

Math: Grade 4, Lesson 18, Division

Lesson Focus: Estimating Quotients

Practice Focus: Students will focus on estimation strategies for division.

Objective: Students will use compatible numbers to estimate quotients

Key Vocabulary: estimate, division, divisor, dividend, remainder

TN Standards: 4.OA.A.3

Teacher Materials:

- Whiteboard and markers
- Student Practice Packet

Student Materials:

- Paper and a pencil, and a surface to write on

Teacher Do	Student Do
<p><u>Opening</u> (1 minute)</p> <p>Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 4th graders out there, though all children are welcome to tune in. This lesson is the eighteenth in our series.</p> <p>My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!</p> <p>If you didn't see our previous lesson, you can find it on the TN Department of Education's website at www.tn.gov/education. You can still tune in to today's lesson if you haven't see any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.</p> <p>Today we will be learning about estimating quotients! Before we get started, to participate fully in our lesson today, you will need:</p> <ul style="list-style-type: none"> • Paper and a pencil, and a surface to write on • The student packet for Math, Grade 4, Lesson 18 which can be found at www.tn.gov/education. <p>Ok, let's begin!</p>	<p>Students get materials ready for the lesson.</p>
<p><u>Intro</u> (3 minutes)</p> <p>Remember that a quotient is the answer to a division question. Since we're going to be exploring quotients a little more today, let's do a quick review.</p> <p>Consider this problem.</p> <p>Holly has 38 cookies. She has 5 friends coming to visit. If Holly and her 5 friends each eat an equal number of cookies, how many cookies will each friend get to eat?</p>	<p>This warm-up will support students' understanding of multiplying a whole number by 10, foreshadowing the work in the Teacher Model section.</p> <p>Students will listen to the teacher think aloud modeling the thought</p>

<p>What information does the problem give us? [Pause.] Good. There are 38 cookies for Holly and her 5 friends to share. So how many people will be eating cookies? [Pause.] I heard 6 people. Good catch! Holly will be eating cookies, too! So Holly's 5 friends plus Holly makes 6 people.</p> <p>What are we asked to find? [Pause.] Okay, how many cookies each person gets. Good!</p> <p>What operation will we need to use to find the answer? [Pause.] Yes! Division. Holly needs to figure out how to divide her 38 cookies among 6 people, which includes herself and her 5 friends. That makes 38 the dividend or the total number of cookies being divided into equal groups. And 6 is the divisor or the number of equal groups, in this case, the people who are getting the cookies.</p> <p>What are some of the strategies we can use to solve this? [Pause.] I hear lots of different strategies including making equal groups of objects, drawing a picture, and using multiples of 6. For this problem, let's use multiples of 6. Remember, to get multiples of 6, think about 6 times 1 is 6, 6 times 2 is 12, and so on until we get to 38 or get close to 38. Help me list them. [Say each of these as you list them.] 6, 12, 18, 24, 30, 36, 42. Oh! 42 is bigger than 38, so let's go back to 36. 36 is 6 times what number? [Pause.] 6! Yes! So each person will get 6 cookies!</p> <p>Is there a remainder? In this case, the remainder would be any cookies left over. [Pause.] Yes, there are! How many are left over? [Pause.] 2? How do you know there are 2 cookies left over? [Pause.] Good! Because 36 is 2 less than 38. Hmmm. I wonder who gets the last 2 cookies...</p>	<p>process for a problem from the start of the problem through finding the solution. Students will follow along and responding to teacher questioning.</p>
<p><u>Teacher Model</u> (9 minutes)</p> <p>Sometimes when we are solving problems, we don't really need an exact answer. We may just want a quick answer that we can calculate in our heads that's close to the exact answer. Estimates also help us compare two quotients or even determine if exact answers we found are reasonable. In these situations, we can estimate the answer using compatible numbers. You may have already used compatible numbers to estimate products when multiplying.</p> <p>You can use compatible numbers to estimate the answer to a division question. Compatible numbers are numbers that are easy to compute mentally.</p>	<p>Students will listen to the teacher do a think aloud working a contextual problem modeling the thought process for a problem from the start of the problem through finding the solution.</p>

Let's look at this question.

Objective #1: Use compatible numbers to estimate a quotient.

A horse's heart beats 132 times in 3 minutes. About how many times does it beat in 1 minute?

What is the division problem we're estimating here? [Pause.]

Good! We need to estimate $132 \div 3$. [Write $132 \div 3$.]

First we need to find a compatible number close to 132 that divides easily by 3 using basic facts.

What are some numbers that will divide easily by 3? [Pause.]

I'm hearing 3... and 6... and 9... and 12...and 15... [Write these as you say them] **Good! What are those numbers called?**

[Pause.] **Multiples! Yes! Because 3×1 is 3, and 3×2 is 6, and so on. So can we use any of those to help us?** [Pause.] **They aren't very close to 132, are they? We would have to keep going for a long time to get multiples close to 132. If you participated in the last lesson, we learned how to use basic facts to find multiples of tens, hundreds, and thousands. So since we know we are looking for a multiple of 3 that is close to 132, we can consider each of these multiples as tens: 3 tens, 6 tens, and so on. So how much is 3 tens?** [Pause.] **30, yes** [Write 30 under 3 in the list of multiples] **And 6 tens is?** [Pause.] **60. And 9 tens?** [Pause.] **90. 12 tens?** [Pause.] **120. 15 tens?** [Pause.] **150. Oh! Wait! 150 is past 132, so let's back up to 120.**

[Write the following as you talk through it, it should look like this: $120 = 12$ tens

$$12 \div 3 = 4$$

$$12 \text{ tens} \div 3 = 4 \text{ tens}$$

$$120 \div 3 = 40$$

We know that 120 is the same as 12 tens.

$12 \div 3$ equals what? [Pause.] **4, good.**

$12 \text{ tens} \div 3$ equals what? [Pause.] **Very good! 4 tens**

And how much is 4 tens? [Pause.] **40, okay**

Therefore, $120 \div 3$ equals what? [Pause.] **40! Yes!**

So we can say that a good estimate for $132 \div 3$ is 40. And therefore, to answer the question, a horse's heart beats about 40 times each minute.

Objective #2: Use compatible numbers to estimate what two numbers a quotient will fall between.

Remember that since an estimate doesn't have to be exact, there can be more than one estimate for a problem.

Objective #1:

Through following along with the think aloud, students will learn how to estimate a quotient using compatible numbers.

Objective #2:

Through following along with the think aloud, students will estimate

Is there another number that will easily divide by 3 in our list of numbers that would give us a different estimate? [Pause.] Consider 15. Again, while 15 isn't very close to 132, 15 tens or 150 is pretty close to 132. Let's try that one.

[Write the following as you talk through it, it should look like this: $150 = 15 \text{ tens}$
 $15 \div 3 = 5$
 $15 \text{ tens} \div 3 = 5 \text{ tens}$
 $150 \div 3 = 50$]

We know that 150 is the same as 15 tens.

$15 \div 3$ equals what? [Pause.] 5, good.

$15 \text{ tens} \div 3$ equals what? [Pause.] Very good! 5 tens

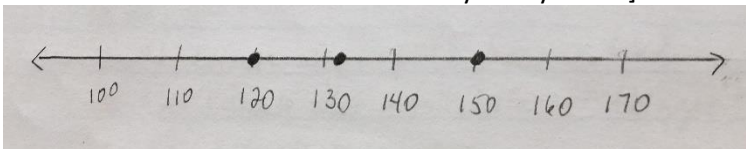
And how much is 5 tens? [Pause.] 50, okay

Therefore, $150 \div 3$ equals what? [Pause.] 50! Yes!

So another good estimate for $132 \div 3$ is 50.

Which estimate do you think is closer to the actual answer, 40 or 50? [Pause.] Interesting choice. Why? [Pause.]

Let's look at the compatible numbers we chose to use for dividends in our estimates on a number line and compare them to the dividend of the original problem. [Draw a number line and label the numbers as you say them.]



The compatible numbers were 120 and 150. The dividend of the original problem was 132, which is close to 130. Now which one do you think is better to use for our estimate? [Pause.] Yes! 120 is better because it's closer to 132. Therefore, our estimated solution of 40 is closer to the actual answer.

Objective #3: Estimate to compare two quotients
 Estimations can be particularly helpful and save a lot of time when you're asked to compare two quotients.

Let's look at an example. [Write this as $613 \div 3$ ○ $581 \div 2$.] Determine if $613 \div 3$ is greater than, less than, or about the same as $581 \div 2$.

To compare, let's estimate each quotient.
 We'll start with $613 \div 3$. What is a compatible number for 613 that divides easily by 3? [Pause.] I heard 600. Is 600 close to 613? Yes, it is! [Write $600 \div 3$.] Since 6 is easily divided by

what two numbers a quotient will fall between.

Students will talk or think about their choice.

Objective #3:
 Through following along with the think aloud, students compare two quotients using greater than, less than, or equal to.

<p>3, then 6 hundreds would also be easily divided by 3, right? Yes! So what is 6 hundreds divided by 3 or $600 \div 3$? [Pause.] Yes, 2 hundreds or 200. So an estimate for $613 \div 3$ is 200. [Write this.]</p> <p>Now let's estimate $581 \div 2$. What is a compatible number for 581 that divides easily by 2? [Pause.] I heard 600. Can we use 600 again? Is 600 close to 581? Then, yes we can! [Write $600 \div 2$.] Since 6 is easily divided by 2, then 6 hundreds would also be easily divided by 2, right? So what is 6 hundreds divided by 2 or $600 \div 2$? [Pause.] Yes, 3 hundreds or 300. So an estimate for $581 \div 2$ is 300. [Write this.]</p> <p>[At this point you should have the following written:</p> $\begin{array}{r} 613 \div 3 \quad \bigcirc \quad 581 \div 2 \\ 600 \div 3 \quad 600 \div 2 \\ 200 \quad 300 \quad] \end{array}$ <p>So is $613 \div 3$ greater than, less than, or about the same as $581 \div 2$? [Pause.] It's less than, yes! Because 200 is less than 300! Nice work!</p> <p>Tying the learning together: So remember, compatible numbers help us estimate quotients easily in our heads. We can use compatible numbers to find two estimates that the actual answer falls in between. Then we can consider each one to determine which is a better estimate based on which compatible number is closer to the original dividend.</p> <p>Thank you for thinking through these strategies with me today. Now you will get to practice these strategies. So get your paper and pencil ready!</p>	<p>Tying the learning together: Students will review the strategies used in this lesson and consider how they are related.</p>
<p><u>Guided Practice</u> (12 minutes)</p> <p>Work through this next problem with me as I think aloud.</p> <p>[I do] Mrs. Poe has 1382 books in her library. If she puts about the same amount of books on each of 5 large bookcases, approximately how many books will be on each bookcase?</p> <p>Since the question is asking for an approximate [Point to the word approximately.] answer, I know I only need to find an estimate. I also know from the context that Mrs. Poe is dividing up the books among 5 bookcases, so I know I need to divide 1382 books among 5 bookcases or $1382 \div 5$. [Write $1382 \div 5$.]</p>	<p>Students work alongside the teacher as the teacher thinks aloud.</p>

I'm going to use compatible numbers to find two estimates that the quotient $1382 \div 5$ is between.

First, I'm going to find two numbers close to 1382 that divide easily by 5. One of the numbers will be slightly less than 1382 and the other will be slightly greater than 1382.

I know that 10 divides easily by 5, so 10 hundreds also divides easily by 5. Ten hundreds is the same as 1000, which is slightly less than 1382. [Write the following as you say it.]

$10 \div 5 = 2$, so

10 hundreds $\div 5 = 2$ hundreds, which is the same as

$1000 \div 5 = 200$

So 200 is one estimate for $1382 \div 5$.

I also know that 15 divides easily by 5, so 15 hundreds also divides easily by 5. Fifteen hundreds is the same as 1500, which is slightly greater than 1382. [Write the following as you say it.]

$15 \div 5 = 3$, so

15 hundreds $\div 5 = 3$ hundreds, which is the same as

$1500 \div 5 = 300$

So 300 is another estimate for $1382 \div 5$.

1382 is between 1000 and 1500, therefore the quotient of $1382 \div 5$ is between 200 and 300.

That means that Mrs. Poe will need to put between 200 and 300 books on each bookcase.

Which estimate do you think is closer to the actual answer? [Pause.] Yes, since 1382 is closer to 1500, and $1500 \div 5 = 300$, 300 is closer to the actual answer. Mrs. Poe will need to keep that in mind as she decides how to divide up the books. I am sure she appreciates the flexibility so she can make that choice as she places them on the shelves.

Thank you for thinking through that with me. Now let's do one together.

[We do]

Cacie was asked to make 175 cupcakes for a bake sale. She wants to have about the same amount of each of 3 different flavors: chocolate, vanilla, and strawberry. Approximately how many of each cupcake flavor will she need to make?

What's the division problem we are estimating here? [Pause.] Yes, $175 \div 3$. Write that down. [Write $175 \div 3$.] What compatible numbers are close to 175 that divide easily by 3?

Students will respond to teacher questions with less scaffolding than the previous example. Students will have more time to think and respond on their own prior to the teacher providing solutions.

[Pause.] I heard 150 and 180. [Write down 150 and 180.]
Great! 15 and 18 both divide easily by 3, therefore, so do 150 and 180.

Which compatible number would be best to use for this estimate? [Pause.] 180? Why 180? [Pause.] I hear two good reasons! One is that 175 is closer to 180. Great! And the other is that if Cacie only makes 150 cupcakes, she won't have enough for the bake sale. Good thinking!

Okay, write the problem using the compatible number we chose. [Write $180 \div 3$] Go ahead and find the answer to that in your head. [Pause. Allow time for students to think and divide.] What did you get for your estimate? [Pause.] 60? Good job! How did you get 60? [Pause.] I am hearing a lot of good thinking! I recognized that since 180 is the same as 18 tens and 18 divided by 3 is 6, then 18 tens divided by 3 is 6 tens or 60.

So about how many of each flavor cupcake should Cacie make for the bake sale? [Pause.] Yes! She should make about 60 cupcakes of each flavor.

Great work everyone!

[You do]

Now I'm going to give you a few minutes to do this problem on your own.

Estimate each quotient to determine if $364 \div 4$ is greater than or less than $117 \div 6$. [Write $364 \div 4$ ☐ $117 \div 6$]

[Allow students time to think through, find, and compare these estimates.]

How did you do? Is $364 \div 4$ greater than, less than, or about the same as $117 \div 6$? [Pause.] Yes! Greater than! [Fill in the greater than symbol in the circle.] Of course, your estimate may be a little different than mine. I estimated the first quotient as 90 using the compatible number 360, and the second quotient as 20 using the compatible number 120. Therefore, since my estimate of 90 is greater than my estimate of 20, $364 \div 4$ is greater than $117 \div 6$.

Great job, students!

Additional Problems (if needed):

Jamie and his two brothers divided a package of 125 toy cars so each boy got about the same amount. About how many

Students are working almost exclusively independently with the teacher providing answers at the end.

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<p>cars did each of them receive? [Possible answer: about 40 cars each.]</p> <p>Estimate $2593 \div 6$. [Possible answer: between 400 and 500.]</p>	
<p><u>Independent Practice</u> (1 min)</p> <p>Great work, everyone! Today, we practiced estimating quotients. I hope you're seeing that you can use mental math strategies to quickly estimate a quotient in your head. You sure did a great job! After the video, you will have some problems to practice on your own. I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education. [Teacher shows student practice page under document camera or camera zooms in on student practice page.]</p> <p>Good luck and do your best!</p>	
<p><u>Closing</u> (1 min)</p> <ul style="list-style-type: none">• Boys and Girls, I enjoyed learning about estimating quotients with you! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series!• Bye!	

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