

# ALGEBRA: OPERATIONS AND EXPRESSIONS

## 8–9 ASSESSMENT

***How will I determine my students' needs, and how will I know which activities are appropriate for addressing those needs?***

Two tools are available to help you determine the needs of your students: Assessments and Teacher Inventories.

Assessments are provided for each grade band within a content strand, for example, there is a K-2 Number and Operation Assessment and a 3–5 Number and Operation Assessment. The Assessments for the 8–9 Linear and Non-Linear Relationships units are slightly different from those for the other grades, but the assessment for this 8-9 Unit is similar to those for other grades.

Assessments are designed to help you target your students' areas of conceptual strength and difficulty. Each question on the Assessment addresses one or more mathematical concepts and is correlated to one or more activities in the unit. Begin by using this Assessment, but have available the Assessments for grades 6–8 and the other 8–9 Assessments. If students quickly and easily answer all the questions on the Assessment, you may want to try one of the other 8–9 Assessments to see if there is a different Algebra unit in which students could use some work. If students have difficulty with a question on the Assessment, begin by simplifying the question, if possible. For example, if the question tells students to *use a calculator to find whole numbers that divide evenly into 156*, it could be simplified by asking students to do the same for the number 56, or, simpler still, 16. If your students struggle with most of the questions, move down a grade band level to one of the 6–8 Assessments.

When possible, seek the assistance of your students' classroom teachers in assessing the students' current needs. The Teacher Inventory, to be completed by each student's classroom teacher, provides another lens for determining a student's areas of difficulty. These Inventories contain a list of concepts associated with the mathematical strand; next to each concept is a place for the teacher to give information regarding the student's mastery of the concept. For your reference, a column in the Teacher Inventory lists the activities within the grade band where each concept is practiced.

Using the information you have gathered from the Assessment, and the Teacher Inventory (if available), create an informal mentoring plan for the upcoming weeks. Determine which activities you will use and approximately how much time you will allocate to each activity, but remember—be flexible!

## Algebra: Operations and Expressions 8–9 Assessment

The questions listed below are designed to help you assess your students' current needs. During the first mentoring session, spend some time working through the questions. After each question, determine whether students seems to have a good understanding of the concept or whether they would benefit from additional help. Based on your determination, circle *Yes* or *No* in the *Understands the Concept* column. Each question indicates one or more activities in the unit that can be used to explore and develop the mathematical concepts listed if you feel that the students have not yet mastered them. Keep in mind that even if students are successful with an Assessment question and seem to understand the concept involved they may still enjoy and benefit from the related activities, which were designed to give students a meaningful context in which to think about the various concepts.

For the activities below, you will need the following:

- Paper and pens or pencils
- Notecards

	Understands the Concept
<p>1. Write the following problems on a piece of paper for students to work through. (Do not write the answers, which are in brackets after each problem.) Ask students to explain how they figured out their answers to each problem.</p> <ul style="list-style-type: none"> <li>• <math>+4 \times +5</math> [<math>+20</math>]</li> <li>• <math>-4 \times +5</math> [<math>-20</math>]</li> <li>• <math>-4 \times -3</math> [<math>+12</math>]</li> <li>• <math>-12 + -2 \times +8</math> [<math>-28</math>]</li> <li>• <math>-11 + -2 \times -7</math> [<math>+3</math>]</li> <li>• <math>-5 + +3 \times +4</math> [<math>+7</math>]</li> <li>• <math>-6 + +4 \times -9</math> [<math>-42</math>]</li> </ul> <p>If students have success with the problems listed above, ask them to try to solve some more problems—this time involving decimals—and to explain their thinking as they work.</p> <ul style="list-style-type: none"> <li>• <math>-4.5 \times -2</math> [<math>+9</math>]</li> <li>• <math>+3.75 \times -3</math> [<math>-11.25</math>]</li> <li>• <math>+14.6 + -2 \times +0.3</math> [<math>+14</math>]</li> <li>• <math>-12 - -2 \times +3.5</math> [<math>-5</math>]</li> </ul> <p>Ask students to make up a problem to go with each of the following answers and to explain their thinking as they work.</p> <ul style="list-style-type: none"> <li>• <math>-10</math> [Example: <math>-2 \times +5</math>]</li> <li>• <math>-16</math> [Example: <math>-8 + -2 \times +4</math>]</li> <li>• <math>+5</math> [Example: <math>-7 - -2 \times +6</math>]</li> <li>• <math>+12</math> [Example: <math>-3 \times -4</math>]</li> <li>• <math>0</math> [Example: <math>+24 + -3 \times +8</math>]</li> </ul> <p>Mathematical concepts: Addition, subtraction, and multiplication of positive and negative integers; addition, subtraction, and multiplication of positive and negative decimal number; order of operations Concepts explored in Activities: 1, 2, and 3</p>	<p>Yes      No</p>
<p>2. Note that the following assessment item is the same as the first assessment</p>	

<p>item on the Linear Relationships assessment. The concepts assessed by this item are a prerequisite for the Linear Relationships unit; the assessment for the Linear Relationships unit is meant to assess whether students have the prerequisite skills to begin the unit. These same concepts are explored in this Operations and Expressions unit; this assessment is meant to assess the level of the students' comfort or their need for work in the different unit activities.</p> <p>Write each of the following pairs of expressions on a notecard. Do not include the answer, which is in brackets next to each pair of expressions. Show students one of the notecards and ask: <i>Are the two expressions equal to each other? If not, which expression is larger?</i> Have students check their answers by working out the answers to the expressions. Repeat this process with each of the notecards.</p> <p> <math>7 \times (3 + 4)</math>    or    <math>(7 \times 3) + 4</math>    [Left is larger]  <math>18 - 6 \div 2</math>    or    <math>(18 - 6) \div 2</math>    [Left is larger]  <math>3(5 + 8)</math>    or    <math>(3 \times 5) + (3 \times 8)</math>    [They are equal]  <math>5 + 15 - 6 + 3</math>    or    <math>3 - 6 + 15 + 5</math>    [They are equal]  <math>12 \div 4 \times 3</math>    or    <math>3 \times 12 \div 4</math>    [They are equal]  <math>3(8 - 5)</math>    or    <math>3 \times 8 - 5</math>    [Right is larger] </p> <p>Mathematical concepts: Order of operations; use of parentheses to determine order of operations; evaluating numeric expressions; commutative property of addition and multiplication; distributive property; addition, subtraction, multiplication, and division of positive and negative integers</p> <p>Concepts explored in activities 1 and 3</p>	<p>Yes      No</p>
<p>3. Show students the following list of pairs of expressions. Ask them to determine whether the two expressions in each pair are equivalent and to explain how they know. If the expressions are equivalent, students should show the steps that could be taken to get from one expression to the other.</p> <ul style="list-style-type: none"> <li>• <math>(n + 1)(n + 2)</math> and <math>n^2 + 3n + 2</math> [Equivalent]</li> <li>• <math>(n + 2)(n + 6)</math> and <math>n^2 + 4n + 12</math> [Not equivalent]</li> <li>• <math>(n + 3)^2</math> and <math>(n + 1)(n - 1) + 2(3n + 5)</math> [Equivalent]</li> <li>• <math>6n + 5</math> and <math>6(2n + 1) - 5(n + 1)</math> [Not equivalent]</li> <li>• <math>(n + 1)(n + 1)</math> and <math>(n + 1)(n - 1) + 2(n + 1)</math> [Equivalent]</li> <li>• <math>4n + 3</math> and <math>5(2n + 1) - 2(3n + 1)</math> [Equivalent]</li> </ul> <p>Mathematical concepts: Different expressions that describe the same mathematical patterns; the use of algebraic manipulation to write an expression in two or more equivalent forms; comparison of expressions to determine whether they are equivalent</p> <p>Concepts explored in activities 4 and 5</p>	
<p>4. Ask students to simplify as much as they can the following expressions. Have students explain the steps they take to simplify the expressions.</p> <ul style="list-style-type: none"> <li>• <math>(n + 6)(n + 2) - (n + 3)(n + 3)</math> [Simplifies to <math>2n + 3</math>]</li> <li>• <math>3[2(n + 5) - (n + 6)]</math> [Simplifies to <math>3(n + 4)</math> or <math>3n + 12</math>]</li> </ul>	

<p>Mathematical concepts: The use of simple algebraic operations to simplify and to complicate algebraic expressions Concepts explored in Activity 5</p>	
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Teacher Inventory: Algebra: Operations and Expressions (Grades 8–9)

<b>Concept</b>		<b>Teacher Rating</b> Has the student mastered the concept? (Circle Yes, No, or Unknown for each topic.)			<b>Grades 8–9</b> Activities Where the Concept Is Explored:
Numbers	Order of operations	Yes	No	Unknown	3
	Use of parentheses to determine order of operations	Yes	No	Unknown	3
	Addition, subtraction, multiplication, and division of positive and negative integers	Yes	No	Unknown	1
	Addition, subtraction, multiplication, and division of positive and negative decimal numbers	Yes	No	Unknown	2
Mathematical Thinking	Ability to follow a set of logical instructions	Yes	No	Unknown	1
	Use of a model to understand an arithmetical system	Yes	No	Unknown	2
	Ability to keep track of a bottom line over a series of transactions	Yes	No	Unknown	2
Manipulating Expressions	Different expressions that describe the same mathematical patterns	Yes	No	Unknown	4
	The use of algebraic manipulation to write an expression in two or more equivalent forms	Yes	No	Unknown	4
	Comparison of expressions to determine whether they are equivalent	Yes	No	Unknown	5
	The use of simple algebraic operations to simplify and to complicate algebraic expressions	Yes	No	Unknown	5

Additional comments:

## **Mentoring Plan**

Based on your assessment of your students' needs and the Teacher Inventory (if available), decide on which of the activities in the Algebra: Operations and Expressions unit you will spend the most time. Again, keep in mind that while students may have some comfort level with the concepts covered by this assessment, the activities could still be beneficial and enjoyable because they are structured to provide a conceptual framework and concrete models for these concepts.

- Activity 1: Robot Game
- Activity 2: Profit and Loss
- Activity 3: The Operations Game
- Activity 4: Equivalent Expressions
- Activity 5: Simplifying Expressions