# Common Core Georgia Performance Standards
## Fifth Grade

### Common Core Georgia Performance Standards: Curriculum Map

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These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units. All units will include the Mathematical Practices and indicate skills to maintain.

**NOTE:** Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.

**Grades 3-5 Key:**
- G = Geometry
- MD = Measurement and Data
- NBT = Number and Operations in Base Ten
- NF = Number and Operations
- Fractions
- OA = Operations and Algebraic Thinking

Georgia Department of Education
Dr. John D. Barge, State School Superintendent
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# Fifth Grade Math

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Unit 1: Order of Operations and Whole Numbers

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OVERVIEW

In this unit students will:

- Solve problems by representing mathematical relationships between quantities using mathematical expressions and equations.
- Use the four whole number operations efficiently, including the application of order of operations.
- Write and evaluate mathematical expressions with and without using symbols.
- Apply strategies for multiplying a 2- or 3-digit number by a 2-digit number.
- Develop paper-and-pencil multiplication algorithms (not limited to the traditional algorithm) for 3- or 4-digit number multiplied by a 2- or 3-digit number.
- Apply paper-and-pencil algorithms for division.
- Solve problems involving multiplication and division.
- Investigate the effects of the powers of 10 on a whole number.

Combining multiplication and division within lessons is very important to allow students to understand the relationship between the two operations. Students need guidance and multiple experiences to develop an understanding that groups of things can be a single entity while at the same time contain a given number of objects. These experiences are especially useful in contextual situations such as the tasks in this unit.

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed throughout the year. Ideas related to the eight standards of mathematical practices should be addressed continually as well. The first unit should establish these routines, allowing students to gradually enhance their understanding of the concept of number and to develop computational proficiency.

To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the competencies listed under “Evidence of Learning” be reviewed early in the planning process. The tasks in these units illustrate the types of learning activities that should be utilized from a variety of sources.
STANDARDS FOR MATHEMATICAL CONTENT

- **MCC5.OA.1** Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
- **MCC5.OA.2** Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.
- **MCC5.NBT.1** Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- **MCC5.NBT.2** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
- **MCC5.NBT.5** Fluently multiply multi-digit whole numbers using the standard algorithm.
- **MCC5.NBT.6** Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

ENDURING UNDERSTANDINGS

- Multiplication may be used to find the total number of objects when objects are arranged in equal groups.
- One of the factors in multiplication indicates the number of objects in a group and the other factor indicates the number of groups.
- Products may be calculated using invented strategies.
- Unfamiliar multiplication problems may be solved by using known multiplication facts and properties of multiplication and division. For example, $8 \times 7 = (8 \times 2) + (8 \times 5)$ and $18 \times 7 = (10 \times 7) + (8 \times 7)$.
- Multiplication may be represented by rectangular arrays/area models.
- There are two common situations where division may be used: fair sharing (given the total amount and the number of equal groups, determine how many/much in each group) and
measurement (given the total amount and the amount in a group, determine how many groups of the same size can be created).

- Some division situations will produce a remainder, but the remainder will always be less than the divisor. If the remainder is greater than the divisor, that means at least one more can be given to each group (fair sharing) or at least one more group of the given size (the dividend) may be created.
- The dividend, divisor, quotient, and remainder are related in the following manner: dividend = divisor x quotient + remainder.
- The quotient remains unchanged when both the dividend and the divisor are multiplied or divided by the same number.
- The properties of multiplication and division help us solve computation problems easily and provide reasoning for choices we make in problem solving.

**ESSENTIAL QUESTIONS**

- How can an expression be written given a set value?
- How can estimating help us when solving division problems?
- How can estimating help us when solving multiplication problems?
- How can expressions be evaluated?
- How can I apply my understanding of area of a rectangle and square to determine the best buy for a football field?
- How can I effectively explain my mathematical thinking and reasoning to others?
- How can I use cues to remind myself of the order of steps to take in a multi-step expression?
- How can I use the situation in a story problem to determine the best operation to use?
- How can identifying patterns help determine multiple solutions?
- How can we simplify expressions?
- How can you represent the quantity of a multiple of 10?
- In what kinds of real world situations might we use equations and expressions?
- In what ways is multiplication used in beautifying a football field?
- What happens when we multiply a whole number by powers of 10?
- What is the difference between an expression and an equation?
- What operations are needed to find area and cost per square inch?
- What pattern is created when a number is multiplied by a power of 10?
- What strategies can we use to determine how numbers are related?
- What strategies can we use to efficiently solve division problems?
- What strategies can we use to efficiently solve multiplication problems?
- Why is it important to follow an order of operations?

**CONCEPTS/SKILLS TO MAINTAIN**

It is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.
• Solve two-step word problems using four operations
• Fluently multiply and divide within 100 using strategies
• Multiply one-digit whole numbers by multiples of 10
• Solve multi-step word problems
• Divide up to four digit dividends by one digit divisors

SELECTED TERMS AND SYMBOLS

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The terms below are for teacher reference only and are not to be memorized by the students. Teachers should present these concepts to students with models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

- Algorithm
- Dividend
- Divisor
- Exponents
- Expression
- Measurement Division (or repeated subtraction)
- Multiplicand
- Multiplier
- Partition Division (or fair-sharing)
- Product
- Properties
- Quotient
- Remainder

STRATEGIES FOR TEACHING AND LEARNING

Students should be given ample opportunities to explore numerical expressions with mixed operations. This is the foundation for evaluating numerical and algebraic expressions that will include whole-number exponents in Grade 6.

There are conventions (rules) determined by mathematicians that must be learned with no conceptual basis. For example, multiplication and division are always done before addition and subtraction. Begin with expressions that have two operations without any grouping symbols (multiplication or division combined with addition or subtraction) before introducing expressions with multiple operations. Using the same digits, with the operations in a different order, have students evaluate the expressions and discuss why the value of the expression is different. For example, have students evaluate $5 \times 3 + 6$ and $5 + 3 \times 6$. Discuss the rules that must be followed. Have students insert parentheses around the multiplication or division part in an expression. A discussion should
focus on the similarities and differences in the problems and the results. This leads to students being able to solve problem situations which require that they know the order in which operations should take place.

After students have evaluated expressions without grouping symbols, present problems with one grouping symbol, beginning with parentheses, then, in combination with brackets and/or braces. Have students write numerical expressions in words without calculating the value. This is the foundation for writing algebraic expressions. Then, have students write numerical expressions from phrases without calculating them.

Because students have used various models and strategies to solve problems involving multiplication with whole numbers, they should be able to transition to using standard algorithms effectively. With guidance from the teacher, they should understand the connection between the standard algorithm and their strategies.

Connections between the algorithm for multiplying multi-digit whole numbers and strategies such as partial products or lattice multiplication are necessary for students’ understanding. The multiplication can also be done without listing the partial products by multiplying the value of each digit from one factor by the value of each digit from the other factor. Understanding of place value is vital in using the standard algorithm. In using the standard algorithm for multiplication, when multiplying the ones, 32 ones is 3 tens and 2 ones. The 2 is written in the ones place. When multiplying the tens, the 24 tens is 2 hundreds and 4 tens. But, the 3 tens from the 32 ones need to be added to these 4 tens, for 7 tens. Multiplying the hundreds, the 16 hundreds is 1 thousand and 6 hundreds. But, the 2 hundreds from the 24 tens need to be added to these 6 hundreds, for 8 hundreds.

**EVIDENCE OF LEARNING**

By the conclusion of this unit, students should be able to demonstrate the following competencies:

- Write and solve expressions including parentheses and brackets
- Apply the rules for order of operations to solve problems.
- Solve word problems involving the multiplication of 3- or 4-digit multiplicand by a 2- or 3-digit multiplier.
- Use exponents to represent powers of ten.
- Solve problems involving the division of 3- or 4-digit dividends by 2-digit divisors.

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As this unit has no Culminating Task, you may pair/modify tasks to include all unit standards in combination.
Scaffolding Task: Order of Operations

STANDARDS FOR MATHEMATICAL CONTENT

CCGPS.5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

(for descriptors of standard cluster please see beginning of the unit)

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

ESSENTIAL QUESTIONS

• Why is it important to follow an order of operations?
• How can I use cues to remind myself of the order of steps to take in a multi-step expression?
• How can I effectively explain my mathematical thinking and reasoning to others?

MATERIALS:

• Color Tiles (100 per group)
• paper (1 sheet per group)
• pencils (1 per group)

GROUPING

small group or individual

BACKGROUND KNOWLEDGE

Students have solved two step word problems using the four operations in third grade and multi-step equations in 4th grade. Therefore; the understanding of order or operations within the four operations should have been mastered. At the 5th grade level students are now exploring these four operations within parentheses and brackets. This standard builds on the expectations of third grade where
students are expected to start learning the conventional order. Students need experiences with multiple expressions that use grouping symbols throughout the year to develop understanding of when and how to use parentheses, brackets, and braces. First, students use these symbols with whole numbers. Then the symbols can be used as students add, subtract, multiply and divide decimals and fractions.

**TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION**

**Comments:** The order of operations makes the language of mathematics more universal. Knowing these rules helps students to communicate more accurately as they gain fluency in manipulating symbolic relationships. The sequence for the order of operations is listed below.
1. Calculate inside parentheses.
2. Multiply and divide in order, from left to right.
3. Add and subtract in order, from left to right.

**Students should derive the rules for order of operations on their own during task.**

In this task, students will understand why order of operations is necessary versus solving equations from left to right, and how parentheses are used within order of operations.

To begin the lesson:
1. Write \(3 + 4 \times 4\) on the board. Have students start by laying down 3 tiles. Then have students add a 4-by-4 array. **Ask:** How many tiles are shown in the model?
2. Have students show \(3 + 4\) using a different color of tile for each addend. Then have the students build an array to show this quantity times four. **Ask:** How many tiles are shown in the model?
3. Have the students discuss the two models they have constructed. Students will then discuss and journal how the two models are different? Have students write an expression to represent each model.
4. Have students discuss what order the operations in each expression were evaluated. Students will then discuss why this order was necessary versus solving from left to right in the way that we read.

Task in groups of 4:
Jay brought some juice boxes to soccer practice to share with his teammates. He had 3 single boxes and 4 multi-packs. There are 6 single boxes in each multi-pack. To determine how many boxes of juice Jay brought to practice, evaluate \(3 + 4 \times 6\).

Introduce the problem. Then have students do the activity to solve the problem. Distribute color tiles, paper, and pencils to students. Explain that the order of operations provides rules for simplifying expressions. Have students discuss possible solutions and the order in which solutions were evaluated. Ask students……should these be a rule?

**FORMATIVE ASSESSMENT QUESTIONS**

- Why did you multiply first (for \(3 + 4 \times 6\) in the task)?
- What will you do to try to figure out if the answer given is correct?
- How will you demonstrate that it is correct?
DIFFERENTIATION

Intervention
- Provide more opportunities for students to explore order of operations using color tiles

Extension
- To explore the complexities of order of operations, have students create and solve their own numerical expressions and defend their solutions in writing.
- Give students a number and ask them to create complex expressions equivalent to the number. Encourage students to continually expand the expression as shown below:
  
  $17$
  $10 + 7$
  $(2 \times 5) + 7$
  $[2 \times (30 \div 6)] + 7$
  $[2 \times (15 \times 2 \div 6)] + 7$

TECHNOLOGY CONNECTION
- [http://www.learningwave.com/lwonline/numbers/ordofops.html](http://www.learningwave.com/lwonline/numbers/ordofops.html) Provides students with additional instruction, concept development, and practice with order of operations.
- [http://www.nzmaths.co.nz/resource/four-fours-challenge?parent_node](http://www.nzmaths.co.nz/resource/four-fours-challenge?parent_node) This link provides teachers with some additional, student centered lessons to develop the concept of order of operations.
Constructing Task: Trick Answers

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students have solved two step word problems using the four operations in third grade and multi step equations in 4th grade. Therefore; the understanding of order or operations within the four operations should have been mastered. At the 5th grade level students are now exploring these four operations within parentheses and brackets.

ESSENTIAL QUESTIONS

- Why is it important to follow an order of operations?
- How can I use cues to remind myself of the order of steps to take in a multi-step expression?
- How can I effectively explain my mathematical thinking and reasoning to others?

MATERIALS

- Trick Answer recording sheet
- Accessible manipulatives

GROUPING:

Partner or individual task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:
In this task, students analyze a mock work sample to demonstrate and explain their understanding of the order of operations.

Comments: Students should have an understanding of the order of operations through several problem solving experiences before being given this task. Teachers can adjust this task based upon the level of independence of their students with order of operations. For example, parenthesis can be added to or removed from any of the problems. Also, it is possible to do this task multiple times in order to introduce new order of operations concepts.

FORMATIVE ASSESSMENT QUESTIONS

- What will you do to try to figure out if the answer given is correct?
- How will you demonstrate that it is correct?
- How will you convince Sasha when you think her answer is incorrect?
- Are my students able to explain their math reasoning clearly to both their peers and teachers?
- What strategies are students using to analyze the given problems?
- What cues are students using to recognize the correct order of operations?
- What misconceptions exist and how can they be addressed?

DIFFERENTIATION

Extension
- To explore the complexities of order of operations, have students create and solve their own numerical expressions and defend their solutions in writing.
- Give students a number and ask them to create complex expressions equivalent to the number. Encourage students to continually expand the expression as shown below:
  17
  10 + 7
  (2 x 5) + 7
  [2 x (30 ÷ 6)] + 7
  [2 x (15 x 2 ÷ 6)] + 7

Intervention
- Help students who lack background knowledge in understanding these concepts by limiting the number of operations and introducing them one at a time.
- Teach students to group operations using the parentheses, even when they are not included in the original problem. For example, if they see this problem:
  6 + 5 x 10 – 4 ÷ 2
  They can rewrite it like this:
  6 + (5 x 10) – (4 ÷ 2)
In this way, the parentheses guide their work.
• Using a Hop Scotch board like the one shown on the right is one way to help students remember the order of operations. Remembering the rules of Hop Scotch, one lands with both feet on squares 3 & 4 and 6 & 7. This is used as a reminder to students that multiplication and division computed in the order in which they appear in the problem, left to right. The same is true for addition and subtraction, which is also performed in the order of appearance, left to right.

TECHNOLOGY CONNECTION


• [http://www.nzmaths.co.nz/resource/four-fours-challenge?parent_node](http://www.nzmaths.co.nz/resource/four-fours-challenge?parent_node) This link provides teachers with some additional, student centered lessons to develop the concept of order of operations.
Trick Answers

You and your best friend, Sasha, sat down after school at your house to work on your math homework. You both agreed to work out the problems and check each other’s work for mistakes. Here is Sasha’s homework paper. She didn’t show her work, but she did list her answers to each problem. Check her work for her and explain to her how you know her answers are correct or incorrect.

Sasha

Order of Operations Homework

1. \(6 + 2 \times 4 = 31\)

1a. If Sasha were to incorporate parentheses within her problem, where would she place them?

2. \(24 - 8 + 6 \div 2 = 11\)

3. \(30 \div (10 + 5) \times 3 = 24\)

4. \(3 \times (18 - 3) + (6 + 4) \div 2 = 50\)
Practice Task: Operation Bingo

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
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6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students have had experience writing expressions. This task is for students’ to practice writing an expression from the written form to number form.

ESSENTIAL QUESTIONS

- How can an expression be written given a set value?

MATERIALS

- Bingo student sheet
- teacher sheet
- Clear chips

GROUPING Group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Students work to write expressions and given the word form. Using the Bingo sheet students will chose the correct expression to go with what is being read.

Comments
This task will allow students to write expressions using numbers
FORMATIVE ASSESSMENT QUESTIONS

- What strategy are you using to find a solution(s) to this problem?
- How could you organize your thinking/work when solving this problem? Why is that an effective strategy?
- Did you find all of the ways to solve this problem? How do you know?

DIFFERENTIATION

Extension
- Students solve each expression

Intervention
- Use expressions that only include operations, not parentheses

TECHNOLOGY CONNECTION

http://illuminations.nctm.org/ActivityDetail.aspx?ID=26 students may want to use this web site to check their work. This interactive activity allows students to see two expressions can be equal through the use of a balance. The balance helps reinforce the meaning of the equal symbol as showing that two quantities are the same.
# OPERATION BINGO

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>I</td>
<td>N</td>
<td>G</td>
<td>O</td>
</tr>
<tr>
<td>(3 + 2) x 4</td>
<td>8 ÷ 2 + 6</td>
<td>12 x (2 + 6)</td>
<td>2 + 16 - 10</td>
<td>7 x 2 + 6</td>
</tr>
<tr>
<td>6 + 7 - 12</td>
<td>8 - (6 x 1)</td>
<td>22 + 6 - 8</td>
<td>(12 ÷ 2) + 7</td>
<td>(9 + 5) - (4 x 3)</td>
</tr>
<tr>
<td>16 ÷ 2 + 6</td>
<td>8 x 2 - 10</td>
<td>(2 + 2) x 6</td>
<td>(7 x 7) + 6</td>
<td>14 - (2 x 2)</td>
</tr>
<tr>
<td>5 + 7 - 8</td>
<td>18 - 9 + 6</td>
<td>16 ÷ 4 + 10</td>
<td>6 + 6 - 3</td>
<td>(13 - 3) x 6</td>
</tr>
</tbody>
</table>
Georgia Department of Education  
Common Core Georgia Performance Standards Framework  
Fifth Grade Mathematics • Unit 1

Teacher Bingo sheet

Cut into strips for Bingo Game

<table>
<thead>
<tr>
<th>The sum of two and three multiplied by four</th>
<th>The quotient of eight and two added to six</th>
<th>The sum of six and two multiplied by twelve</th>
<th>The sum of sixteen and two subtracted by ten</th>
<th>The product of seven and two added to six</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sum of six and seven subtracted by twelve</td>
<td>The product of six and one subtracted by eight</td>
<td>The sum of twenty two and six subtracted by eight</td>
<td>The quotient of twelve and two added to seven</td>
<td>The sum of nine and five subtracted by the product of four and three</td>
</tr>
<tr>
<td>The quotient of sixteen and two added to six</td>
<td>The product of eight and two subtracted by ten</td>
<td>The sum of two and two multiplied by six</td>
<td>The product of seven and seven added to six</td>
<td>The product of two and two subtracted from fourteen</td>
</tr>
<tr>
<td>The sum of five and seven subtracted by eight</td>
<td>The difference of eighteen and nine added to six</td>
<td>The quotient of sixteen and four added to ten</td>
<td>The sum of six and six subtracted by three</td>
<td>The difference of thirteen and three multiplied by six</td>
</tr>
</tbody>
</table>
Constructing Task: What’s My Rule?

STANDARDS FOR MATHEMATICAL CONTENT

Write and interpret numerical expressions.
MCC.5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them. 
2. Reason abstractly and quantitatively. 
3. Construct viable arguments and critique the reasoning of others. 
4. Model with mathematics. 
5. Use appropriate tools strategically. 
6. Attend to precision. 
7. Look for and make use of structure. 
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students should have had prior experiences with all whole number computations and with solving expressions using the order of operations.

ESSENTIAL QUESTIONS

• What strategies can we use to determine how numbers are related?

MATERIALS

• “What’s My Rule?” student directions sheet 
• “What’s My Rule?” student recording sheet 
• “What’s My Rule?” cards (one of each set of cards, Number Cards and Rule Cards, per group – copy onto cardstock and/or laminate for durability)

GROUPING

Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this task, students will use deductive reasoning to determine an algebraic expression given different values for the variable(s).
Comments
Students explore the relationship between inputs and outputs in a table. This task may be used throughout the school year varying the number cards and rule cards. This task refers to expressions. Expressions are a series of numbers and symbols (+, -, x, ÷) without an equals sign. Equations result when two expressions are set equal to each other (2 + 3 = 4 + 1).

Task Directions
Students will follow the directions below from the “What’s My Rule, Directions” student sheet.

Materials:
Two sets of cards: Rule Cards and Number Cards

Directions:
1. Work in groups of 2. Player 1 is in charge of the Rule Cards and player 2 is in charge of the Number Cards.
2. Player 1 pulls a Rule Card out of the set and looks at it. Do NOT let player 2 see the rule card.
3. Player 2 pulls a Number Card out of the deck and lays it face up on the table so both players can see it. Player 1 records the number in the Input column on the recording sheet.
4. Player 1 fills in the Output column by applying the rule to the number on the Rule Card.
5. Player 2 continues to draw Input numbers, and allows player 1 to determine the Output number following the Rule Card.
6. When ready, Player 2 may tell Player 1 the Output number based on the Input number drawn.
7. If the Output is NOT correct, Player 2 wins the game.
8. If the Output is correct, Player 1 must write the rule in the rule space on the chart. If the rule is correct, Player 1 wins the game!

FORMATIVE ASSESSMENT QUESTIONS
- What do you think about what _____ said?
- Do you agree? Why or why not?
- Does anyone have the same answer but a different way to explain it?
- Do you understand what ______ is saying?
- Can you convince the rest of us that your answer makes sense?
- _____ can you explain to us what _____ is doing?

DIFFERENTIATION

Extension
- Allow the player to decide what number to use for the input number.
- Encourage students to use mental math and estimation to determine the output number.
• Ask students to devise their own rules.

**Intervention**

• Provide a student recording sheet where the Input values are filled in 0-10.
• Use this task in direct, small group instruction.
• Ask students to devise their own rules.

**TECHNOLOGY CONNECTION**

• [http://teams.lacoe.edu/documentation/classrooms/amy/algebra/3-4/activities/functionmachine/functionmachine3_4.html](http://teams.lacoe.edu/documentation/classrooms/amy/algebra/3-4/activities/functionmachine/functionmachine3_4.html) Students can enter a value, find the output value, or determine the rule.
• [http://www.amblesideprimary.com/ambleweb/mentalmaths/functionmachines.html](http://www.amblesideprimary.com/ambleweb/mentalmaths/functionmachines.html) Students enter an input value and are given the output value. They then need to determine the rule. Students choose the level of difficulty before beginning the game.
## What's My Rule?

### NUMBER CARDS

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>20</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

### RULE CARDS

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ + 7</td>
<td>□ + 18</td>
<td>□ + 29</td>
<td>□ + 40</td>
</tr>
<tr>
<td>3 × (□ - 6)</td>
<td>(□ + □) ÷ 3</td>
<td>38 - □</td>
<td>75 - □</td>
</tr>
<tr>
<td>□ × 4</td>
<td>□ × 8</td>
<td>□ × 15</td>
<td>□ × 21</td>
</tr>
<tr>
<td>□ ÷ 2</td>
<td>□ ÷ 5</td>
<td>□ ÷ 8</td>
<td>4 × □ + 1</td>
</tr>
<tr>
<td>(□ + □) ÷ 2</td>
<td>3 × (□ + □)</td>
<td>□ × (3 + □)</td>
<td>3 × (□ - 4)</td>
</tr>
<tr>
<td>□ + □ ÷ 2</td>
<td>3 × □ + □</td>
<td>□ ÷ 2 + 3</td>
<td>□ + 0.9</td>
</tr>
<tr>
<td>□ + 3.9</td>
<td>2.1 × □</td>
<td>□ × 0.9</td>
<td>□ × □ + 2.5</td>
</tr>
</tbody>
</table>
Georgia Department of Education
Common Core Georgia Performance Standards Framework
Fifth Grade Mathematics • Unit 1

What’s My Rule?
Directions

Materials:
Two sets of cards: Rule Cards and Number Cards

Directions:
1. Work in groups of 2. Player 1 is in charge of the Rule Cards and player 2 is in charge of the Number Cards.
2. Player 1 pulls a Rule Card out of the set and looks at it. Do NOT let player 2 see the rule card.
3. Player 2 pulls a Number Card out of the deck and lays it face up on the table so both players can see it. Player 1 records the number in the Input column on the recording sheet.
4. Player 1 fills in the Output column by applying the rule to the number on the Rule Card.
5. Player 2 continues to draw Input numbers, and allows player 1 to determine the Output number following the Rule Card.
6. When ready, Player 2 may tell Player 1 the Output number based on the Input number drawn.
7. If the Output is NOT correct, Player 2 wins the game.
8. If the Output is correct, Player 1 must write the rule in the rule space on the chart. If the rule is correct, Player 1 wins the game!
<table>
<thead>
<tr>
<th>What's My Rule?</th>
<th>What's My Rule?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rule:</strong></td>
<td><strong>Rule:</strong></td>
</tr>
<tr>
<td>Input</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Acting Task: Money for Chores

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students are not expected to find all possible solutions, but ask students who are able to find one solution easily to try to find all possible solutions (but don’t tell students how many solutions there are). Through reasoning, students may recognize that it is not possible to earn $40 and paint more than 5 doors because 8 × 5 = 40. Since the payment for one door is equal to the payment for two windows, every time the number of doors is reduced by one, the number of windows painted must increase by two. Alternately, students may recognize that the most number of windows that could be painted is 10 because 4 × 10 = 40. Therefore, reducing the number of window by two allows students to increase the number of doors painted.

ESSENTIAL QUESTIONS

- What is the difference between an expression and an equation?
- How can an expression be written given a set value?

MATERIALS

- “Money from Chores” student recording sheet

GROUPING

Partner or individual task
TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Students work to write expressions and solve equations. Students will determine how many windows and doors can be painted to earn $40. All solutions should be recorded on Money for Chores recording sheet.

Comments
Before photocopying the students recording sheet for this task, consider if students need the table. The table may limit students’ approaches to this problem.

To introduce this task, the problem could be shared with the students and they could be asked to write the expression for the problem. After it is clear that all students have the correct expression for the problem, allow students to work on finding solutions for the problem in partners or small groups.

As student competency increases, teacher support for tasks such as these should decrease. This level of student comfort with similar tasks only comes after many experiences of successful problem solving and all students will not reach it at the same time.

Scaffolding Activity:

Number Tricks:

Have students do the following sequence of operations:

1. Write down any number.
2. Add to it the number that comes after it.
3. Add 9
4. Divide by 2.
5. Subtract the number you began with.

Now you can “magically” read their minds. Everyone ended up with 5!

The task is to see if students can discover how the trick works. If students need a hint, suggest that instead of using an actual number, they use a box to begin with. The box represents a number, but even they do not need to know what the number is. Start with a square. Add the next number $\square + (\square + 1) = 2\square + 1$. Adding 9 gives $2\square + 10$. Dividing by 2 leaves $\square + 5$. Now subtract the number you began with, leaving 5.

Task Directions
Students will follow the directions below from the “Money from Chores” student recording sheet.

Manuel wanted to save to buy a new bicycle. He offered to do extra chores around the house. His mother said she would pay him $8 for each door he painted and $4 for each window frame he painted. If Manuel earned $40 from painting, how many window frames and doors could he have painted?

1. Write an algebraic expression showing how much Manuel will make from his painting chores.
2. Use the table below to find as many ways as possible Manuel could have earned $40 painting window frames and doors.
3. Did you find all of the possible ways that Manuel could have painted windows and doors? How do you know?

FORMATIVE ASSESSMENT QUESTIONS

- What strategy are you using to find a solution(s) to this problem?
- How could you organize your thinking/work when solving this problem? Why is that an effective strategy?
- Did you find all of the ways to solve this problem? How do you know?
- Which students used an organized strategy to solve the problem?
- Which students are able to find all possible solutions to the problem?
- Which students are able to explain how they knew they found all possible solutions?

DIFFERENTIATION

Extension
- How many windows and doors could he have painted to earn $60? $120? For some students, the problem can be changed to reflect the earnings of $60 or $120 before copying.

Intervention
- Some students may benefit from solving a similar but more limited problem before being required to work on this problem. For example, using benchmark numbers like 10 and 50, students could be asked how many of each candy could be bought with $1, if gumballs are 10¢ each and licorice strings are 50¢ each.
TECHNOLOGY CONNECTION

http://illuminations.nctm.org/ActivityDetail.aspx?ID=26 students may want to use this web site to check their work.
Money from Chores

Manuel wanted to save to buy a new bicycle. He offered to do extra chores around the house. His mother said she would pay him $8 for each door he painted and $4 for each window frame he painted.

If Manuel earned $40 from painting, how many window frames and doors could he have painted?

1. Write an expression showing how much Manuel will make from his painting chores.

2. Use the table below to find as many ways as possible Manuel could have earned $40 painting window frames and doors.

<table>
<thead>
<tr>
<th>windows</th>
<th>doors</th>
<th>Work Space</th>
<th>Amount of Money Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

3. Did you find all of the possible ways that Manuel could have painted windows and doors? How do you know?
Constructing Task: Hogwarts House Cup

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students have solved two step word problems using the four operations in third grade and multi step equations in 4th grade. Therefore; the understanding of order or operations within the four operations should have been mastered. At the 5th grade level students are now exploring these four operations within parentheses and brackets.

ESSENTIAL QUESTIONS

- What is the difference between an equation and an expression?
- In what kinds of real world situations might we use equations and expressions?
- How can we simplify expressions?

MATERIALS

- “Hogwarts House Cup, Year 1” student recording sheet, 2 pages

GROUPING

Partner/Small Group Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Students explore writing expressions and equations as well as simplifying expression in the context of points earned at Hogwarts. This task should be carried over several class periods as these ideas are developed.
Comments

This task could be introduced by reading short passages from one of the Harry Potter books where points are given or deducted or when the students are sorted into houses. See the “Technology Connection” below for links to websites with a lot of information on these topics.

This task is broken into three parts. Each part builds on the understanding from the part before it. It is best to do the parts in order. Be sure to facilitate discussion of math reasoning, which is critical to the understanding of the algebraic concepts presented.

Students may require some additional practice with the ideas presented in each part of this task. Use formative assessment data to guide your decision regarding how much practice students need with each part of the task.

This task can be used as a learning task or an alternative would be to use the individual parts of the task as formative assessment tools to measure student understanding of algebraic concepts.

Task Directions

Students will follow the directions below from the “Hogwarts House Cup, Year 1” student recording sheet.

As explained in Harry Potter and the Sorcerer’s Stone, "The four houses are called Gryffindor, Hufflepuff, Ravenclaw, and Slytherin. Each house has its own noble history and each has produced outstanding witches and wizards. While you are at Hogwarts, your triumphs will earn your house points, while any rule breaking will lose house points. At the end of the year, the house with the most points is awarded the House Cup, a great honor. I hope each of you will be a credit to whichever house becomes yours."

1. A house at Hogwarts is given 10 points when a student knows the answer to an important question in class. Write an expression if Gryffindor earned 20 points for answering important questions during one week.

2. A house at Hogwarts is given 5 points when students show they have learned a magic spell. Write an expression if Hogwarts earned 15 points for magic spells during one week.

3. At the end of one week, Harry wants to know how many points Gryffindor has earned. He sees they have earned 40 points for answering questions correctly. Write an equation that represents the number of points the Gryffindor students earned for answering questions correctly.

4. Professor McGonagall kept track of the number of points Gryffindor students received for correct answers and knowing magic spells one week. She wrote these two equations on the board to show the total points:

   \[(10 \times 2) + (7 \times 5) = \square\]

   \[10 \times 2 + 7 \times 5 = \square\]

   \[10(2) + 7(5) = \square\]

   \[10 \cdot 2 + 7 \cdot 5 = \square\]

How are these equations the same? How are they different? Will the answer for these equations be the same or different? How do you know?
5. Professor McGonagall wrote an equation to show the total number of points Gryffindor earned during one week. 

\[(10 \times 3) + (5 \times 4) = 50\]

If students earned 10 points for answering difficult questions correctly and 5 points for using a magic spell correctly, use words to explain the equation above.

FORMATIVE ASSESSMENT QUESTIONS

- What do you need to do first to simplify an expression? Why?
- Is this an expression? Is this an equation? How do you know? How can you tell the difference between an expression and an equation?

DIFFERENTIATION

Extension

- “Hogwarts House Cup, Year 4” student recording sheet is meant to be an extension. It could be used in addition to or it could replace the year 3 student recording sheet. If used in place of the year 3 student recording sheet, be sure students are asked to write equations to represent some of the relationships described in the charts on the year 4 student recording sheet. Students should be told that the points earned on the year 4 student recording sheet represent information from a different year, so while the number of points earned per activity is the same as previous years, the number of occurrences will not be the same.
- The complexity of simplifying algebraic expressions can be increased through the use of decimals and multi-step word problems.

Intervention

- Provide explicit vocabulary instruction for terms introduced in this task, such as expression, equation, and substitution. Allow students to participate in vocabulary activities to ensure these terms are understood.
- Ask students to complete a graphic organizer, such as the “Hogwarts House Cup, Note-taking Sheet.” This gives students a tool they can use to help write and simplify algebraic expressions when solving problems.

TECHNOLOGY CONNECTION

- [http://www.hp-lexicon.org/hogwarts/points.html](http://www.hp-lexicon.org/hogwarts/points.html) This web page describes the points awarded and deducted during the years that Harry Potter attended Hogwarts.
Hogwarts House Cup
Year 1

As explained in *Harry Potter and the Sorcerer's Stone*, "The four houses are called **Gryffindor**, **Hufflepuff**, **Ravenclaw**, and **Slytherin**. Each house has its own noble history and each has produced outstanding witches and wizards. While you are at Hogwarts, your triumphs will earn your house points. At the end of the year, the house with the most points is awarded the **House Cup**, a great honor. I hope each of you will be a credit to whichever house becomes yours."

1. A house at Hogwarts is given 10 points when a student knows the answer to an important question in class. Write an expression if Gryffindor earned 20 points for answering important questions during one week.

________________________________________________________________________

2. A house at Hogwarts is given 5 points when students show they have learned a magic spell. Write an expression if Hogwarts earned 15 points for magic spells during one week.

________________________________________________________________________

3. At the end of one week, Harry wants to know how many points Gryffindor has earned. He sees they have earned 40 points for answering questions correctly. Write an equation that represents the number of points the Gryffindor students earned for answering questions correctly.

________________________________________________________________________

4. Professor McGonagall kept track of the number of points Gryffindor students received for correct answers and knowing magic spells one week. She wrote these equations on the board to show the total points:

   MATHEMATICS • GRADE 5 • UNIT 1: Order of Operations and Whole Numbers
   Georgia Department of Education
   Dr. John D. Barge, State School Superintendent
   May 2012 • Page 34 of 70
   All Rights Reserved
(10 x 2) + (7 x 5) = □
10 * 2 + 7 * 5 = □
10(2) + 7(5) = □
10 * 2 + 7 * 5 = □

How are these equations the same? How are they different?
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Will the answer for these equations be the same or different? How do you know?
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

5. Professor McGonagall wrote an equation to show the total number of points Gryffindor earned during one week.

(10 × 3) + (5 × 4) = 50

If students earned 10 points for answering difficult questions correctly and 5 points for using a magic spell correctly, use words to explain the equation above.
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Practice Task: Hogwarts House Cup Part 2

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students have solved two step word problems using the four operations in third grade and multi step equations in 4th grade. Therefore; the understanding of order or operations within the four operations should have been mastered. At the 5th grade level students are now exploring these four operations within parentheses and brackets.

ESSENTIAL QUESTIONS

- What is the difference between an equation and an expression?
- In what kinds of real world situations might we use equations and expressions?
- How can we simplify expressions?

MATERIALS

- “Hogwarts House Cup, Year 2” student recording sheet
- “Hogwarts House Cup, Year 3” student recording sheet
- Optional, “Hogwarts House Cup, Year 4” student recording sheet, 2 pages

GROUPING

Partner/Small Group Task
TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:
Students explore writing expressions and equations as well as simplifying expression in the context of points earned at Hogwarts. This task should be carried over several class periods as these ideas are developed.

Comments
This task could be introduced by reading short passages from one of the Harry Potter books where points are given or deducted or when the students are sorted into houses. See the “Technology Connection” below for links to websites with a lot of information on these topics.

This task is broken into three parts. Each part builds on the understanding from the part before it. It is best to do the parts in order. Be sure to facilitate discussion of math reasoning, which is critical to the understanding of the algebraic concepts presented.

Students may require some additional practice with the ideas presented in each part of this task. Use formative assessment data to guide your decision regarding how much practice students need with each part of the task.

This task can be used as a learning task or an alternative would be to use the individual parts of the task as formative assessment tools to measure student understanding of algebraic concepts.

Task Directions
Students will follow the directions below from the “Hogwarts House Cup, Year 2” student recording sheet.

1. Students at Hogwarts typically earn 15 points for tackling a boggart and 20 points for identifying potions. Complete the chart as shown in the example.

<table>
<thead>
<tr>
<th>Hogwarts House</th>
<th>Number of Students Tackling a Boggart</th>
<th>Number of Students Identifying Potions</th>
<th>Expression</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>3</td>
<td>2</td>
<td>(15 × 3) + (20 × 2)</td>
<td>(15 × 3) + (20 × 2) = 85</td>
</tr>
<tr>
<td>Gryffindor</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hufflepuff</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ravenclaw</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slytherin</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Students at Hogwarts typically earn 5 points for using a magic spell correctly and 10 points for correctly answering a difficult question. In the chart below: Complete the chart as shown in the example.
Students will follow the directions below from the “Hogwarts House Cup, Year 3” student recording sheet.

This time you are going to find out how many points the houses at Hogwarts lost! To find the total number of points lost, you will need to write an expression with the given value to find the total number of points each house lost.

1. Students at Hogwarts typically lose 10 points for being late to class and students lose 20 points for being out of bed at midnight. Complete the chart as shown in the example

<table>
<thead>
<tr>
<th>Hogwarts House</th>
<th>Number of Students Correctly Using a Magic Spell</th>
<th>Number of Students Correctly Answering a Question</th>
<th>Expression</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>1</td>
<td>1</td>
<td>(5 x 1) + (10 x 1)</td>
<td>(5 x 1) + (10 x 1) = 15</td>
</tr>
<tr>
<td>Gryffindor</td>
<td></td>
<td></td>
<td>(5 × 5) + (10 × 2)</td>
<td></td>
</tr>
<tr>
<td>Hufflepuff</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ravenclaw</td>
<td></td>
<td></td>
<td>(5 × 4) + (10 × 1)</td>
<td></td>
</tr>
<tr>
<td>Slytherin</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Write an equation below for the number of points each house lost according to the chart above and the number of points each house earned in Hogwarts Year 2.

Example: 85 + 15 - [(10 x 3) + (20 x 2)] = 30
FORMATIVE ASSESSMENT QUESTIONS

- What do you need to do first to simplify an expression? Why?
- Is this an expression? Is this an equation? How do you know? How can you tell the difference between an expression and an equation?

DIFFERENTIATION

Extension
- “Hogwarts House Cup, Year 4” student recording sheets meant to be an extension. I could be used in addition to or it could replace the year 3 student recording sheet. If used in place of the year 3 student recording sheet, be sure students are asked to write equations to represent some of the relationships described in the charts on the year 4 student recording sheet. Students should be told that the points earned on the year 4 student recording sheet represent information from a different year, so while the number of points earned per activity is the same as previous years, the number of occurrences will not be the same.
- The complexity of simplifying algebraic expressions can be increased through the use of decimals and multi-step word problems.

Intervention
- Provide explicit vocabulary instruction for terms introduced in this task, such as expression, equation, and substitution. Allow students to participate in vocabulary activities to ensure these terms are understood.
- Ask students to complete a graphic organizer, such as the “Hogwarts House Cup, Note-taking Sheet.” This gives students a tool they can use to help write and simplify algebraic expressions when solving problems.

TECHNOLOGY CONNECTION

- [http://www.hp-lexicon.org/hogwarts/points.html](http://www.hp-lexicon.org/hogwarts/points.html) This web page describes the points awarded and deducted during the years that Harry Potter attended Hogwarts.

<table>
<thead>
<tr>
<th>Gryffindor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hufflepuff</td>
</tr>
<tr>
<td>Ravenclaw</td>
</tr>
<tr>
<td>Slytherin</td>
</tr>
</tbody>
</table>
Hogwarts House Cup
Year 2

2. Students at Hogwarts typically earn 15 points for tackling a boggart and 20 points for identifying potions. Complete the chart as shown in the example.

<table>
<thead>
<tr>
<th>Hogwarts House</th>
<th>Number of Students Tackling a Boggart</th>
<th>Number of Students Identifying Potions</th>
<th>Expression</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>3</td>
<td>2</td>
<td>(15 × 3) + (20 × 2)</td>
<td>(15 × 3) + (20 × 2) = 85</td>
</tr>
<tr>
<td>Gryffindor</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hufflepuff</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ravenclaw</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slytherin</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Students at Hogwarts typically earn 5 points for using a magic spell correctly and 10 points for correctly answering a difficult question. In the chart below: Complete the chart as shown in the example.

<table>
<thead>
<tr>
<th>Hogwarts House</th>
<th>Number of Students Correctly Using a Magic Spell</th>
<th>Number of Students Correctly Answering a Question</th>
<th>Expression</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>1</td>
<td>1</td>
<td>(5 × 1) + (10 × 1)</td>
<td>(5 × 1) + (10 × 1) = 15</td>
</tr>
<tr>
<td>Gryffindor</td>
<td>(5× 5)+ (10 × 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hufflepuff</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ravenclaw</td>
<td>(5× 4)+ (10 × 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slytherin</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hogwarts House Cup
Year 3

This time you are going to find out how many points the houses at Hogwarts lost! To find the total number of points lost, you will need to write an expression with the given value to find the total number of points each house lost.

4. Students at Hogwarts typically lose 10 points for being late to class and students lose 20 points for being out of bed at midnight.
   Complete the chart as shown in the example.

<table>
<thead>
<tr>
<th>Hogwarts House</th>
<th>Number of Students Late to Class</th>
<th>Number of Students Out of Bed at Midnight</th>
<th>Expression</th>
<th>Total Number of Points Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>3</td>
<td>2</td>
<td>(10 × 3) + (20 × 2)</td>
<td>70</td>
</tr>
<tr>
<td>Gryffindor</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hufflepuff</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ravenclaw</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slytherin</td>
<td>6</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Write an equation below for the number of points each house lost according to the chart above and the number of points each house earned in Hogwarts Year 2.
   Example: 85 + 15 - [ (10 × 3 ) + (20 × 2) ] = 30

| Gryffindor     |                                  |
| Hufflepuff     |                                  |
| Ravenclaw      |                                  |
| Slytherin      |                                  |
Constructing Task: Patterns R Us

STANDARDS FOR MATHEMATICAL CONTENT

Understand the place value system.

MCC5.NBT.1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

MCC5.NBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students should have experiences working with connecting the pattern of the number of zeros in the product when you multiply by powers of 10.

Examples:

1. \(2.5 \times 10^3 = 2.5 \times (10 \times 10 \times 10) = 2.5 \times 1,000 = 2,500\)

Students should reason that the exponent above the 10 indicates how many places the decimal point is moving (not just that the decimal point is moving but that you are multiplying or making the number 10 times greater three times) when you multiply by a power of 10. Since we are multiplying by a power of 10 the decimal point moves to the right.

ESSENTIAL QUESTIONS:

- What happens when we multiply a whole number by powers of 10?
- How can you represent the quantity of a multiple of 10?
- What pattern is created when a number is multiplied by a power of 10?
MATERIALS

- “Patterns-R-Us” Recording Sheet
- Calculators (one per team)

GROUPING

Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

In this task, students are asked to identify, describe, and explain any patterns they notice when multiplying numbers by powers of 10 such as 1,000, 100 and 10. Students need to be provided with opportunities to explore this concept and come to this understanding; this should not just be taught procedurally.

Comments

This task is designed to serve as a discovery opportunity for the students. Students should notice that a pattern is created when a number is multiplied by a power of 10. While students may notice patterns in each individual part of the task, encourage them to look for a pattern when considering the overall task. Students should be able to explain and defend their solutions through multiple representations. For example, students should try several numbers for each part to verify that each number follows the same pattern. This activity lends itself to working in pairs for reinforcement.

The practice standards directly addressed within this task are:

2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Calculators are optional for this investigation. However, students will be more likely to explore a variety of numbers and be able to recognize patterns more efficiently with the use of a calculator. Require students to record what they put into the calculator and the result. If students could benefit from some practice with multiplication, require them to solve the problems in part one without a calculator and you can allow students to use a calculator for the rest of the task.

TASK

Students will follow the directions below from the “Patterns-R-Us” Recording Sheet.

A statistician is interested in finding out what pattern is created, if any, under certain situations. Your mission is to help come up with concrete rules for certain mathematical situations. Record all of your work and explain your thinking in order to defend your answer. Good luck!
PART ONE
2. Multiply that number by 1000, 100, and 10.
3. What is happening?
4. Is there a pattern?
5. What do you think would happen if you multiplied your number by 1,000,000?

PART TWO
1. Start with 23.
2. Multiply that number by 1000, 100, and 10.
3. What is happening?
4. Is there a pattern?
5. What do you think would happen if you multiplied your number by 1,000,000?

PART THREE
1. Start with any whole number.
2. Multiply that number by 1000, 100, and 10.
3. What is happening?
4. Is there a pattern?
5. What do you think would happen if you multiplied your number by 1,000,000?

PART FOUR
1. \(28 \times 10^2 = 2800\)
2. \(28 \times 10^3 = 28000\)
3. What is the product of \(28 \times 10^4\)?
4. Is there a pattern?
5. Is there a similar pattern you’ve noticed?

FORMATIVE ASSESSMENT QUESTIONS

- How did you get your answer?
- How do you know your answer is correct?
- What would happen if you started with a different number?
- What patterns are you noticing?
- Can you predict what would come next in the pattern?

DIFFERENTIATION

Extension
- Have students multiply a number by 0.1. Now ask them to multiply that same number by 0.01. What happened? Repeat this with several numbers. Can a conjecture be made based on the results? Have students write their conjecture. Now, share their conjecture with a partner. Are the two conjectures the same? (You may also use \(10^{-2}\) and \(10^{-4}\) as another example.)
Intervention

- Pair students who may need additional time together so that they will have time needed to process this task.

TECHNOLOGY CONNECTION

- [http://www.mathagonyaunt.co.uk/INTERACTIVE/mult_divide/mult_div_lorry.html](http://www.mathagonyaunt.co.uk/INTERACTIVE/mult_divide/mult_div_lorry.html) - Mathagony Aunt: Interactive mathematical practice opportunities
**Patterns-R-Us**

A statistician is interested in finding out what pattern is created, if any, under certain situations. Your mission is to help come up with concrete rules for certain mathematical situations and operations. Record all of your work and explain your thinking so that you can defend your answers.

<table>
<thead>
<tr>
<th>Multiply and put it in the box</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>× 1,000</td>
<td></td>
</tr>
<tr>
<td>× 100</td>
<td></td>
</tr>
<tr>
<td>× 10</td>
<td></td>
</tr>
</tbody>
</table>

What do you think would happen if you multiplied your number by 1,000,000?

<table>
<thead>
<tr>
<th>Multiply and put it in the box</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>× 1,000</td>
<td></td>
</tr>
<tr>
<td>× 100</td>
<td></td>
</tr>
<tr>
<td>× 10</td>
<td></td>
</tr>
</tbody>
</table>

What do you think would happen if you multiplied your number by 1,000,000?
What is happening?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Is there a pattern?

_________________________________________________________________________________
_________________________________________________________________________________

What do you think would happen if you multiplied your number by 1,000,000?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Pick a whole number to multiply and put it in the box

<table>
<thead>
<tr>
<th>X 10</th>
<th>X 100</th>
<th>X 1,000</th>
</tr>
</thead>
</table>

multiplied your number by 1,000,000?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Is there a pattern?

_________________________________________________________________________________

Is there a similar pattern you’ve noticed?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Looking at the patterns you have identified, what conjecture can you make about multiplying numbers by powers of 10?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

How does the use of exponents in $10^2$ and $10^3$ connect to changes in the place value of numbers?

_________________________________________________________________________________
_________________________________________________________________________________

Complete the pattern

<table>
<thead>
<tr>
<th>$X 10^2$</th>
<th>$X 10^3$</th>
<th>$X 10^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>2,800</td>
<td></td>
</tr>
</tbody>
</table>
Practice Task: Multiplication Three in a Row

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

This game can be made available for students to play independently. However, it is important for students to share some of the strategies they develop as they play more. Strategies may include:

- estimating by rounding the numbers in Box A
- multiplying tens first, then ones; for example, 47 x 7 = (40 x 7) + (7 x 7) = 280 + 49 = 329

Be sure students know and understand the appropriate vocabulary used in this task. Provide index cards or sentence strips with key vocabulary words (i.e. factor, product). Have students place the cards next to the playing area to encourage the usage of correct vocabulary while playing the game.

ESSENTIAL QUESTIONS

- How can estimating help us when solving multiplication problems?
- What strategies can we use to efficiently solve multiplication problems?

MATERIALS

- Color Counters
- “Three in a Row” game board (printed on card stock and/or laminated for durability)
- Calculators

GROUPING:

Small Group or Partner Task
In this task, students practice multiplying 2-digit by 2 or 3-digit numbers in a game format.

Comments: Being able to estimate and mentally multiply a 2-digit number by a 2 or 3-digit number is an important pre-requisite skill for dividing a whole number by a 2-digit number. Helping students develop their mental computation or estimation abilities in general is also an important focus of Grade 4 GPS. As students play this game, encourage students to try mental computation and explain strategies. It is important to remind them that they can use the calculator only after they announce their products. Remember that we want students to use estimation skills and mental math strategies to multiply a 2-digit number by a 2 or 3-digit number.

**KEY TO THREE IN A ROW GAME**

<table>
<thead>
<tr>
<th>79x25 or 25x79</th>
<th>91x76 or 76x91</th>
<th>232x802 or 802x232</th>
<th>472x32 or 32x472</th>
<th>91x802 or 802x91</th>
<th>18x512 or 512x18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,975</td>
<td>6,916</td>
<td>186,064</td>
<td>15,104</td>
<td>72,982</td>
<td>9,216</td>
</tr>
<tr>
<td>18x802 or 802x18</td>
<td>232x32 or 32x232</td>
<td>472x76 or 76x472</td>
<td>35x512 or 512x35</td>
<td>232x25 or 25x232</td>
<td>18x97 or 97x18</td>
</tr>
<tr>
<td>14,436</td>
<td>7,424</td>
<td>35,872</td>
<td>17,920</td>
<td>5,800</td>
<td>1,746</td>
</tr>
<tr>
<td>91x97 or 97x91</td>
<td>8,827</td>
<td>18x25 or 25x18</td>
<td>2,528</td>
<td>35x802 or 802x35</td>
<td>28,070</td>
</tr>
<tr>
<td>79x76 or 76x79</td>
<td>6,004</td>
<td>472x25 or 25x472</td>
<td>450</td>
<td>35x97 or 97x35</td>
<td>3,395</td>
</tr>
<tr>
<td>79x76 or 76x79</td>
<td>6,004</td>
<td>472x97 or 97x472</td>
<td>45,784</td>
<td>35x97 or 97x35</td>
<td>3,395</td>
</tr>
<tr>
<td>18x32 or 32x18</td>
<td>576</td>
<td>7,663</td>
<td>11,800</td>
<td>18x76 or 76x18</td>
<td>1,368</td>
</tr>
<tr>
<td>18x32 or 32x18</td>
<td>576</td>
<td>97x97 or 79x76</td>
<td>11,800</td>
<td>18x76 or 76x18</td>
<td>1,368</td>
</tr>
<tr>
<td>91x512 or 512x91</td>
<td>46,592</td>
<td>472x802 or 802x472</td>
<td>35x32 or 32x35</td>
<td>91x25 or 25x91</td>
<td>35x76 or 76x35</td>
</tr>
<tr>
<td>46,592</td>
<td>378,544</td>
<td>35x32 or 32x35</td>
<td>1,120</td>
<td>2,275</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>35x32 or 32x35</td>
<td>1,120</td>
<td>2,275</td>
<td></td>
</tr>
</tbody>
</table>

**Task Directions**

Students will follow the directions below from the “Three in a Row” game board.

This is a game for two or three players. You will need color counters (a different color for each player), game board, pencil, paper, and a calculator.

**Step 1:** Prior to your turn, choose one number from Box A and one number from Box B. Multiply these numbers on your scratch paper. Be prepared with your answer when your turn comes.

**Step 2:** On your turn, announce your numbers and the product of your numbers. Explain your strategy for finding the answer.
Step 3: Another player will check your answer with a calculator after you have announced your product. If your answer is correct, place your counter on the appropriate space on the board. If the answer is incorrect, you may not place your counter on the board and your turn ends.

Step 4: Your goal is to be the first one to make “three-in-a-row,” horizontally, vertically, or diagonally.

FORMATIVE ASSESSMENT QUESTIONS

- Who is winning the game? How do you know? What do you think their strategy is?
- Is there any way to predict which factors would be best to use without having to multiply them all?
- How are you using estimation to help determine which factors to use?
- How many moves do you think the shortest game of this type would be if no other player blocked your move?

DIFFERENTIATION

Extension

- A variation of the game above is to require each player to place a paper clip on the numbers they use to multiply. The next player may move only one paper clip either the one in Box A or the one in Box B. This limits the products that can be found and adds a layer of strategy to the game.
- Another variation is for students to play “Six in a Row” where students need to make six products in a row horizontally, vertically, or diagonally in order to win.
- Eventually, you will want to challenge your students with game boards that contain simple 3-digit numbers (e.g. numbers ending with a 0 or numbers like 301) in Box A or multiples of 10 (i.e., 10, 20, … 90) in Box B. As their competency develops, you can expect them to be able to do any 3-digit by 2-digit multiplication problem you choose.

Intervention

- Allow students time to view the game boards and work out two or three of the problems ahead of time to check their readiness for this activity.
- Use benchmark numbers in Box A, such as 25, 50, 100, etc.
Three in a Row Game Board

This is a game for two or three players. You will need color counters (a different color for each player), game board, pencil, paper, and a calculator.

Step 1: Prior to your turn, choose one number from Box A and one number from Box B. Multiply these numbers on your scratch paper. Be prepared with your answer when your turn comes.

Step 2: On your turn, announce your numbers and the product of your numbers. Explain your strategy for finding the answer.

Step 3: Another player will check your answer with a calculator after you have announced your product. If your answer is correct, place your counter on the appropriate space on the board. If the answer is incorrect, you may not place your counter on the board and your turn ends.

Step 4: Your goal is to be the first one to make “three-in-a-row,” horizontally, vertically, or diagonally.

<table>
<thead>
<tr>
<th>Box A</th>
<th>Box B</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>232</td>
</tr>
<tr>
<td>35</td>
<td>472</td>
</tr>
<tr>
<td>79</td>
<td>25</td>
</tr>
<tr>
<td>72</td>
<td>79</td>
</tr>
<tr>
<td>91</td>
<td>97</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1,975</th>
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</tr>
</thead>
<tbody>
<tr>
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Constructing Task: The Grass is Always Greener

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm.

MCC5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Along with the use of multiplication and division of whole numbers, students need to compute the area of each roll of sod and the area of the football field. Students will need to recognize that all units of measure are the same unit. Students will need to find a way to compare unit prices, which may include comparing whole number amounts if students determine the cost per square foot of each size sod.

ESSENTIAL QUESTIONS

• How can I apply my understanding of area of a rectangle and square to determine the best buy for a football field?
• What operations are needed to find area and cost per square inch?
• In what ways is multiplication used in beautifying a football field?

MATERIALS

• Paper/Graph paper
• Pencil
• Accessible manipulatives
GROUPING

individual/partner task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Comments
To get students started, the area of a rectangle should be reviewed. Students can work in groups of three for about 15 minutes to brainstorm ideas on how to approach the problem, and then separated to do individual work.

TASK

The Westend Recreation Center Booster Club is considering replacing the existing grass football field with a new type that is softer that provides better traction. Visiting teams have been complaining about the large number of injuries from inadvertent slips on the slippery sod. Local fans have agreed to volunteer labor and equipment. The Booster Club is concerned only with the cost of the sod for the field. They are looking for the best buy for their money.

Below are price quotes from various local nurseries:

6’ x 2’ roll $1.00
6’ x 6’ roll $4.00
8’ x 3’ roll $2.00
6’ x 3’ roll $3.00

The field dimensions are 120ft x 160ft.

Which is the best buy?
How many rolls of sod will be needed?
What will be the total cost of the sod?

FORMATIVE ASSESSMENT QUESTIONS

• What is the question asking?
• How can you determine the total size of the football field?
• How can you determine the cost of each roll of sod? Can you use this information to find the cost per square inch?
• Which size roll is the best buy and why?

DIFFERENTIATION

Extension
• Make a scale diagram of how the sod will be laid down on the field.
Intervention

- The Westend Recreation Center Booster Club is considering replacing the existing grass football field with a new type that is softer. Local fans have agreed to volunteer labor and equipment. The Booster Club is concerned only with the cost of the sod for the field. They found that a 6' x 2' roll costs $2.00. The field dimensions are 360' x 160'. How many rolls of sod will be needed? What will be the total cost of the sod?

TECHNOLOGY CONNECTION

http://www.syvum.com/math/wordproblems/level1.html A resource for teachers to find additional word problems
The Grass is Always Greener

The Westend Recreation Center Booster Club is considering replacing the existing grass football field with a new type that is softer that provides better traction. Visiting teams have been complaining about the large number of injuries from inadvertent slips on the slippery sod. Local fans have agreed to volunteer labor and equipment. The Booster Club is concerned only with the cost of the sod for the field. They are looking for the best buy for their money.

Below are price quotes from various local nurseries:

- 6' x 2' roll $1.00
- 6' x 6' roll $4.00
- 8' x 3' roll $2.00
- 6' x 3' roll $3.00

The field dimensions are 120ft x 160ft.

Which is the best buy?
How many rolls of sod will be needed?
What will be the total cost of the sod?
Practice Task: Division Four in a Row

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Be sure students know and understand the appropriate vocabulary used in this task. Provide index cards or sentence strips with key vocabulary words (i.e. quotient, dividend, and divisor). Have students place the cards next to the playing area to encourage the usage of correct vocabulary while playing the game.

As students play this game, it is important to remind them that they can use the calculator only after they announce their quotients. Remember that we want students to use estimation skills and mental math strategies to divide a 3-digit number by a 1-digit number.

Even though this standard leads more towards computation, the connection to story contexts is critical. Make sure students are exposed to problems where the divisor is the number of groups and where the divisor is the size of the groups. In fourth grade, students’ experiences with division were limited to dividing by one-digit divisors. This standard extends students’ prior experiences with strategies, illustrations, and explanations. When the two-digit divisor is a “familiar” number, a student might decompose the dividend using place value.

ESSENTIAL QUESTIONS

- How can estimating help us when solving division problems?
- What strategies can we use to efficiently solve division problems?
MATERIALS

- Color Counters
- “Division Four in a Row” game board (printed on card stock and/or laminated for durability)
- Calculators

GROUPING
Small Group or Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

In this task, students practice dividing numbers up to 4-digits by 1 and 2-digit numbers in a game format.

Comments

Being able to estimate and mentally divide a 3 and 4-digit number by a 1-digit number is an important pre-requisite skill for dividing a whole number by a 2-digit number. Helping students develop their mental computation or estimation ability in general is also an important focus of Grade 5 CCGPS. This task challenges your students with game boards that contain simple 4-digit numbers in the Dividend Box or multiples of 10 (i.e., 10, 20, … 90) in the Divisor Box.

This practice standards directly addressed within this task are:

3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

KEY TO DIVISION FOUR IN A ROW GAME

<table>
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<tr>
<th>315÷10</th>
<th>315÷9</th>
<th>504÷28</th>
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<td>842</td>
<td>51 R3</td>
</tr>
</tbody>
</table>

MATHEMATICS • GRADE 5 • UNIT 1: Order of Operations and Whole Numbers
Georgia Department of Education
Dr. John D. Barge, State School Superintendent
May 2012 • Page 57 of 70
All Rights Reserved
This game can be made available for students to play independently. However, it is important for students to share some of the strategies they develop as they play. Strategies may include:

- Estimating the product of the number in a desired space with one of the divisors to find the dividend.
- Estimating by rounding the numbers in Box A.
- Using expanded notation for example, \( \frac{2682}{25} = \frac{(2000 + 600 + 80 + 2)}{25} \)
- Using an equation that relates division to multiplication.
- Using base ten models to make an array.
- An area model for division and keep track of how much of the dividend is left to divide.

**TASK:**

Students will follow the directions below from the “Division Four in a Row” Game Board.

This is a game for two or three players. You will need color counters (a different color for each player), game board, pencil, paper, and a calculator.

**Step 1:** Prior to your turn, choose one number from Box A and one number from Box B. Divide these numbers using a mental strategy. Record your answer on a scratch piece of paper. Be prepared with your answer when your turn comes.

**Step 2:** On your turn, announce your numbers and the quotient for your numbers. Explain your strategy for finding the answer.

**Step 3:** Another player will check your answer with a calculator after you have announced your quotient. If your answer is correct, place your counter on the appropriate space on the board. If the answer is incorrect, you may not place your counter on the board and your turn ends.

**Step 4:** Your goal is to be the first one to make “four-in-a-row,” horizontally, vertically, or diagonally.

**FORMATIVE ASSESSMENT QUESTIONS**

- What do you think about what ____ said?
- Do you agree? Why or why not?
- Does anyone have the same answer but a different way to explain it?
- Do you understand what ______ is saying?
- Can you convince the rest of us that your answer makes sense?
- _____ can you explain to us what _____ is doing?

**DIFFERENTIATION**

Extension
• Have students develop their own game boards to include different divisors, dividends and quotients.
• A variation of the game above is to require each player to place a paper clip on the numbers they use to divide. The next player may move only one paper clip either the one in Box A or the one in Box B. This limits the quotients that can be found and adds a layer of strategy to the game.

**Intervention**

• Allow students time to view the game boards and work out two or three of the problems ahead of time to check their readiness for this activity.
• Use numbers in Box A that are evenly divisible, and then move to quotients with remainders.
Division Four in a Row Game Board

This is a game for two or three players. You will need color counters (a different color for each player), game board, pencil, paper, and a calculator.

Step 1: Prior to your turn, choose one number from Box A and one number from Box B. Divide these numbers using a mental strategy. Record your answer on a scratch piece of paper. Be prepared with your answer when your turn comes.

Step 2: On your turn, announce your numbers and the quotient for your numbers. Explain your strategy for finding the answer.

Step 3: Another player will check your answer with a calculator after you have announced your quotient. If your answer is correct, place your counter on the appropriate space on the board. If the answer is incorrect, you may not place your counter on the board and your turn ends.

Step 4: Your goal is to be the first one to make “four-in-a-row,” horizontally, vertically, or diagonally.

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<tr>
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Name ____________________________ Date __________________________
Constructing Task: Are These All…

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Since third grade, students have worked with division through the use of partitioning whole numbers, rectangular arrays area models and through the relationship of multiplication. They should be able to apply these understandings of various division situations within this task.

This standard references various strategies for division. Division problems can include remainders. Even though this standard leads more towards computation, the connection to story contexts is critical. Make sure students are exposed to problems where the divisor is the number of groups and where the divisor is the size of the groups. In fourth grade, students’ experiences with division were limited to dividing by one-digit divisors. This standard extends students’ prior experiences with strategies, illustrations, and explanations. When the two-digit divisor is a “familiar” number, a student might decompose the dividend using place value.

ESSENTIAL QUESTIONS:

- How can I use the situation in a story problem to determine the best operation to use?
- How can I effectively explain my mathematical thinking and reasoning to others?

MATERIALS

- Paper
- Pencil
- Accessible manipulatives
GROUPING

whole/individual/small group task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task, students analyze story problems that demonstrate three different division situations.

Comments

The three problems in this task represent situations where division can be used to solve different kinds of problems.

Problem A (measurement), creates a situation in which a given area must be divided to determine the number of openings in the fencing. This situation promotes the strategy similar to the one listed below:

\[
\begin{array}{c|c}
15 & 364 \\
\hline
300 & 20 \\
64 & \\
60 & 4 \\
4 & 24 \text{ R}4
\end{array}
\]

Problem B calls for the partitioning of the money given by Old Mother Hubbard to her 15 children.

In Problem C, subtraction is used as a strategy to divide the given amounts. This is a low level strategy, but it opportunity for students to connect their understanding of repeated subtraction to help develop a more efficient division strategy.

Notice that students were not asked to actually solve any of these situations. The teacher may have students solve them either pictorially or using student invented strategies. Regardless, students should be required to explain their thinking.

TASK

Students will follow the directions below from the “Are These All 364 ÷ 15?” recording sheet.

You have been learning about many situations that can be solved with division. Even though the following problems all use the same numbers, think about whether each describes a different type of division problem. After each problem explain why 364 ÷ 15 can or cannot be used to solve the problem.

Problem A

The new playground equipment was delivered to Anywhere Elementary School before the new fence was installed. Thomas Fencing Company arrived the next day with 364ft of fencing the school’s principal wanted an opening in the fence every 25 feet. According to the principal’s estimation the playground area would have about 15 openings. The Thomas
Fencing Company workers estimated 20 openings around the playground. Who is correct? How do you know?

Problem B
Old Mother Hubbard found an old silver coin in her empty cupboard. She took it to the neighborhood coin collector and received $364 for the coin. With this increase in income, Old Mother Hubbard was able to pay her children for the chores they completed during the month. The 15 children inquired of their mother the amount of money each would receive. She was excited by the children’s inquiry and ran to the cupboard to retrieve beans to represent the money and Ziploc bags. Her kids were told to use the materials to figure out the answer to their own question! What do you think they figured out and why?

Problem C
The new poetry book by Mel Goldstein is 364 pages packed of humorous poems. Lily Reader set a goal to read the entire book in 25 days. She planned to read 15 pages a days. With this plan, will she reach her goal? How do you know?

On the back of this paper, write 3 of your own problems that can be solved using 252 ÷ 12.

FORMATIVE ASSESSMENT QUESTIONS

- What is the question asking?
- What is happening to the whole or dividend within this situation?
- How many total parts does this situation involve?
- Does that amount make sense in this situation? Why or why not?

DIFFERENTIATION

Extension
Students should be challenged to write problem situations that require a variety of operations and then solve them. Next, students can trade problems with a partner and discuss their solutions.

Intervention
- Carefully screen the vocabulary to make sure that it is suitable for your students.
- Working in cooperative learning groups will support the student who is an English language learner or for whom this task is challenging.

TECHNOLOGY CONNECTION

http://www.sylvum.com/math/wordproblems/level1.html A resource for teachers to find additional word problems
Are These All 364 ÷ 15?

You have been learning about many situations that can be solved with division. Even though the following problems all use the same numbers, think about whether each describes a different type of division problem. After each problem explain why 364 ÷ 15 can or cannot be used to solve the problem.

Problem A
The new playground equipment was delivered to Anywhere Elementary School before the new fence was installed. Thomas Fencing Company arrived the next day with 364ft of fencing the school’s principal wanted an opening in the fence every 25 feet. According to the principal’s estimation the playground area would have about 15 openings. The Thomas Fencing Company workers estimated 20 openings around the playground. Who is correct? How do you know?

Problem B
Old Mother Hubbard found an old silver coin in her empty cupboard. She took it to the neighborhood coin collector and received $364 for the coin. With this increase in income, Old Mother Hubbard was able to pay her children for the chores they completed during the month. The 15 children inquired of their mother the amount of money each would receive. She was excited by the children’s inquiry and ran to the cupboard to retrieve beans to represent the money and Ziploc bags. Her kids were told to use the materials to figure out the answer to their own question! What do you think they figured out and why?

Problem C
The new poetry book by Mel Goldstein is 364 pages packed of humorous poems. Lily Reader set a goal to read the entire book in 25 days. She planned to read 15 pages a days. With this plan, will she reach her goal? How do you know?
Write 3 of your own problems that can be solved using $252 \div 12$.

1. 

2. 

3. 
Culminating Task: Start of the Year Celebration!

STANDARDS FOR MATHEMATICAL CONTENT

MCC.5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

MCC5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

MCC5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm.

MCC.5.NBT.6 Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Within this unit, students were required to write and evaluate expressions using order of operations and multiply and divide multi-digit numbers. They will apply their understanding within this culminating task.

ESSENTIAL QUESTIONS

- How can expressions be evaluated?
- How can identifying patterns help determine multiple solutions?

MATERIALS

- “Start of the Year Celebration!” student recording sheet
- Square tiles or small paper squares or toothpicks
GROUPING

individual/small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Students will create expressions to determine how many tables and chairs will be needed at the party.

Comments

One way to introduce this task is by reading *Spaghetti And Meatballs For All! A Mathematical Story*, by Marilyn Burns (or a similar story). The characters in the story have a similar problem; however, the number of tables in the story is fixed, while the number tables in this problem will be flexible. Use the story to initiate a conversation about various arrangements needed to seat the people invited to the party using the amount of money you have received to rent the tables.

An important part of this activity is to encourage students to find all solutions to this problem and to describe how they know they found all of the solutions. Representing solutions in a variety of ways also shows how patterns can occur numerically and geometrically, and how patterns can be written as expressions.

Students will need to understand that there must be enough room for 120 people to sit around the tables. There’s a predetermined amount of money students will have to spend on tables and chairs, each costing $14 and $12 respectively. Once students determine all possible solutions, they will then decide which solution best fits the predetermined amount of $1700.

Square tiles can be used to concretely represent the tables. The shape of the table is left open to the students. Therefore, students will need to be aware two squares will represent a rectangular table.

This practice standards directly addressed within this task are:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

TASK

Students will follow the directions below from the “Start of the Year Celebration!” student recording sheet.

Part A:

Five fifth grade classes are planning a start of the year celebration. There are a total of 120 students invited to the celebration. The teachers have decided to rent chairs and tables from a company which charges $14 per table and $12 per chair. Write an expression for all the ways you could arrange the tables to seat 120 people. Use pictures and charts for your
solution. Find the largest number of tables that could be used as well as the smallest number of tables that could be used to seat 120 people.

Part B:

If the teachers only have $1700 to spend on the rentals, which solution would be the most cost efficient?

Possible solutions:

This arrangement 15 times:

\[(120\times12)+(15\times14)=1650\]
\[1700-[(120\times12)+(15\times14)]=50\]
120 chairs= $1440, 15 tables=$210, total= $1650

This arrangement 9 times:

\[(120\times12)+(20\times14)=1720\]
\[1700-[(120\times12)+(20\times14)]=-20\]
120 chairs=$1440, 20 tables= $280, total= $1720

FORMATIVE ASSESSMENT QUESTIONS

- What shape tables would you choose to seat your guests?
- How can you determine the cost of your representation?
- How does your representation help you to find the best possible solution?
- How much of your money will be used?

DIFFERENTIATION:

Extension

- For an extension of this activity, change to number of persons so that students can analyze the patterns using a different number of guests.
Intervention

- Arrange the tables to seat 48 people, rather than 120. Help students begin the task using an organizational strategy such as is described in the “Background Knowledge” section above.
Start of the Year Celebration!

Part A:

Five fifth grade classes are planning start of the year celebration. There are a total of 120 students invited to the celebration. The teachers have decided to rent chairs and tables from a company which charges $14 per table and $12 per chair. Write an expression for all the ways you could arrange the tables to seat 120 people. Use pictures and charts for your solution. Find the largest number of tables that could be used as well as the smallest number of tables that could be used to seat 120 people.

Part B:

If the teachers only have $1700 to spend on the rentals, which solution would be the most cost efficient?