



GRADE 5 SUPPLEMENT

Set A4 Numbers & Operations: Long Division

Includes

Activity 1: Introducing the Standard Algorithm

A4.1

Activity 2: Extending the Standard Algorithm

A4.11

Skills & Concepts

- ★ fluently and accurately divide up to a 4-digit number by 1- and 2-digit divisors accurately using the standard long division algorithm
- ★ estimate quotients to approximate solutions and determine reasonableness of answers in problems involving up to 2-digit divisors
- ★ determine and interpret the mean of a small data set of whole numbers

Bridges in Mathematics Grade 5 Supplement

Set A4 Numbers & Operations: Long Division

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A4 ★ Activity 1



ACTIVITY

Introducing the Standard Algorithm

Overview

Chances are, many of your students are using the strategies taught in Unit Four with pretty good success by now. There are times, however, when the multiplication menu is not the most efficient or effective method to divide one number by another. This activity introduces the standard algorithm for long division as another method.

Skills & Concepts

- ★ fluently and accurately divide up to a 4-digit number by 1- and 2-digit divisors accurately using the standard long division algorithm
- ★ estimate quotients to approximate solutions and determine reasonableness of answers in problems involving up to 2-digit divisors
- ★ determine and interpret the mean of a small data set of whole numbers

You'll need

- ★ Schools in Two Towns (pages A4.5 and A4.6, run one copy of each sheet on a transparency)
- ★ More Long Division Problems (page A4.7, run one copy on a transparency)
- ★ Using the Standard Algorithm for Long Division (pages A4.8 and A4.9, run a class set)
- ★ a piece of paper to mask parts of the transparency
- ★ overhead pens
- ★ Student Math Journals or 1 piece of lined or grid paper per student

Instructions for Introducing the Standard Algorithm

1. Let students know that you are going to introduce a strategy for long division that may be new to some of them, and familiar to others. Place the top portion of the first overhead on display as students get out their journals and pencils.

Set A4 Numbers & Operations: Long Divis on Blackline Run one copy on a transparency

Schools in Two Towns page 1 of 2

1 There are 3 elementary schools in Jewel. The chart below shows how many students there are in each school.

School	Number of Students
Lincoln Elementary	296
Washington Elementary	322
King Elementary	245

a What is the average (mean) number of students in the Jewel elementary schools?

2. Read the information on the overhead with the class. Review the definition of the term *mean*, and ask students to record an estimate in their journals, along with a brief explanation of their thinking. After a minute or two, ask them to pair-share their estimates. Then call on volunteers to share their estimates with the class and explain their thinking.

Activity 1 Introducing the Standard Algorithm (cont.)

Marcus *I said the average is going to be around 280. The first school is almost 300. The second one is more than 300, but the third school is a little less than 250. I think the third school is going to bring the average down to around 280*

Elisha *I pretty much agree with Marcus, but I think the average is going to be around 275.*

3. Now show the bottom portion of the overhead. Review with students how to find the mean by adding and then dividing. Ask them to add the three numbers in their journals, but go no further for now. Have them raise their hands when they have the total. When most hands are raised, call on a few students to share their answers. When there is general consensus that the total is 863, work with student input to record the division problem on the grid that has been provided.

b Estimate the average.

c Find the average.

	3	8	6	3			

$$\begin{array}{r} 296 \\ 322 \\ + 245 \\ \hline 863 \end{array}$$

4. Think with students about how using the multiplication menu would play out for this problem. What if you started with 10×3 , then 20×3 , then 5×3 , as you have so many times in solving long division problems this year. Would this information be useful and helpful? Does it seem as if the multiplication menu would be an effective and efficient strategy for solving this problem? Let students pair-share for a minute about these questions.

5. Then explain that there is another strategy that might be easier in this situation. It is called the “standard algorithm” for long division because it is a common paper-and-pencil method for finding a quotient. When people use this strategy, they work with the numbers in the divisor separately. Tell students you are going to demonstrate the strategy. Ask them to watch closely to see if they can understand what you are doing. Challenge them to watch for some of the differences and likenesses between the standard algorithm and the multiplication menu strategy.

Teacher *First I look at the 8 in 863 and think, “8 divided by 3 is more than 2, just not more than 3, because 2×3 is 6, and 3×3 is too much.” So I write a 2 in the hundreds place. Then I write 6 under the 8 and subtract. That’s 2, so I bring down the 6. Now I divide 26 by 3. I get 8 with 2 left over since 8×3 is 24. So I write an 8 in the tens place and subtract 24 from 26. Does it look like the average is going to be close to your estimate?*

Students *I’ve seen this way to divide from my sister.
It looks like it’s going to come out to two eighty-something.
I think maybe 275 is a little too low.*

6. Continue until the problem is complete. Then discuss the remainder with the students. What does a remainder of 2 mean in this context? Would it make best sense to express the remainder as a whole number, a decimal, or a fraction? Why?

Activity 1 Introducing the Standard Algorithm (cont.)

Students You can't cut up the 2. These are kids, not cookies!

If you put exactly the same number of kids in each school, there would be 287 in one school and 288 in the other two.

c Find the average.

		2	8	7	r 2		
	3	8	6	3			
	-	2					
		2	6				
		-	2	4			
			2	3			
			-	2	1		
					2		

$$\begin{array}{r} 296 \\ 322 \\ + 245 \\ \hline 863 \end{array}$$

The average number of students is 287.

The is a remainder of 2. It's kids, so we'll leave the number whole

7. Ask students to compare the answer with their estimates.

- Is 287 with a remainder of 2 a reasonable answer?
- Why or why not?

Invite them to comment on the long division algorithm as well.

- How does it compare with the multiplication menu?
- Do they think this strategy would be equally useful in all contexts?
- Why or why not?

8. After students have had a chance to share their thinking, display the second overhead. Repeat the steps described above, but this time, ask students to work the problem with you in their journals.

Set A4 Numbers & Operations: Long Divis on Blackline Run one copy on a transparency

Schools in Two Towns page 2 of 2

2 There are 4 elementary schools in Emerald. The chart below shows how many students there are in each school.

School	Number of Students
Sarah Goode Elementary	397
Hayes Elementary	423
Carver Elementary	229
Grover Elementary	486

a Do you think that the average number of students in the Emerald schools is greater or less than the average number of students in the Jewel Schools? Why?

b Estimate the average.

c Find the average.

		3	8	3	r 3		
	4	1	5	3	5		
	-	1	2				
			3	3			
			-	3	2		
					1	5	
					-	1	2
							3

$$\begin{array}{r} 397 \\ 423 \\ 229 \\ + 486 \\ \hline 1535 \end{array}$$

Activity 1 Introducing the Standard Algorithm (cont.)

9. Now display the problems on the More Long Division Problems overhead one at a time. Each time, ask students to generate a word problem to match, and record an estimate in their journals, along with a brief explanation of their thinking. You can also ask them apply what they know about divisibility to predict whether or not there will be a remainder. Have them record each problem in their journals, using the grid lines to help align the numbers correctly, and work it as you do so at the overhead. If some of your students are already very familiar with the algorithm, you might let them take turns leading the class at the overhead.

Set A4 Numbers & Operations: Long Division Blackline Run one copy on a transparency

More Long Division Problems

1

5	9	8	5		

2

6	8	0	4		

3

3	8	4	5	4	

4

9	3	7	4	6	

Set A4 Numbers & Operations: Long Division Blackline Run a class set

NAME _____ DATE _____

Using the Standard Algorithm for Long Division Page 1 of 2

The standard algorithm is not the only strategy for long division. However, many people find it especially useful when they are dividing a very large number, like 8,746 by a very small number, like 5.

For each of the long division problems on this page and the next:

- write a story problem to match.
- estimate the answer and write a sentence to explain your estimate.
- predict whether there will be a remainder or not, and explain your thinking.

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	3	7	6	5																																																									

10. Finally, give students each a copy of Using the Standard Algorithm for Long Division. Review the instructions on the first sheet with the class. When students understand what to do, let them go to work. Depending on the strengths and needs of your students, you might give them the choice of working on the sheet independently or working as a smaller group with you.

Schools in Two Towns page 1 of 2

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b Estimate the average.

c Find the average.

Schools in Two Towns page 2 of 2

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a Do you think that the average number of students in the Emerald schools is greater or less than the average number of students in the Jewel Schools? Why?

b Estimate the average.

c Find the average.

More Long Division Problems

1

	5	9	8	5			

2

	6	8	0	4			

3

	3	8	4	5	4		

4

	9	3	7	4	6		

NAME _____

DATE _____

Using the Standard Algorithm for Long Division Page 1 of 2

The standard algorithm is not the only strategy for long division. However, many people find it especially useful when they are dividing a very large number, like 8,746 by a very small number, like 5.

For each of the long division problems on this page and the next:

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- estimate the answer and write a sentence to explain your estimate.
- predict whether there will be a remainder or not, and explain your thinking.

example

		1	7	4	9	r1	
5	8	7	4	6			
-	5	↓	↓	↓			
	3	7					
-	3	5	↓				
		2	4				
	-	2	0	↓			
			4	6			
			-	4	5		
					1		

Story Problem

Estimate:

Remainder or Not?

1

3	7	6	5				

Story Problem

Estimate

Remainder or Not?

NAME _____

DATE _____

Using the Standard Algorithm for Long Division Page 2 of 2

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	5	7	4	2	0																																																																												

Set A4 ★ Activity 2



ACTIVITY

Extending the Standard Algorithm

Overview

Students use the standard algorithm to divide 3- and 4-digit numbers by 2-digit numbers. In the process, they explore the idea of using a “mini” multiplication menu if and when needed.

Skills & Concepts

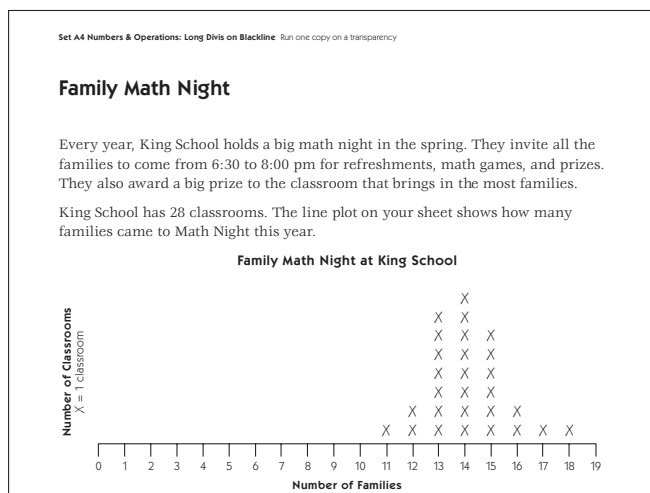
- ★ fluently and accurately divide up to a 4-digit number by 1- and 2-digit divisors accurately using the standard long division algorithm
- ★ estimate quotients to approximate solutions and determine reasonableness of answers in problems involving up to 2-digit divisors
- ★ read and interpret a line plot
- ★ determine and interpret the mean of a small data set of whole numbers

You'll need

- ★ Family Math Night (page A4.15, run one copy on a transparency)
- ★ Family Math Night Worksheet (pages A4.16 and A4.17, run a class set)
- ★ a piece of paper to mask parts of the overhead
- ★ overhead pens
- ★ Student Math Journals or 1 piece of lined or grid paper per student

Instructions for Extending the Standard Algorithm

1. Open the activity by explaining that the class is going to think some more about strategies for handling long division problems today. Then place the top portion of the Family Math Night overhead on display. Read the text with the class, and give students a minute or two to examine the line plot quietly. Ask them to think of at least two observations they can share with a partner in a minute.



Activity 2 Extending the Standard Algorithm (cont.)

2. Have students pair-share their observations about the line plot. Then pose the following questions about the line plot.

- What information does the line plot provide?
- Who might be interested in this information?
- What does each x stand for? (a classroom)
- How many classrooms brought 14 families to Math Night? (8 classrooms)
- How many families was that in all? (112 families)
- About how many families in all came to Math Night?
- Can you find the exact total by counting up the x's? Why not?
- What do you need to do to find the total number of families that came to Math Night?

Be sure students understand that they can't find the total number of families by simply counting the x's on the line plot, because each x stands for a classroom. There are 6 x's above the 15, which means that 6 classrooms brought in 15 families each. 6×15 is 90, and that's only part of the total.

3. Now give students each a copy of the Family Math Night Worksheets, and display the prompt toward the bottom of the Family Math Night overhead that instructs students to use the information on the line plot to answer the questions on their sheets. Be sure students understand they need to stop after question 4b on the second sheet.

Set A4 Numbers & Operations: Long Division Blackline Run a class set

NAME _____ DATE _____

Family Math Night Worksheet page 1 of 2

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families. King School has 28 classrooms. The line plot below shows how many families came to Math Night this year.

Family Math Night at King School

1 How many families did the winning classroom bring to Math Night? _____

2 How many families did most of the classrooms bring in? _____

3 Use the information from the line plot to complete the chart below.

Classrooms	Families	Total Number of Families
a 1	11	$1 \times 11 = 11$ families
b 2	12	$2 \times 12 = 24$ families
c 7	13	$7 \times 13 = \underline{\hspace{1cm}}$ families
d _____	14	$\underline{\hspace{1cm}} \times 14 = \underline{\hspace{1cm}}$ families
e 6	_____	$6 \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ families
f 1	17	$\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ families
g 1	18	$\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ families
h Grand Total: How many families in all attended Math Night? _____ families		

Set A4 Numbers & Operations: Long Division Blackline Run a class set

NAME _____ DATE _____

Family Math Night Worksheets page 2 of 2

4a Sara thinks the average number of families that came to Math Night from each classroom is 14. Do you agree with Sara? (Circle your answer.)

Yes No

b If you think the average is 14 families per classroom, explain why. If you think the average is not 14 families, tell what you think it is and explain why.

c Use the standard algorithm for long division to find the average number of families per classroom that came to Math Night at King School.

The average number of families per classroom was _____

5 Copy each of the problems below into your Math Journal. Use the standard algorithm for long division to solve each. Make mini-menus when you need them.

a

b

c

d

e

f

g

h

i

4. Read the information on the overhead to the class, and review the worksheets with them. When they understand what to do, let them go to work. Encourage them to share and compare their answers to problems 3, 4a, and 4b, and use scratch paper to make or check their calculations. If their solutions don't match, challenge them to work together until they can come to consensus.

Activity 2 Extending the Standard Algorithm (cont.)

5. Circulate to provide support as students are working. Ask students who finish early to double-check their answers to 3, 4a, and 4b, and then find a quiet task to do until their classmates have completed their sheets through question 4b.

6. When most students have completed their sheets through 4b, reconvene the class. Confirm with the group that the total number of families is 395, and ask students to explain what they will need to do to find the average number of families per classroom. Set up the division problem on the overhead grid while students do so on their worksheets. Then ask them to set their sheets aside for a few minutes and work the problem as a class while you record at the overhead.

Teacher *We're going to use the long division algorithm we learned during the last activity, so I'm going to look at the numbers in the dividend one by one. How many times will 28 go into 3?*

Students *It doesn't.*

None at all!

You can't divide 3 by 28, but you can divide 39 by 28.

Yep, 28 goes into 39 one time. Two times 28 is 56, so 2 is way too much.

Teacher *Okay, so I'll write a 1 above the 9 to show that we've divided 39 by 28. Then I'll subtract 28 from 395. Uh oh, I think I'm in trouble now. I got 115 when I brought down the 5. I don't have any idea how many times 28 goes into 115.*

Use the information on the line plot to answer the questions on Family Math Night, sheets 1 and 2. *STOP after question 4b.*

			1				
2	8	3	9	5			

→

Use the information on the line plot to answer the questions on Family Math Night, sheets 1 and 2. *STOP after question 4b.*

			1				
2	8	3	9	5			
		-	2	8	↓		
			1	1	5		

7. When 115 remains, suggest making a mini-menu for 28 so you don't have to solve the problem by trial and error. Work with input from the students to jot a quick menu to the side. We find ten times the divisor to be useful in nearly every situation, and many students will use the information to quickly ascertain that 4×28 will bring them closest to 115.

Use the information on the line plot to answer the questions on Family Math Night, sheets 1 and 2. *STOP after question 4b.*

			1	4	r	3	
2	8	3	9	5			
		-	2	8	↓		
			1	1	5		
		-	1	1	2		
					1		

Mini-Menu for 28

$10 \times 28 = 280$

$5 \times 28 = 140$

$4 \times 28 = 112$

Activity 2 Extending the Standard Algorithm (cont.)

8. When you have finished working the problem at the overhead, ask students to replicate your work on their sheets. What did the average number of families per classroom turn out to be? Were their estimates close? Should the remainder of 3 be left as a whole number, or converted to a fraction or a decimal? Why?

Students *You can't split up families.*

You have to leave the remainder whole.

It's like each classroom brought 14 families, and then 3 of the rooms had 15 if you take the average.

9. Before students complete the rest of the second sheet, erase the grid at the bottom of the overhead. Write $684 \div 23$ into the grid, ask students to copy the problem into their journals, and work it with you, reviewing each step carefully. Chances are, students will agree that a mini-menu is helpful for this problem as soon as they get to the second step, $224 \div 23$.

10. Repeat step 9 with several other problems. Here are some possibilities:

$$509 \div 19$$

$$835 \div 23$$

$$5,604 \div 17$$

$$6,003 \div 24$$

11. When most students are working comfortably with the algorithm, have them complete their second worksheet, or give them time to do so during a designated seatwork period the following day.

Extensions

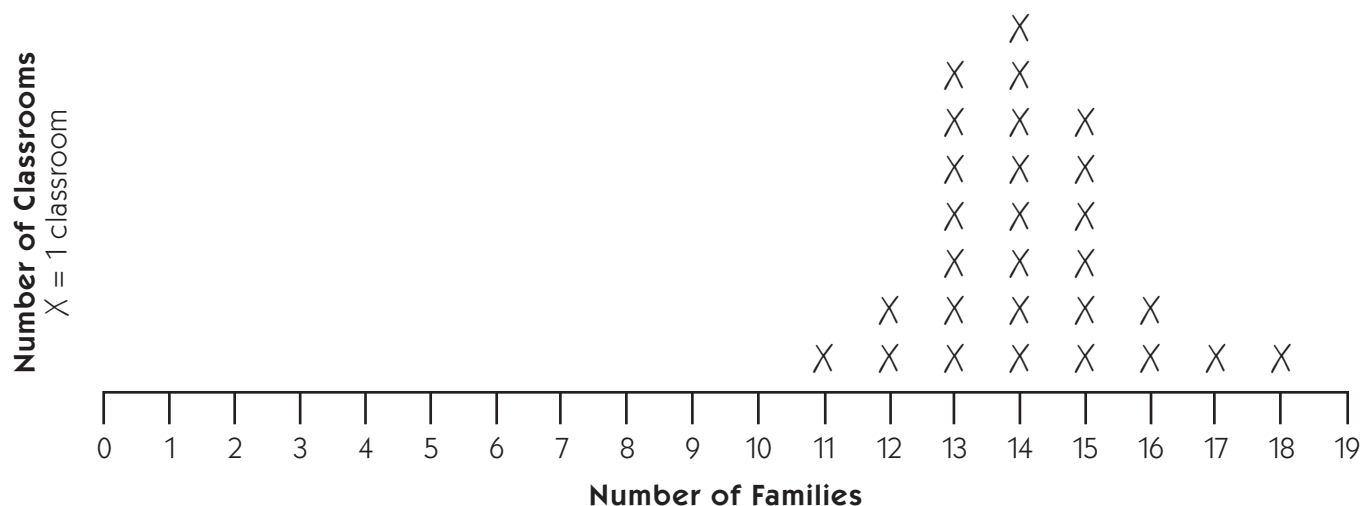
- Home Connections 52, 60 and 61 all offer more practice with long division. Ask students to use the long division algorithm to solve the problems on these sheets.
- Encourage students to experiment with the full-blown multiplication menu, the long division algorithm, and the mini-menu strategy you introduced today. When is each strategy most useful? Is the standard algorithm for long division always the most efficient and effective?
- Ask students to solve a small set of 3–4 long division problems twice or three times a week during seatwork periods throughout the rest of the school year.

Family Math Night

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families.

King School has 28 classrooms. The line plot on your sheet shows how many families came to Math Night this year.

Family Math Night at King School



Use the information on the line plot to answer the questions on Family Math Night, sheets 1 and 2. *STOP after question 4b.*

NAME _____

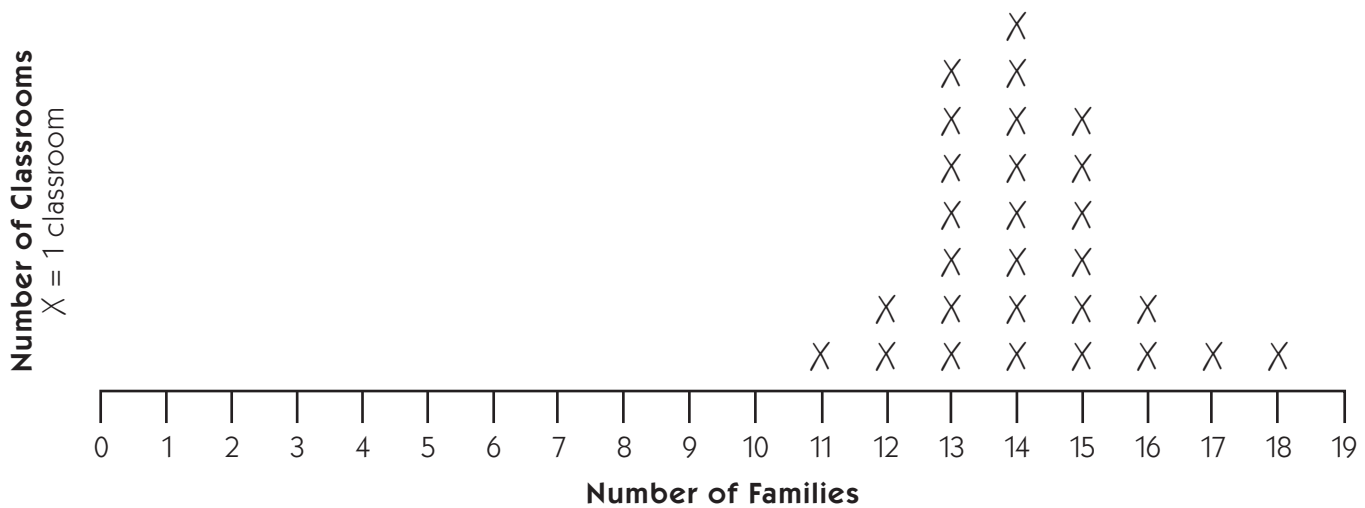
DATE _____

Family Math Night Worksheet page 1 of 2

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families.

King School has 28 classrooms. The line plot below shows how many families came to Math Night this year.

Family Math Night at King School



- How many families did the winning classroom bring to Math Night? _____
- How many families did most of the classrooms bring in? _____
- Use the information from the line plot to complete the chart below.

Classrooms	Families	Total Number of Families
a 1	11	$1 \times 11 = 11$ families
b 2	12	$2 \times 12 = 24$ families
c 7	13	$7 \times 13 = \underline{\quad}$ families
d _____	14	$\underline{\quad} \times 14 = \underline{\quad}$ families
e 6	_____	$6 \times \underline{\quad} = \underline{\quad}$ families
f _____	16	$\underline{\quad} \times 16 = \underline{\quad}$ families
g 1	17	$\underline{\quad} \times \underline{\quad} = \underline{\quad}$ families
h 1	18	$\underline{\quad} \times \underline{\quad} = \underline{\quad}$ families
i	Grand Total: How many families in all attended Math Night? _____ families	

NAME _____

DATE _____

Family Math Night Worksheets page 2 of 2

4a Sara thinks the average number of families that came to Math Night from each classroom is 14. Do you agree with Sara? (Circle your answer.)

Yes

No

b If you think the average is 14 families per classroom, explain why. If you think the average is not 14 families, tell what you think it is and explain why.

c Use the standard algorithm for long division to find the average number of families per classroom that came to Math Night at King School.

The average number of families per classroom was _____

5 Copy each of the problems below into your Math Journal. Use the standard algorithm for long division to solve each. Make mini-menus when you need them.

a

2	6	9	7	8			

b

2	4	7	8	4			

c

1	7	6	3	1			

d

3	2	7	9	6			

e

4	3	9	9	2			

f

1	4	5	0	7	7		

g

2	3	8	5	9	4		

h

2	6	7	4	0	2		

i

3	8	9	4	1	0		

