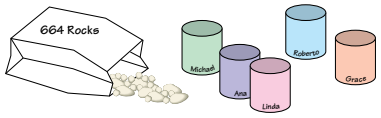
Modeling Division

Grace collected 664 rocks at the beach. She wants to divide the rocks equally among four friends and herself. How many rocks should Grace put into each cup?



Explore

1. Write Grace's problem as a division problem.
2. How many rocks should Grace put into each of the five cups? Show or tell how you know. Draw a picture.
3. Are any rocks left over after dividing them among the five cups?
4. How can you check that your answer is reasonable?

Grace starts to put rocks into each cup one at a time. Then she decides it will be easier if she first figures out how many to put in each cup. She draws a diagram to help her solve the problem.


Grace

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Explore

5. What does the total number of rocks collected in one column represent?
6. What do the numbers to the right of the columns mean?
7. How does Grace figure out how many rocks are left in the bag after each try?
8. When does Grace decide she is done with the problem?
9. What does it mean to say that there are four rocks left over? Why doesn't Grace divide them into the columns too?

When Grace can no longer divide the remaining rocks evenly into the cups, she has carried the division as far is it will go (since she cannot cut rocks into pieces). The number of rocks that is left in the bag is called the **remainder.**

Remainders can be written in several ways. A common way to express a remainder is with the letter 'R.' For example, in Grace 's problem, the quotient and remainder can be written the following ways:

132 R4 or 132 r4

10. Nila has a bag of 837 shells to share equally among her five classmates. Help her use Grace's Column Method to figure out how many shells each person gets.
    - **A.** Draw and label the columns Nila needs to solve this problem.
    - **B.** "Fill" the columns equally.
    - **C.** How many shells did each classmate get?
    - **D.** How many shells are left over?
    - **E.** What should Nila do with the leftover shells?

Use the Column Method to solve the problems on the *Dividing Into Columns* pages in the *Student Activity Book.*

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Student Guide

Modeling Division (SG pp. 298–304)
Questions 1–29

1. $664 \div 5$ or $5\overline{)664}$
2. 132 rocks; Possible drawing:

2	2	2	2	2
10	10	10	10	10
20	20	20	20	20
100	100	100	100	100
1	**2**	**3**	**4**	**5**

3. 4 rocks left over
4. Possible responses: Use estimation ($5 \times 120 = 600$, so the number of rocks will be greater than 120) or check with multipliction ($5 \times 132 + 4 = 664$).
5. Numbers in each column are each student's share of the rocks taken from the bag; or the total number in each column is each student's total share of the rocks. The total is the quotient.
6. Numbers to the right are the amounts taken from the bag and distributed into each cup.
7. Grace subtracts the total number of rocks going into the cups from the number left in the bag from the previous try.
8. Grace is done when there are not enough rocks in the bag to distribute equally into all five cups.
9. Rocks cannot be easily split into pieces. Four rocks cannot be divided evenly into 5 bags.
10. **A–B.**

2	2	2	2	2	10
5	5	5	5	5	25
10	10	10	10	10	50
50	50	50	50	50	250
100	100	100	100	100	500
1	**2**	**3**	**4**	**5**	

C–D. 167 shells with 2 left over

E. Answers will vary. Possible response: Nila should keep the 2 leftover shells for herself.

11.

5	5	5	5	5	5	5	5	5	5	5	5
40	40	40	40	40	40	40	40	40	40	40	40
50	50	50	50	50	50	50	50	50	50	50	50
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

Into the Columns	Left to Divide
60	60 – 60 = 0
480	540 – 480 = 60
600	1140 – 600 = 540

12. Possible response:

$$\begin{array}{rl} 12 \times 90 & = 1080 \\ 12 \times 5 & = \underline{\ \ 60} \\ & \ \ 1140 \end{array}$$

$1140 \div 12 = 95$

13.* There would still be 95 teams, but there would be 11 extra players left over.

14. Stories and related number sentences will vary. Related multiplication problems and answers are shown.

A.* $3 \times ? = 512$; 170 R2

B. $7 \times ? = 728$; 104

C. $6 \times ? = 3024$; 504

D. $4 \times ? = 7000$; 1750

E. $? \times 5 = 4253$; 850 R3

F. $? \times 8 = 792$; 99

15. A. 60 sq. ft.; $5 \times 12 = 60$

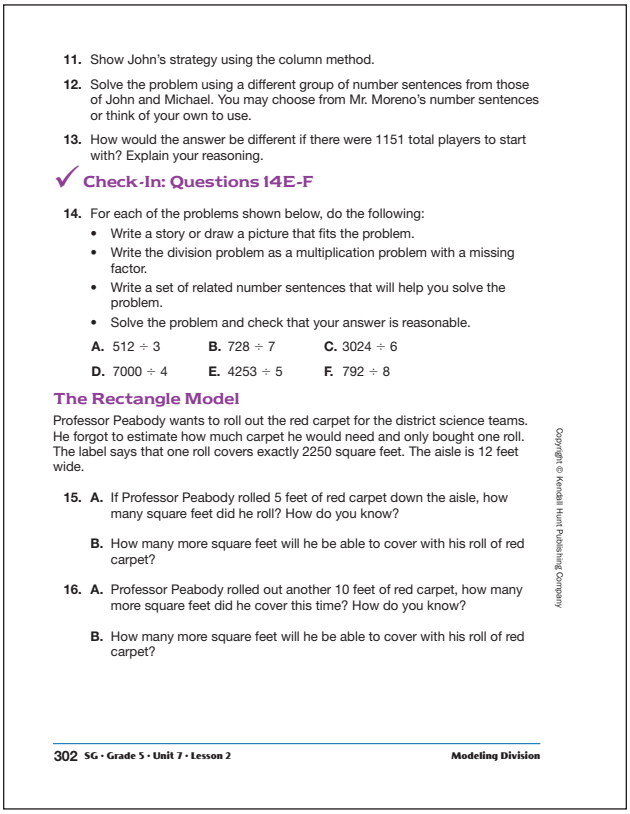
B. 2190 sq. ft.; $2250 - 60 = 2190$

16. A. 120 sq. ft.; $10 \times 12 = 120$

B. 2070 sq. ft.; $2190 - 120 = 2070$

17.* 187 feet with 6 square feet of carpet left over; Possible strategy: So far Professor Peabody has covered $10 + 5 = 15$ ft. down the hall. He has 2070 sq. ft. of carpet left. $100 \times 12 = 1200$ so he can cover another 100 ft.
$2070 - 1200 = 870$. He has 870 sq. ft. of carpet left. $70 - 12 = 840$, so he can cover another 70 ft with 30 sq. ft. left. $2 \times 12 = 24$, so he can cover another 2 feet down the hall, with 6 sq. ft. left.
$15 + 100 + 70 + 2 = 187$ feet down the hall.

18.* Yes, there is enough left over carpet to cover 6 square feet.



11. Show John's strategy using the column method.

12. Solve the problem using a different group of number sentences from those of John and Michael. You may choose from Mr. Moreno's number sentences or think of your own to use.

13. How would the answer be different if there were 1151 total players to start with? Explain your reasoning.

✓ **Check-In: Questions 14E-F**

14. For each of the problems shown below, do the following:
- Write a story or draw a picture that fits the problem.
- Write the division problem as a multiplication problem with a missing factor.
- Write a set of related number sentences that will help you solve the problem.
- Solve the problem and check that your answer is reasonable.

A. 512 ÷ 3 **B.** 728 ÷ 7 **C.** 3024 ÷ 6
D. 7000 ÷ 4 **E.** 4253 ÷ 5 **F.** 792 ÷ 8

The Rectangle Model

Professor Peabody wants to roll out the red carpet for the district science teams. He forgot to estimate how much carpet he would need and only bought one roll. The label says that one roll covers exactly 2250 square feet. The aisle is 12 feet wide.

15. **A.** If Professor Peabody rolled 5 feet of red carpet down the aisle, how many square feet did he roll? How do you know?

B. How many more square feet will he be able to cover with his roll of red carpet?

16. **A.** Professor Peabody rolled out another 10 feet of red carpet, how many more square feet did he cover this time? How do you know?

B. How many more square feet will he be able to cover with his roll of red carpet?

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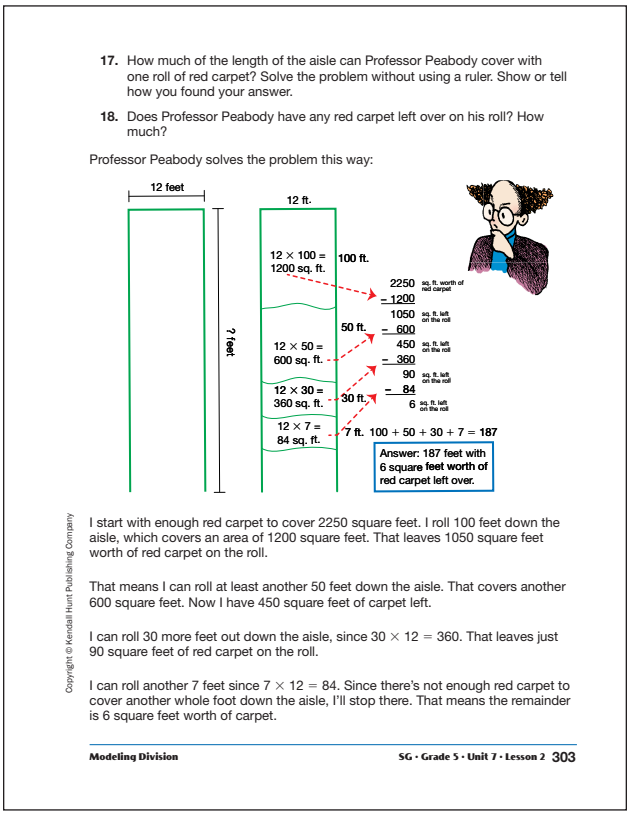

17. How much of the length of the aisle can Professor Peabody cover with one roll of red carpet? Solve the problem without using a ruler. Show or tell how you found your answer.

18. Does Professor Peabody have any red carpet left over on his roll? How much?

Professor Peabody solves the problem this way:

I start with enough red carpet to cover 2250 square feet. I roll 100 feet down the aisle, which covers an area of 1200 square feet. That leaves 1050 square feet worth of red carpet on the roll.

That means I can roll at least another 50 feet down the aisle. That covers another 600 square feet. Now I have 450 square feet of carpet left.

I can roll 30 more feet out down the aisle, since $30 \times 12 = 360$. That leaves just 90 square feet of red carpet on the roll.

I can roll another 7 feet since $7 \times 12 = 84$. Since there's not enough red carpet to cover another whole foot down the aisle, I'll stop there. That means the remainder is 6 square feet worth of carpet.

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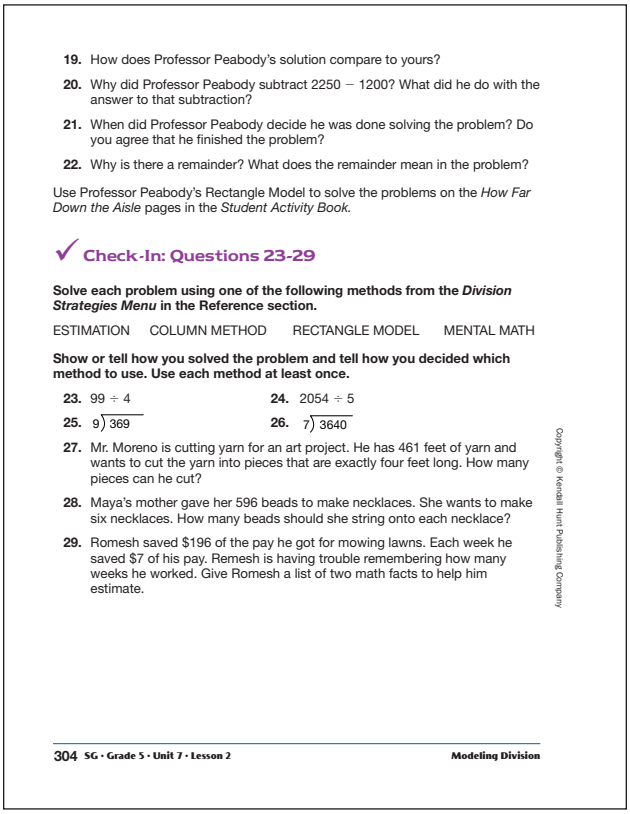
***Answers and/or discussion are included in the lesson.**



19. How does Professor Peabody's solution compare to yours?

20. Why did Professor Peabody subtract 2250 − 1200? What did he do with the answer to that subtraction?

21. When did Professor Peabody decide he was done solving the problem? Do you agree that he finished the problem?

22. Why is there a remainder? What does the remainder mean in the problem?

Use Professor Peabody's Rectangle Model to solve the problems on the *How Far Down the Aisle* pages in the *Student Activity Book*.

✓ **Check-In: Questions 23-29**

Solve each problem using one of the following methods from the *Division Strategies Menu* in the Reference section.

ESTIMATION COLUMN METHOD RECTANGLE MODEL MENTAL MATH

Show or tell how you solved the problem and tell how you decided which method to use. Use each method at least once.

23. 99 ÷ 4

24. 2054 ÷ 5

25. $9\overline{)369}$

26. $7\overline{)3640}$

27. Mr. Moreno is cutting yarn for an art project. He has 461 feet of yarn and wants to cut the yarn into pieces that are exactly four feet long. How many pieces can he cut?

28. Maya's mother gave her 596 beads to make necklaces. She wants to make six necklaces. How many beads should she string onto each necklace?

29. Romesh saved $196 of the pay he got for mowing lawns. Each week he saved $7 of his pay. Remesh is having trouble remembering how many weeks he worked. Give Romesh a list of two math facts to help him estimate.

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19. Answers will vary.

20. He used up 1200 square feet of carpet from the 2250 square feet on the roll.

    He continued to "divide" the remaining carpet by rolling another 50 feet down the hall.

21. When he could not roll another full foot down the hall (i.e., when he had less than 6 square feet worth of carpet left).

22. He had enough carpet left over to cover only 6 square feet, not 12.

23. 24 R3

24. 410 R4

25. 41

26. 520

27. 115 pieces with1 foot left over

28. 99 beads with 2 beads left over

29. 28 weeks; Possible math facts: $7 \times 8 = 56$, $7 \times 20 = 140$

Homework (SG p. 305)
Questions 1–7

1. A. Stories and related number sentences will vary. $9 \times ? = 4780$. $4780 \div 9 = 531$ R1

B. Stories and related number sentences will vary. $80 \times ? = 885$. $885 \div 80 = 11$ R5

2. $768 \div 11$ is between 60 and 70 but closer to 70. $11 \times 60 = 660$ and 11×70 is 770.

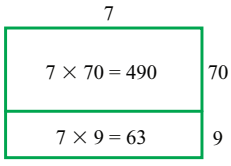
3. $8523 \div 4 = 2{,}130$ R3. Possible solution using column method:

				Into the Columns	Left to Divide
5	5	5	5	20	23 – 20 = 3
25	25	25	25	100	123 – 100 = 23
100	100	100	100	400	523 – 400 = 123
2000	2000	2000	2000	8000	8523 – 8000 = 523
1	2	3	4		

Answer: 2130 R3

4. $84{,}000 \div 12 = 7000$. Possible solution using mental math: To solve $84{,}000 \div 12$, I think about multiplication. I know $12 \times 7 = 84$, $12 \times 70 = 840$, $12 \times 700 = 8400$, and $12 \times 7000 = 84{,}000$. So $84{,}000 \div 12 = 7000$.

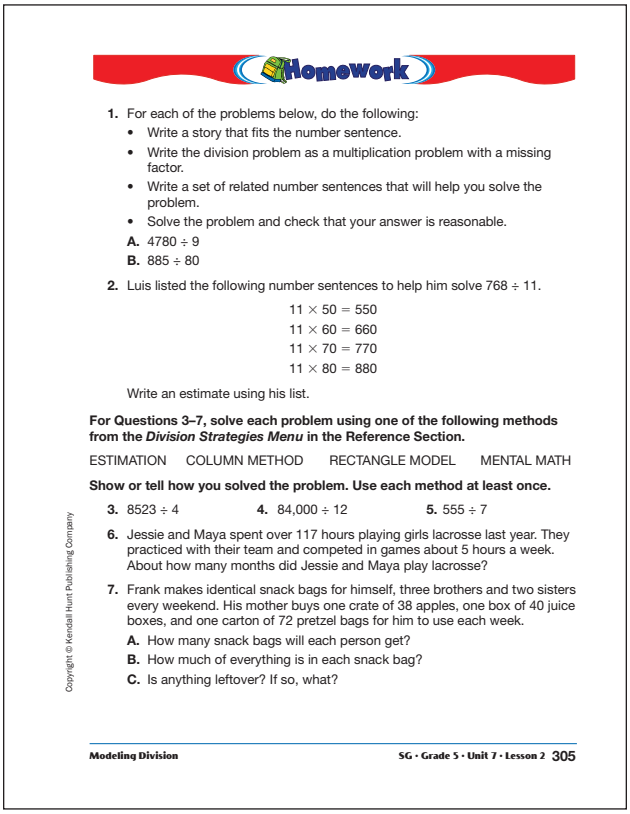
5. $555 \div 7 = 79$ R2. Possible solution using the rectangle model:



Answer: 79 R2

$555 - 490 = 65$, $65 - 63 = 2$

6. About 6 months. Possible solution using estimation: I know that $5 \times 20 = 100$ plus $5 \times 3 = 15$ is 115. $117 - 115 = 2$ hours left over. $20 + 3 = 23$ weeks. To find how many months I know that $24 \div 4 = 6$, so $23 \div 4$ is a little less.



Homework

1. For each of the problems below, do the following:
   - Write a story that fits the number sentence.
   - Write the division problem as a multiplication problem with a missing factor.
   - Write a set of related number sentences that will help you solve the problem.
   - Solve the problem and check that your answer is reasonable.

   A. 4780 ÷ 9
   B. 885 ÷ 80

2. Luis listed the following number sentences to help him solve 768 ÷ 11.

   11 × 50 = 550
   11 × 60 = 660
   11 × 70 = 770
   11 × 80 = 880

   Write an estimate using his list.

For Questions 3–7, solve each problem using one of the following methods from the *Division Strategies Menu* in the Reference Section.

ESTIMATION COLUMN METHOD RECTANGLE MODEL MENTAL MATH

Show or tell how you solved the problem. Use each method at least once.

3. 8523 ÷ 4 4. 84,000 ÷ 12 5. 555 ÷ 7

6. Jessie and Maya spent over 117 hours playing girls lacrosse last year. They practiced with their team and competed in games about 5 hours a week. About how many months did Jessie and Maya play lacrosse?

7. Frank makes identical snack bags for himself, three brothers and two sisters every weekend. His mother buys one crate of 38 apples, one box of 40 juice boxes, and one carton of 72 pretzel bags for him to use each week.
   A. How many snack bags will each person get?
   B. How much of everything is in each snack bag?
   C. Is anything leftover? If so, what?

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7. Methods and answers will vary. Possible response using the column method:

12 pretzel bags	12 pretzel bags	12 pretzel bags	12 pretzel bags	12 pretzel bags	12 pretzel bags	12 × 6 = 72 pretzel bags	72 − 72 = 0 left over
6 juice boxes	6 juice boxes	6 juice boxes	6 juice boxes	6 juice boxes	6 juice boxes	6 × 6 = 36 juice boxes	40 − 36 = 4 left over
6 apples	6 apples	6 apples	6 apples	6 apples	6 apples	6 × 6 = 36 apples	38 − 36 = 2 left over
Frank	Bro 1	Bro 2	Bro 3	Sis 1	Sis 2		

A. 6 snack bags per person

B. 1 apple, 1 juice box, and two pretzel bags

C. 2 apples and 4 juice boxes are left over