



San Diego Unified
SCHOOL DISTRICT

FIFTH GRADE

Unit 7

Expressions and the Coordinate Plane

15 days

enVision 2.0 Topics 13 - 15

Overarching Understandings:

Using an understanding of place value and properties of operations, problems can be solved using addition, subtraction, multiplication, and division. There is an agreed upon order in which operations are carried out in a numerical expression. Numerical expressions show relationships among the quantities involved which you can interpret without evaluating the expressions. The coordinate system is a visual representation. It is used to graph points and show the relationship between two variables. If one of the variables is time, the graph can show how something changes over time. It is also used to graph linear equations and can help determine the relationship between numerical patterns.

Essential Questions:

- How can I write an expression that demonstrates a situation or context?
- How does the coordinate system work?
- In what real life situations would you use a graph on the coordinate plane?
- How do coordinate grids help you organize information?
- How might a coordinate grid help me understand the relationship between two numbers?
- How can a line graph help us determine relationships between two numerical patterns?

Common Core State Standards:

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

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

5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).

5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

FIFTH GRADE

Unit 7

Expressions and the Coordinate Plane

15 days

14 Lessons
1 Assessment Day

Suggested Order of Lessons

Objective 1: Students will write, solve and evaluate expressions by using the order of operations. (5.OA.1, 5.OA.2)

Day	Source	Lesson Title	Page Number	Notes
1	enVision 2.0	13-1 Order of Operations	ENV TE p. 735	
2	Georgia	Trick Answers	Unit p.9	
3	enVision 2.0	13-3 Write Numerical Expressions	ENV TE p. 747	
4	Georgia	Hogwarts House Cup	Unit p.13	
5	enVision 2.0	13-4 Evaluate Numerical Expressions	ENV TE p. 753	
6	enVision 2.0	13-5 Reasoning	ENV TE p. 759	

Objective 2: Students will solve problems by graphing points on the coordinate plane. (5.G.1, 5.G.2)

Day	Source	Lesson Title	Page Number	Notes
7	enVision 2.0	14-1 The Coordinate System	ENV TE p. 777	
8	enVision 2.0	14-2 Graph Data Using Ordered Pairs	ENV TE p. 783	
9	enVision 2.0	14-3 Solve Problems Using Ordered Pairs	ENV TE p.789	
10	Georgia	Air Traffic Controller	Unit p.23	

Objective 3: Students will analyze patterns and relationships by graphing ordered pairs on a coordinate plane. (5.OA.3, 5.G.1, 5.G.2)

Day	Source	Lesson Title	Page Number	Notes
11	enVision 2.0	15-1 Numerical Patterns	ENV TE p. 813	
12	enVision 2.0	15-2 More Numerical Patterns	ENV TE p. 819	
13	enVision 2.0	15-3 Analyze and Graph Relationships	ENV TE p. 825	
14	enVision 2.0	15-4 Make Sense and Persevere	ENV TE p. 831	
15	Assessment			

Notes:

enVision Lessons 18-2 and 14-4 were replaced with Georgia tasks to give students more experiences with problem solving during this unit.

SDUSD Math Lesson Map

Number Talks 15 minutes

Number Talks are a chance for students to come together to practice fluency and share their mathematical thinking by engaging in conversations and discussions around problem solving and number sense activities.

The structure of math lessons should follow the Launch, Explore, Summarize format. This structure allows students to explore mathematical concepts with rigor (fluency, concept development, and application) to develop understanding in ways that make sense. Some rich tasks may take multiple days for students to explore. In these cases, each day should still follow the Launch, Explore, Summarize format.

LAUNCH (5–10 minutes)

The teacher sets the stage for learning by ensuring the purpose and the rationale of the lesson are clear by connecting the purpose to prior learning, posing the problem(s), and introducing the Explore task for students. During this time the teacher is identifying the tools and materials available, reviewing academic vocabulary, and setting the expectations for the lesson.

The students are actively engaged in a short task or discussion to activate prior knowledge in preparation of the Explore task. Students may be using tools and/or manipulatives to make sense of the mathematical concept.

WHOLE GROUP

EXPLORE (15–20 minutes)

The teacher provides opportunities and support for students to develop conceptual understanding by providing meaningful explorations and tasks that promote active student engagement.

The teacher monitors the development of student understanding by conferring with students and asking students questions in order to understand and stimulate their thinking. The teacher uses this information to plan for the Summarize and, if needed, to call the students together for a mid-Explore scaffold to focus or propel student thinking.

The students are actively engaged in constructing meaning of the mathematical concept being taught. Students engage in private reasoning time before working with partners or groups. Students use multiple representations to solve rich tasks and communicate their mathematical understanding.

INDIVIDUAL, PAIRS, OR SMALL GROUP

SUMMARIZE (15–20 minutes)

The teacher provides opportunities to make public the learning that was accomplished by the students by sharing evidence of what was learned, and providing opportunities for students to analyze, compare, discuss, extend, connect, consolidate, and record thinking strategies. A summary of the learning is articulated and connected to the purpose of the lesson.

The students are actively engaged as a community of learners, discussing, justifying, and challenging various solutions to the **Explore** task. The students are able to articulate the learning/understanding of the mathematical concept being taught either orally or in writing. Students can engage in this discussion whether or not they have completed the task.

WHOLE GROUP

PRACTICE, REFLECT, and APPLY (10–15 minutes)

This time is saved for after the Summarize so students can use what they have learned to access additional tasks. The opportunities that teachers provide are responsive to student needs.

The students may have the opportunity to: revise their work, reflect on their learning, show what they know with an exit slip, extend their learning with a similar or extension problem, or practice with centers or games.

The teacher confers with individual students or small groups.

INDIVIDUAL, PAIRS, OR SMALL GROUP

FORMATIVE ASSESSMENT

The teacher determines what students are learning and are struggling with by conferring with students and by examining student work throughout the lesson. This formative assessment informs ongoing adjustments in the lesson and next steps for the class and each student.

The students are actively engaged in showing their learning accomplishments related to the mathematical concept of the lesson.

SDUSD Mathematics Units

We understand that for deep and sustainable change in mathematics to take place, teachers, students, and leaders must grapple with what the rich mathematics asked for by Common Core State Standards-Mathematics looks like in the classroom, in pedagogical practice, in student work, in curriculum, and in assessments. It is our goal that teachers and site leaders work collaboratively toward a shared vision of math instruction that develops mathematically proficient students as defined by the CCSS-Mathematics. It is our hope that these units provide a common instructional foundation for this collaboration.

The SDUSD Mathematics Units are designed to support teachers and students as we shift from a more directive style of teaching mathematics toward a more inquiry-based style. In problem-based learning, students develop the habits of mind and interaction of mathematicians through engaging in mathematical discourse, connecting representations, asking genuine questions, and justifying and generalizing ideas. These mathematical habits reflect the shifts in pedagogy required to support the Common Core Standards for Mathematical Practice.

The SDUSD math units are compiled with multiple sources to ensure students have a variety of mathematical experiences aligned to the CCSS. All lessons should follow the structure of Launch, Explore, and Summarize. The following document will guide teachers in planning for daily lessons, by helping them understand the structures of each of the sources.

Structure for enVision 2.0 Lessons

Use Step 1 Develop: Problem-Based Learning is the Launch, Explore, and Summarize for every enVision 2.0 Lesson.

Launch: (Before)

Start with the Solve-and-Share problem. Pose the problem to the students making sure the problem is understood. This does not mean you explain *how* to do the problem, rather you ensure that students understand what the problem is about. Establish clear expectations as to whether students will work individually, in pairs, or in small groups. This includes making sure students know which representations and tools they might be using or if they will have a choice of materials.

Explore: (During)

Students engage in solving the problem using a variety of strategies and tools. Use the suggested guiding questions to check in briefly with students as needed, in order to understand and push student thinking. You may want to use the “Extension for Early Finishers” as needed.

Summarize: (After)

Select student work for the class to analyze and discuss. If needed, use the Sample Student Work provided for each lesson in enVision 2.0.

Practice, Reflect, Apply: (Select Problems from Workbook Pages, Reteach, Games, Intervention Activity)

During this time, students may revise their work from the Explore time or you may use pieces of Step 2 Develop: Visual Learning and Step 3 Assess and Differentiate. Note: The Quick-Check component is now a few select problems that are highlighted with a pink checkmark in the Teacher’s Edition. This time provides an excellent opportunity to pull small groups of students that may need additional support.

Structure for Engage NY Lessons

Launch/Explore: (Concept Development)

The Concept Development constitutes the major portion of instructional time when new learning is introduced. During this time, the lessons move through a deliberate progression on material, from concrete to pictorial to abstract. Your word choice may be slightly different from that in the vignettes, and you should use what works from the suggested talking points to meet your students' needs.

Summarize: (Student Debrief)

The student debrief piece helps develop students' metacognition by helping them make connections between parts of the lesson, concepts, strategies, and tools on their own. The goal is for students to see and hear multiple perspectives from their classmates and mentally construct a multifaceted image of the concepts being learned. Through questions that help make these connections explicit, and dialogue that directly engages students in the Standards for Mathematical Practice, they articulate those observations so the lesson's objective becomes eminently clear to them.

Practice, Reflect, Apply: (Problem Set/Exit Ticket)

The Problem Set often includes fluency pertaining to the Concept Development, as well as conceptual and application word problems. The primary goal of the Problem Set is for students to apply the conceptual understandings learned during the lesson.

Exit Tickets are quick assessments that contain specific questions to provide a quick glimpse of the day's major learning. The purpose of the Exit Ticket is twofold: to teach students to grow accustomed to being individually accountable for the work they have done, and to provide you with valuable evidence of the efficacy of that day's work which is indispensable for planning purposes. This time provides an excellent opportunity to pull small groups of students that may need additional support.

Structure for Georgia Standards Lessons

The Georgia Standards tasks have been included in the units to provide students opportunities for rich, engaging, real-world mathematical experiences. These tasks allow students to develop conceptual understanding over time and may take more than one math lesson to complete. The extra time for these lessons has been allotted for in the units. When planning for a Georgia Task, it is suggested that you start by doing the mathematics the students will be engaging in before presenting it to the students.

Launch:

You may need to activate prior knowledge for some of the tasks that will be presented by showing images, letting students engage in partner talk about real-life situations, or using the suggested activity from the background knowledge component. Pose the task to the students making sure the task is understood. This does not mean that you explain *how* to do the problem, rather you ensure that students understand what the problem is about. You establish clear expectations as to whether students will work individually, in pairs, or in small groups. This includes making sure students know which representations and tools they might be using or if they will have a choice of materials.

Explore:

Students will engage in working on the task using a variety of strategies and tools. You may use the Essential Questions or Formative Assessment questions provided in the lesson as needed in order to understand and prompt student thinking.

Summarize:

Select student work for the class to analyze and discuss. Use partnerships and whole-class collaborative conversations to help students make sense of each others' work. The Formative Assessment questions may also be used during this time to facilitate the conversation.

Practice, Reflect, Apply:

At this time, provide students time to reflect and revise their work from the Explore after they have engaged in the conversation in the Summarize portion of the lesson. This time provides an excellent opportunity to pull small groups of students that may need additional support.

Common Core Approach to Assessment

Assessments provide ongoing opportunities for students to show their learning accomplishments in addition to offering students a pathway to monitor their progress, celebrate successes, examine mistakes, uncover misconceptions, and engage in self-reflection and analysis. A central goal of assessments is to make students aware of their strengths and weaknesses and to give them opportunities to try again, do better and, in doing so, enjoy the experience of seeing their hard work pay off as their skill and understanding increases. Furthermore, the data collected as a result of assessments represent invaluable tools in the hands of teachers and provides specific data about student understanding that can inform instructional decisions.

For each Topic in enVision 2.0 the following assessments are available:

In the Student Workbook:

- Topic Assessment
- Performance Assessment

Online Teacher's Edition:

- Additional topic assessment Black-line Master
- Additional performance assessment Black-line Master

Online Student Assessment

- Teacher can modify the number of items on an assessment
- Teacher can rearrange order of problems

All of the assessment items for enVision 2.0 are aligned to the types of problems students may encounter on state testing. We have found enVision 2.0 has an excessive amount of items suggested for each topic. To avoid over-assessing, we recommend that school sites work collaboratively in grade-level teams to determine how to best use all the assessment resources available to evaluate student understanding and reduce the amount of items assessed. The SDUSD math units have grouped related topics together within a unit. Sites may choose to only give an assessment at the end of each unit, consisting of items from multiple topics, rather than using multiple days to assess each topic individually.

Constructing Task: Trick Answers

In this task, students analyze a mock work sample to demonstrate and explain their understanding of the order of operations.

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

- SMP 2. Reason abstractly and quantitatively.
- SMP 3. Construct viable arguments and critique the reasoning of others.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.
- SMP 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.

COMMON MISCONCEPTIONS:

Students may think that all operations must be done in order from left to right. For example, students who are taught to follow PEMDAS may think that multiplication must be done before division. Use of scientific calculator to verify answers may help students to realize the importance of following the conventional order of operations

ESSENTIAL QUESTIONS

- Why is it important to follow an order of operations?
- How can I effectively critique the reasoning of others?

MATERIALS

- Trick Answer recording sheet
- Accessible manipulatives

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

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.

TASK:

Students will use the recording sheet to critique the answers on Sasha’s homework. They will share their thinking, and discuss why Sasha might have missed the answer.

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?
- How can you explain your math reasoning clearly to your peers and teachers?
- What strategies are you using to analyze the given problems?
- What cues are you using to recognize the correct order of operations?

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
 $10 + 7$
 $(2 \times 5) + 7$
 $[2 \times (30 \div 6)] + 7$
 $[2 \times (15 \times 2 \div 6)] + 7$
- Create or add real life situations to expressions with more than 1 operation.
- Create an expression from a real life situation involving more than one operation.

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:

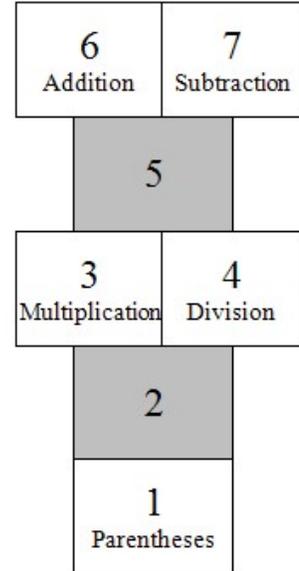
$$6 + 5 \times 10 - 4 \div 2$$

They can rewrite it like this:

$$6 + (5 \times 10) - (4 \div 2)$$

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-fourschallenge?parent_node = This link provides teachers with some additional, student centered lessons to develop the concept of order of operations.



Name _____

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. $6 + 2 \times 4 = 32$ _____

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. $3 \times (18 - 3) + (6 + 4) \div 2 = 50$ _____

Constructing Task: **Hogwarts House Cup**

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.

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.

STANDARDS FOR MATHEMATICAL PRACTICE

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

COMMON MISCONCEPTIONS:

There are many ways to show multiplication symbolically. Before doing this task, teachers should review multiplication symbols such as the one shown in problem 4 on the student worksheet.

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?

MATERIALS

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

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

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:

$$(10 \times 2) + (7 \times 5) =$$

$$10 * 2 + 7 * 5 =$$

$$10(2) + 7(5) =$$

$$10 \cdot 2 + 7 \cdot 5 =$$

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.

$$(10 \times 3) + (5 \times 4) = 50$$

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 evaluate 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.

Name _____ Date _____

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.



Georgia Department of Education
Common Core Georgia Performance Standards Framework
Fifth Grade Mathematics

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:

$$(10 \times 2) + (7 \times 5) =$$
$$10 * 2 + 7 * 5 =$$
$$10(2) + 7(5) = 10$$
$$\cdot 2 + 7 \cdot 5 =$$

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.

$$(10 \times 3) + (5 \times 4) = 50$$

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.

Practice Task: Hogwarts House Cup Part 2

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

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.

STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 2. Reason abstractly and quantitatively.
- SMP 3. Construct viable arguments and critique the reasoning of others.
- SMP 4. Model with mathematics.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.
- SMP 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.

COMMON MISCONCEPTIONS:

There are many ways to show multiplication symbolically. Before doing this task, teachers should review multiplication symbols such as the one shown in problem 4 on the student worksheet.

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 evaluate 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

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

Hogwarts House	Number of Students Tackling a Boggart	Number of Students Identifying Potions	Expression	Equation
<i>Example</i>	3	2	$(15 \times 3) + (20 \times 2)$	$(15 \times 3) + (20 \times 2) = 85$
Gryffindor	4	3		
Hufflepuff	2	4		
Ravenclaw	5	1		
Slytherin	3	3		

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Common Core Georgia Performance Standards Framework
Fifth Grade Mathematics

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.

Hogwarts House	Number of Students Correctly Using a Magic Spell	Number of Students Correctly Answering a Question	Expression	Equation
<i>Example</i>	1	1	$(5 \times 1) + (10 \times 1)$	$(5 \times 1) + (10 \times 1) = 15$
Gryffindor			$(5 \times 5) + (10 \times 2)$	
Hufflepuff	2	3		
Ravenclaw			$(5 \times 4) + (10 \times 1)$	
Slytherin	3	0		

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

Hogwarts House	Number of Students Late to Class	Number of Students Out of Bed at Midnight	Expression	Total Number of Points Lost
<i>Example</i>	3	2	$(10 \times 3) + (20 \times 2)$	70
Gryffindor	4	3		
Hufflepuff	2	2		
Ravenclaw	5	1		
Slytherin	6	3		

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: $85 + 15 - [(10 \times 3) + (20 \times 2)] = 30$

Gryffindor	
Hufflepuff	
Ravenclaw	
Slytherin	

FORMATIVE ASSESSMENT QUESTIONS

- What is the first step when evaluating 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?
- How are the expressions the same? Different?
- What remains the same between the different houses?
- What is different between the different houses?

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.



Name _____ Date _____

Hogwarts House Cup

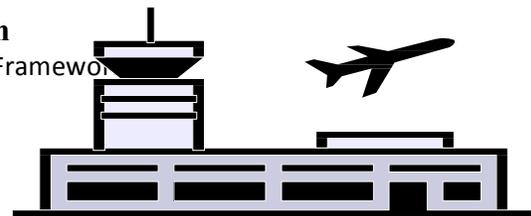
Year 2

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.

Hogwarts House	Number of Students Tackling a Boggart	Number of Students Identifying Potions	Expression	Equation
Example	3	2	$(15 \times 3) + (20 \times 2)$	$(15 \times 3) + (20 \times 2) = 85$
Gryffindor	4	3		
Hufflepuff	2	4		
Ravenclaw	5	1		
Slytherin	3	3		

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.

Hogwarts House	Number of Students Correctly Using a Magic Spell	Number of Students Correctly Answering a Question	Expression	Equation
Example	1	1	$(5 \times 1) + (10 \times 1)$	$(5 \times 1) + (10 \times 1) = 15$
Gryffindor			$(5 \times 5) + (10 \times 2)$	
Hufflepuff	2	3		
Ravenclaw			$(5 \times 4) + (10 \times 1)$	
Slytherin	3	0		



Practice Task: Air Traffic Controller

Adapted from “Paths-Activity 20.22” in Van de Walle’s *Elementary and Middle School Mathematics, Teaching Developmentally*

This task requires students to create travel paths for three airplanes attempting to land safely at the airport.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates.

Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

STANDARDS FOR MATHEMATICAL PRACTICE

SMP 1. Make sense of problems and persevere in solving them. SMP 2. Reason abstractly and quantitatively.

SMP 4. Model with mathematics.

SMP 5. Use appropriate tools strategically. SMP 6. Attend to precision.

SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students need to know the difference between vertical (y -axis) and horizontal (x -axis) lines and how locate and name points in the first quadrant of the coordinate plane.

COMMON MISCONCEPTIONS

- Students reverse the points when plotting them on a coordinate plane. They count up first on the y -axis and then count over on the x -axis. The location of every point in the plane has a specific place. Have students plot points where the numbers are reversed such as (4, 5) and (5, 4). Begin with students providing a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.
- When playing games with coordinates or looking at maps, students may think the order in

Common Core Georgia Performance Standards Framework
Fifth Grade Mathematics Unit 5

plotting a coordinate point is not important. Have students plot points so that the position of the coordinates is switched. For example, have students plot (3, 4) and (4, 3) and discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How can the coordinate system help you better understand other map systems?
- How do coordinate grids help you organize information?

MATERIALS

- “Air Traffic Controller” recording sheet
- Floor grid (could be created with tiles on the floor) or shower curtain grid
- One Person to be the air traffic controller
- Three people to be airplanes
- Colored pencils/markers

GROUPING

Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Comments: Identifying points on a coordinate grid is important in understanding how the coordinate system works and in constructing simple line graphs to display data or to plot points. These skills further help us to examine algebraic functions and relationships. The skills developed in this lesson can be applied cross-curricular to reading latitude and longitude on a map and to plotting data points.

TASK

Getting Started:

1. The Air Traffic Controller tells the planes where they need to go using coordinates on the grid.
2. Each plane enters the grid at the origin (0,0). This is where the Air Traffic Controller’s radar first picks up each plane’s signal. Once the Air Traffic Controller “sees” a plane, he or she must tell them where to go using coordinates.
3. The Air Traffic Controller is responsible for keeping the planes, pilots, and their passengers safe from collisions with other aircrafts.
4. The more planes there are in the sky, the more difficult it is to keep planes safe.
5. Each Air Traffic Controller has to keep track of each plane by doing the following:
 - a. Each plane’s name must be written on the recording sheet.
 - b. The coordinates for the path that each plane takes must be written down.
 - c. The Air Traffic Controller must draw a flight plan on the recording sheet for each plane. Each plane must go from point A (0,0) to the final destination or landing strip, point B (10,10).

- d. Submit both the coordinates and the flight plan to the FAA President (Your Teacher) at the end of this exercise.*
- 6. The job of Air Traffic Controller passes from one person to the next until all students have had the job. Once students have constructed their flight plan, the group may move to the floor grid or shower curtain grid to make sure all planes will land safely.*

Finishing Up:

Air Traffic Controllers:

Before you turn in your flight paths and coordinates, please be sure to complete the following:

- 1. Highlight or shade each plane's flight path a different color with a key at the bottom that shows which color represents each plane.*
- 2. Put your name on your papers.*
- 3. Turn them in to the FAA President.*

FORMATIVE ASSESSMENT QUESTIONS

- What is the coordinate for the horizontal (x-axis) and vertical (y-axis) axis?*
- Why do you need to plot your point where two lines intersect?*
- How do you graph and name a point on the coordinate plane?*
- Explain how you used an ordered pair to locate a point on the coordinate plane?*

DIFFERENTIATION

Extension

- This task can be extended by giving students an opportunity create flight plans for planes ahead of time. Once the students have their plans, they must enter the "radar map" one at a time, moving at a consistent pace. Planes take turns moving from one point to the next, following the flight plan. The students must follow their flight plan, and the "Air Traffic Controller" must facilitate this, should there be any confusion.*

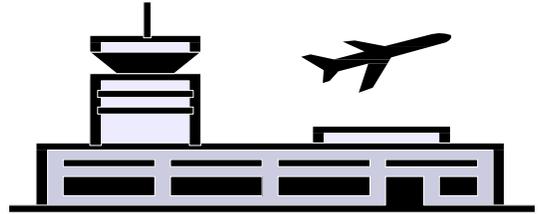
Intervention

- If students are still struggling with plotting points on the coordinate plane, there are two activities in Van de Walle's Elementary and Middle School Mathematics Teaching Developmentally: Activity 20.21 "Hidden Positions" and Activity 20.22 "Paths".*

Name _____ Date _____

Air Traffic Controller

Directions



Objective: To create flight plans to safely direct all planes from point A (0,0) to point B (10,10).

Directions

1. The Air Traffic Controller tells the planes where they need to go using coordinates on the grid.
2. Each plane enters the grid at the origin-point A (0,0). This is where the Air Traffic Controller's radar first picks up each plane's signal. Once the Air Traffic Controller "sees" a plane, he or she must tell them where to go using coordinates.
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Name _____

Air Traffic Controller

	<u>Name & Color</u>	<u>Coordinates</u>
Plane #1		
Plane #2		
Plane #3		

FlightPlan

