

Using Multiplication and Division to Solve Problems



AMERICA'S
CHOICE®

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Online Resources

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Introduction to Math Navigator

Dear Parent/Guardian,

_____ has been selected to participate in Math Navigator! Math Navigator is one of the ways that our school is working to help all students succeed in mathematics. The program gives students the additional time and instruction they need to improve their performance in this important subject.

Your child will be participating in the *Using Multiplication and Division to Solve Problems* module. The main goals of this module are to help students review multiplication and division facts and to help students explore the types of word problems that can be solved using multiplication and division. Students solve problems set in situations involving equal groups, arrays, and measurement. Students record their thinking using math drawings, diagrams, and equations. In the process of solving problems, students explore the commutative and associative properties of multiplication, use the distributive property, and understand division problems as missing-factor problems. Throughout the module, students will review multiplication and division facts, and strategies including skip-counting, composing and decomposing numbers, doubling and halving, and using the relationship between multiplication and division.

There are a variety of materials students will use with this module: one of them is a set of Study Cards. These cards include mathematical ideas for students to master, game cards, and blank cards that students can customize with concepts that they need to work on. Students are encouraged to use these cards during the lessons, as well as during free time and at home. Please encourage your child to share them with you.

The more enthusiastic you can be about Math Navigator, the more it will help your child. Ask questions each day about what your child learned and how the Math Navigator class was different from your child's regular math class. It is important for you to acknowledge what your child has accomplished both on a day-to-day basis and after completing the Math Navigator module.

We are excited about using Math Navigator with students. Learn more about this special program and how it works by reading the short description that follows. If you have any questions about the program, please do not hesitate to contact us here at school.

How Math Navigator Works

Structure of a Module

Each module contains 20 days of 30- or 45-minute lessons, including a pre-test and post-test. During the 20 days, students have two or three checkpoint lessons that assess their understanding of the concepts in the module.

Frequent Skills Practice

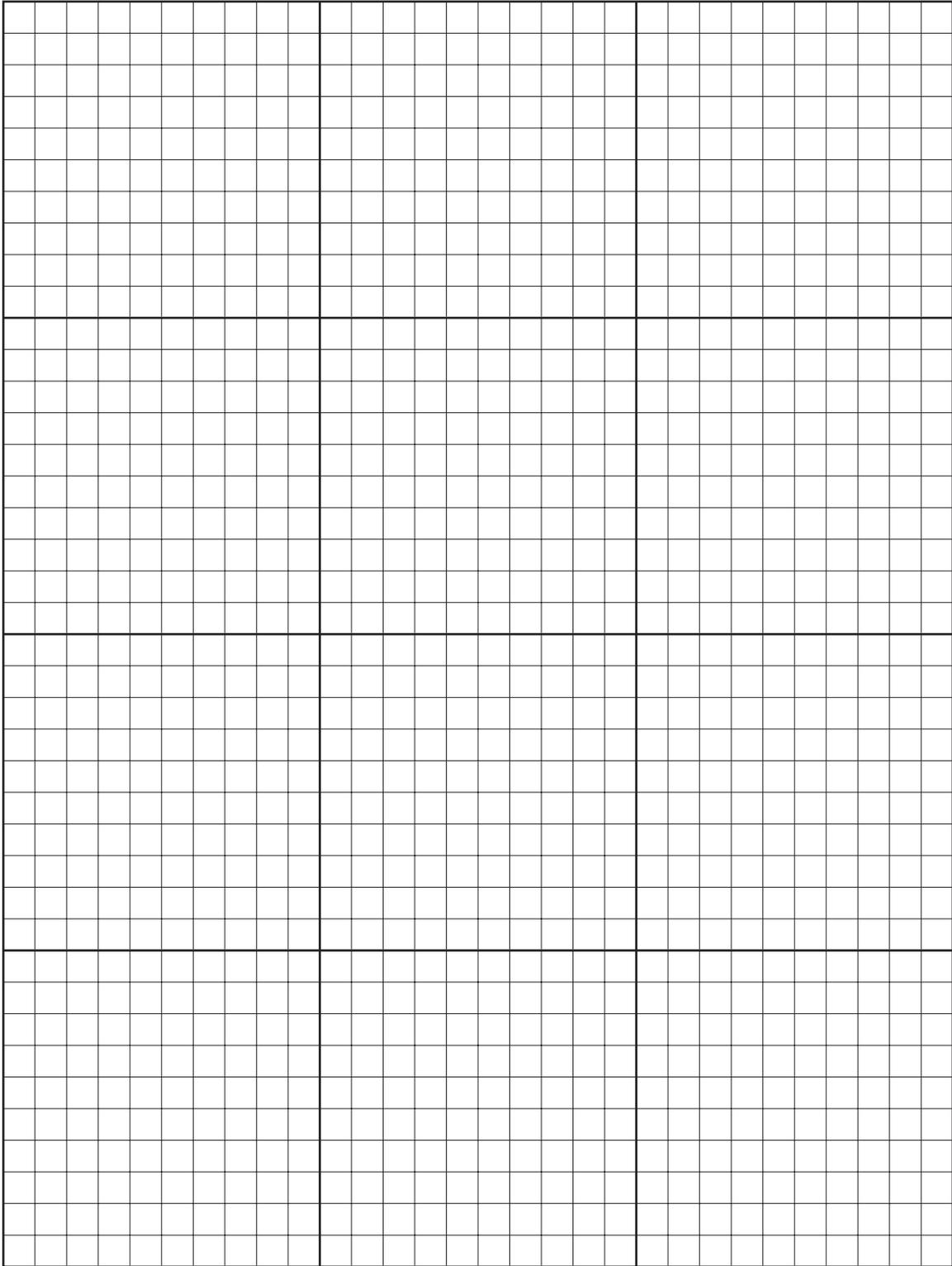
Most lessons include a Show Me session in which students practice and reinforce skills. It is also a time for students to learn strategies and techniques that make computation easier.

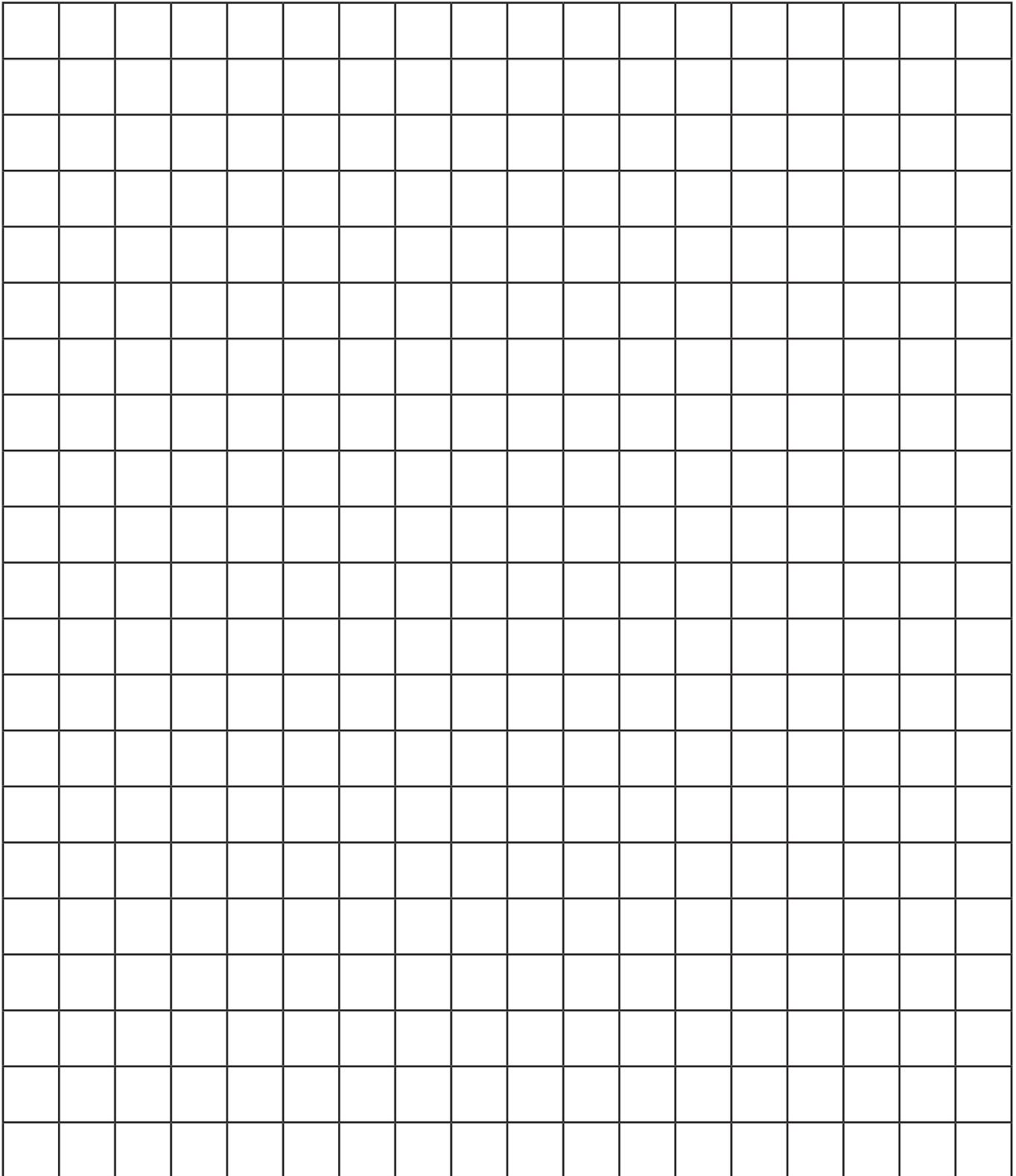
Emphasis on Understanding

The lessons are carefully designed to uncover mistakes that result from students misunderstanding something. We call such mistakes *misconceptions*. Misconceptions need to be corrected because they can interfere with new learning. Math Navigator modules do not attempt to reteach everything that students have learned about a topic. Instead, they help students understand the mathematics of the procedures and concepts that they have already learned so that they can correct the misconceptions that are getting in the way of their progress.

Learning to Think Mathematically

Lessons are structured to teach students to think like mathematicians. Students will learn how to ask themselves questions before beginning a problem; to use diagrams, tables, and other methods of representing problems; and to estimate as a way of determining whether their answers are reasonable. Most importantly, they will come to see that mistakes are opportunities for learning, rather than something to hide.





Misconceptions and Errors

F21	Does not understand the concept of equivalence
O5	Does not recognize a multiplication situation
O6	Does not recognize a division situation
O14	Does not recognize or misapplies the commutative property
O16	Does not recognize or misapplies the associative property
O22	Fails to link addition and subtraction or multiplication and division as inverse operations
O23	Is unable to transfer between different representations of the same operation
O24	Does not recognize or misapplies the distributive property
O25	Does not understand how repeated addition relates to multiplication or how repeated subtraction relates to division
O27	Does not deal with remainders in problem situations appropriately, including thinking remainders can be greater than divisors

F21 Does not understand the concept of equivalence

The student interprets the equals sign as a symbol separating the problem from the answer, and has difficulty using equations with an expression on each side.

example

Which of these are equations?

A $2 \times 3 = 6$
B $7 = 7$

C $5 \times 7 = 7 \times 5$
D $2 \times 6 = 3 \times 4$

Only A is an equation.

O5 Does not recognize a multiplication situation

The student knows how to multiply but does not know when to multiply (other than because she was told to do so, or because the computation was written as a multiplication problem). The student cannot explain why multiplication should be used.

example

Three students each have 9 apples. How many do they have altogether?

$$3 + 9 = 12$$

O6 Does not recognize a division situation

The student knows how to divide but does not know when to divide (other than because he was told to do so, or because the computation was written as a division problem). The student cannot explain why division should be used or connect division to actions with materials.

example

Three students share 9 apples. How many did each one get?

$$3 + 9 = 12$$

O14 Does not recognize or misapplies the commutative property

The student may know the commutative property of multiplication but fails to apply it to simplify the “work” of multiplication.

example

Student states that $9 \times 4 = 36$ with relative ease, but struggles to find the product of $4 \times 9 = ?$

O16 Does not recognize or misapplies the associative property

The student may know the associative property of multiplication but fails to apply it to simplify the “work” of multiplication. The student labors to find the product of three or more numbers, because she fails to recognize that it is much easier to multiply the numbers in a different order.

example

$$8 \times 13 \times 5 =$$

$$\begin{array}{r} 8 \\ \times 13 \\ \hline 24 \\ + 80 \\ \hline 104 \end{array} \times 5 = 500 + 20 = 520$$

O22 Fails to link addition and subtraction or multiplication and division as inverse operations

The student sees multiplication and division as discrete and separate operations. The student’s conception of the operations does not include the fact that they are linked as inverse operations. The student has reasonable facility with division but cannot master multiplication facts, and knows procedures for multiplying but has no idea how to check the reasonableness of his answers.

example

$$357 \div 7 = 51$$

$$51 \times 7 = 42$$

O23 Is unable to transfer between different representations of the same operation

The student does not understand representations for the operations and cannot connect one representation with a different representation.

example

Write a multiplication story problem that is represented by this math drawing.

$\$5 + \$5 + \$5 + \5


$(5 + 5 + 5 + 5) \cdot 4$

O24 Does not recognize or misapplies the distributive property

The student does not understand the distributive property and does not know how to apply it to simplify the “work” of multiplication. The student has reasonable facility with multiplication facts but cannot use the distributive property to simplify multiplication.

example

$15 \times (2 + 10) =$

$$\begin{array}{r}
 15 \\
 \times 12 \\
 \hline
 30 \\
 150 \\
 \hline
 180
 \end{array}$$

O25 Does not understand how repeated addition relates to multiplication or how repeated subtraction relates to division

The student does not understand the relationship between repeated addition and multiplication—therefore she does not understand the concept of multiplication.

example

Rewrite $9 + 9 + 9 + 9$ as a multiplication problem.

$(9 + 9 + 9 + 9) \times 4$

O27 Does not deal with remainders in problem situations appropriately, including thinking remainders can be greater than divisors

The student applies a procedure that results in remainders expressed as “R#” or “remainder #” for all situations, even those for which such a result does not make sense, or handles the remainder inappropriately.

example

There are 53 students attending the class canoe trip.
They plan to have 3 students in each canoe.

How many canoes will they need so that everyone can participate?

Handwritten work shows a long division problem: $3 \overline{)53}$. The student has written 17 above the line, 3 below the 5, and 23 below the 3. A horizontal line is drawn under 23, and 21 is written below it. Another horizontal line is drawn under 21, and 2 is written below it. To the right of the division, the student has written: "They will need 17R2 boats to go canoeing." Below this, the student has written: $53 \div 3 = 17R2$.

Class Profile Instructions

About the Class Profile

Completing an analysis of student work gives you a clear picture of the strategies an individual student is applying to a particular problem or topic in mathematics. Such an analysis is even more powerful when it is applied to the Math Navigator class as a whole.

The Class Profile gives you both. By reading the Class Profile across a row, you can see where each student stands at any point in time. Reading down the columns allows you to see the strengths and needs of the entire class at a glance. By reviewing the Class Profile, you will be able to make decisions that target appropriate instruction to individuals, small groups, and the whole Math Navigator class.

The first pages of the Class Profile provide assessment items related to the content of the module. The last page is based on the mathematical practices from the Common Core State Standards for Mathematics.¹ On this page, record evidence of students using these practices.

Recording Data on the Class Profile

When you see—either through discussion, analysis of student work, or direct observation—that a student understands a concept, still has a misconception, or engages in a mathematical practice, make a note on your Class Profile. As the student’s understanding increases, update the Class Profile.

Using the Class Profile

Review the Class Profile periodically during the lesson to help you decide which topics would be most beneficial for your students to focus on during the class discussion. Address topics that most of the students in the Math Navigator group need to learn during the show me, work time, or probing for understanding parts of the lesson. Address topics that only some students are struggling with during partner work or in conferences. If only one or two students need help with a topic, address the topic in an individual conference.

Give a copy of the completed Class Profile to each student’s classroom teacher at the end of the module.

¹Common Core State Standards Initiative. 2010. “Common Core State Standards for Mathematics”: 6–8. Accessed July 1, 2011. http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf.

CLASS PROFILE (4 OF 4)

Mathematical Practice Standards	
<p>MP1: Make sense of problems and persevere in solving them.</p> <p>MP2: Reason abstractly and quantitatively.</p> <p>MP3: Construct viable arguments and critique the reasoning of others.</p> <p>MP4: Model with mathematics.</p>	<p>MP5: Use appropriate tools strategically.</p> <p>MP6: Attend to precision.</p> <p>MP7: Look for and make use of structure.</p> <p>MP8: Look for and express regularity in repeated reasoning.</p>
Student Name	Observations
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



A Complete Solution to a Math Story

includes all of the following ...



A written estimate



All work that you do



An equation (even if you solved it using column form)



A math drawing or diagram, table, or other representation



The answer to the question in a complete sentence



What to Do If You Get Stuck



Look at past work times



Look at the charts that are posted



Model the problem using counters or other materials



Sketch a math drawing or diagram or other representation



Change the numbers to make the problem simpler



Write what you do know



Write down questions to ask later



Check other resources