**The Pattern and Relations Strand: Outcome P7.2**

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| **Outcome** | **Indicators** |
| P7.2 Demonstrate an understanding of equations and expressions by:   * distinguishing between equations and expressions * evaluating expressions * verifying solutions to equations.   [C, CN, ME]  *In support of the K-12 Mathematics goals of Number Sense, Logical Thinking, and Mathematical Attitude.* | 1. Explain what a variable is and how it is used in an expression. 2. Provide an example of an expression and an equation, and explain how they are similar and different. 3. Explain how to evaluate an expression and how that result is different from a solution to an equation. 4. Verify a possible solution to a linear equation using substitution and explain the result. |
| **Learning Space** [**Top**](#top) | |
| In grade 5, students begin solving equations, and start to develop an understanding of what an equation is and what the solution to an equation represents. In grade 7, they are focusing on linear equations. Deriving and solving linear equations involves the manipulation of variables and numbers, and understanding how to represent mathematical statements of equivalent expressions. It is important that the students also become familiar with expressions, their role in equations, and the evaluating of expressions.  At this point in their mathematical studies, it becomes very important that the students understand the difference between equations and expressions as well as how they are related. All too often, students treat expressions as equations, and also run into problems solving equations because they work with expressions within the equations separately.  Outcome P7.3, “Demonstrate an understanding of one- and two- step linear equations of the form  (where *a, b, c, and d are whole numbers, c < d* and) by modeling the solution of the equations concretely, pictorially, physically and symbolically and explaining the solution in terms of the preservation of equality”, addresses the very specific case of solving linear equations. Thus, it is a good idea to incorporate the learning of this outcome in with the learning of outcome P7.3. This can be done by using outcome P7.2 as the foundation, and then integrating in P7.3 into the students learning experiences when they start to explore the solving of equations.  Whether it is a conversation about how long they have been reading each night, their sport statistics, or the times or other measurement they gathered in a science experiment, it is important for the students to be regularly engaged in creating expressions and equations to represent and play with their daily experiences. The students should also be given lots of opportunities to write and work with both expressions and equations throughout their study of grade seven mathematics. | |

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| **W****hat Students Should…** [**Top**](#top) | | |
| **Know**   * The terms solve, evaluate, expression and equation. | **Understand**   * The differences between equations and expressions as well as their relationships. * The purposes of and differences between evaluating and solving. * The purposes of equations and expressions. * The purpose, role and meaning of a variable in both expressions and equations. * Verification of a solution to an equation involves evaluating two expressions and comparing their resulting values. | **Be Able to Do**   * Write expressions and equations as appropriate for given contexts and problems. * Evaluate an expression for a given value and explain the meaning of the result in terms of a context. * Solve problems involving expressions or equations. * Verify the solution to an equation by evaluating two expressions. |
| **K****ey Questions** [**Top**](#top) | | |
| * How are equations and expressions different? How are they related? * How are evaluating and solving two different mathematical processes? * How can you verify a solution? * What does the solution to an equation mean? * What does the value of an expression mean? * What is a variable? | | |
| **Suggestions for Assessment:** [**Top**](#top) | | |
| **Big Idea:**  Expressions and equations.  **Suggestions for assessment tasks:**   1. Give the students a set of expressions and equations and ask them to sort them into expressions and equations and then write an explanation of their reasoning. 2. Give students a set of possible solutions for the equations that they sorted and ask them to describe how they could determine which, if any, of the values are given for each of the equations. 3. Have students select one expression from the sorted expressions and give them a value to evaluate with the expression. Ask the students to explain why the result is not called a solution to an equation.   **What to look for:**   * See [Expressions and Equations Rubric](file:///C:\Users\kw426\AppData\Local\Temp\Expressions%20and%20Equations%20Rubric.doc). | | |

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| **Suggestions for Instruction:** [**Top**](#top) |
| **Big Idea:**  Expressions and equations.  **Suggestions for instructional activities**   1. To introduce the concept of a variable, tell the students you’ve been thinking about something about each of them that you don’t know. If might be their height, shoe size, birth date, a grandmother’s name… Introduce a variable to represent each of these pieces of data (e.g., h, s, b, g) and ask the students what they think the letters represent. Ask the students for a volunteer to provide the information related to each topic and write the information in the form of “h is \_\_\_\_”, “s is \_\_\_\_”, … Discuss with the students the word “is” and ask them how we represent “is” mathematically. Rewrite the statements using an equal sign in the place of “is”. 2. Once the data has been collected from one student tell the class you feel much better because now you know all their heights, shoe sizes, birthdates, grandmother’s name… Have the students discuss why this statement is false. Lead them through a discussion of how the values or ideas associated with the letters can vary, depending upon the context. Tell the students that when letters or symbols are used to represent that kind of variable quantity – an unknown quantity – they are called “variables” and that letter variables are used to represent any value that is not known or that could vary. Relate this to the use of squares, triangles, and circles and have the students discuss how letters might be more convenient to use. Have the students brainstorm examples of things in their lives that are not known yet (but they would like to know – try to encourage numerical examples) as well as examples of things in their lives that the value varies for. For each situation, have the students assign a variable to the unknown quantity. Finish by talking about the tendency in mathematics to use x, y and z most often as the variable, but that the selection of the letter used is generally a matter of choice. 3. Use concept attainment to help the students develop an understanding of the difference between expressions and equations. Provide examples and non-examples of expressions and equations, categorizing them into YES or NO where YES represents expressions. (YES could also represent equations if desired). As you introduce each new example or non-example of expressions, ask the students to personally reflect on what they think the characteristics need to be present for an item to be classified as a YES. In the examples and non-examples make sure to include variables in different positions, different types of numbers (whole numbers, different fractions, integers, decimals), and in the case of equations, the variable on either side of the equation or both sides. It should not take too many examples and non-examples when the students know that one characteristic is clearly the equal sign not being present. Thus, moving to the second stage where the students suggest where to place examples and non-examples will likely occur very quickly. Debrief the activity by having the students give the characteristics of the YES examples, and also have them note things that aren’t characteristics. Tell the students that what they have described is called an expression. Next, have the students give the characteristics common to the NO examples and also have them note anything that they know isn’t a characteristic for the NO examples. Tell the students that what they have described is called an equation. Have the students make a journal entry where they define expressions and equations. 4. Give the students an expression and a related equation (e.g., x - 5 and x - 5 = 2). Have the students recall what the x is called and what it represents. Ask the students if they think x will have the same value in both situations. Provide the students with a list of values for x, one of which is the solution to the equation, and ask them to comment on each as a value for x. Have the students discuss the difference between what they are seeing when substituting a value for a variable in an expression and a variable in an equation. Tell the students that in the expression they were doing what is called evaluating the expression for a specific variable value. Have the students discuss if evaluating is something that makes sense to do with an equation – it shouldn’t because in all but one case they would have an equality that wasn’t true. 5. Ask the students what they would do if they were given a variable value and asked to check if it was a solution to a given equation. Provide an example. Ask the students if it makes sense to substitute the value directly into the equation. Through the discussion, the students should come to the conclusion that when given a variable value for an equation they need to check if the equation is true, so they need to evaluate the two expressions that form the equation for that variable value, and if the results are equal then the value is a solution to the equation. The other option is to substitute the value into the equation but somehow indicate that the equality may not hold. 6. Have the students work in pairs and write about the following questions: how are expressions and equations different? How can you distinguish between expressions and equations? What is the difference between verifying and evaluating and how are the two terms related to expressions and equations. 7. Give the students a list of expressions and equations, each followed by a variable value (take advantage of the students’ learnings about adding and subtracting integers and fractions when selecting the variable values). Have the students identify whether they would use the value to “evaluate the expression” or “verify the equation” and have them carry out the appropriate action. 8. In small groups have the students brainstorm different situations then create problems involving either expressions or equations. Groups can exchange their problems and correct each other’s work. Discuss any interesting or puzzling problems that arise as well as clarifying any misunderstandings that emerge. |