**The Pattern and Relations Strand: Outcome P7.4**

[Learning Space](#ls) [What Students Should…](#wss) [Key Questions](#kq) [Assessment](#assessment) [Instruction](#instruction)

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| **Outcome** | **Indicators** | | |
| P7.4 Demonstrate an understanding of linear equations of the form  (where *a* and *b* are integers) by modeling problems as a linear equation and solving the problems concretely, pictorially, and symbolically.  [[C, CN, PS, R, V]  *In support of the K-12 Mathematics goals of Number Sense, Spatial Sense, Logical Thinking, and Mathematical Attitude.* | 1. Represent a problem with a linear equation of the form  where *a* and *b* are integers and solve the equation using concrete models (e.g., counters, integer tiles) and record the process symbolically. 2. Verify a solution to a problem involving a linear equation of the form  where *a* and *b* are integers. | | |
| **Learning Space** [**Top**](#top) | | | |
| This outcome is an extension of P7.3 “Demonstrate an understanding of one- and two- step linear equations of the form ” to include integers in the solving of linear equations. It is included to complement the students learning about the addition and subtraction of integers in [N7.6](file:///C:\Users\kw426\AppData\Local\Number%20Strand\Outcome%20Number%20N7_6.doc) “Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically”.  Contexts regarding movement, such as in physical education and arts education, as well as changes in the environment from science or changes in the social environment in social studies can be used to create problems to support the students learning of this outcome. | | | |
| **What Students Should…** [**Top**](#top) | | | |
| **Know**   * The terms equation and solution. | | **Understand**   * Solving equations involving integers is the same process as solving equations involving whole numbers. * Solutions to equations involving integers have the same meaning as solutions to equations involving whole numbers. * The purpose of verifying a solution to an equation involving integers. | **Be Able to Do**   * Model equations involving integers concretely and pictorially. * Use symbolic notation to represent the concrete or pictorial solving of equations involving integers. * Verify the solution to a problem involving an equation involving integers. * Explain the meaning of a solution to an equation given within a context. |

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| **Key Questions** [**Top**](#top) |
| * How does solving equations involving integers compare to solving equations involving whole numbers? * What does the solution to an equation involving integers tell you about the situation or context? * What is the purpose of verifying a solution to an equation? |
| **Suggestions for Assessment:** [**Top**](#top) |
| **Big Idea:**  Solving equations with integer constant terms and integer solutions.  **Suggestions for assessment tasks:**   1. Using the favourite problem situation that the students picked in the final suggested instructional activity, create a new problem for the students to solve. Have the students write and solve the equation, providing explanations for their steps and then verifying the solution. 2. Give the students an incorrect solution to an equation involving integers and ask them to check the solution and then find the error made and correct it. 3. Give the students an equation that has a negative integer solution, showing the solution process. Have the student verify the solution and then ask them to provide an example of where such a solution might occur.   **What to look for:**   * See [Solving Equations With Integer Constant Terms and Integer Solutions Rubric.](C:\\Users\\kw426\\AppData\\Local\\Temp\\Solving Equations Integer Constant Terms And  Solutions Rubric.doc) |
| **Suggestions for Instruction:** [**Top**](#top) |
| **Big Idea:**  Solving equations with integer constant terms and integer solutions.  **Suggestions for instructional activities**   1. Ask the students to brainstorm situations where problems related to those contexts might have a negative solution and what the solution would mean in relation to the situation. 2. Give the students a negative integer, say -3, and ask them to write an equation in the form of x + a = b where a and b are any integers that will give an equation whose solution is x = -3. Tell the students that they must be able to prove that their equation meets the conditions of the task. 3. Have the students share the equations that they came up with. If you notice that the students aren’t straying too far from the obvious (such as x + 7 = 4), try giving them one value for either a or b and ask them to find the remaining constant term (e.g., x + 2 = b or x + a = -1). Discuss with the students what role the a or b is now playing in the equation with the information that they are given (it is now a variable). 4. Have the students create concrete or pictorial models for some equations that involve integer constant terms or integer solutions and then use those models to solve the equations. Have the student verify their solutions. Also have the students record their process of solving the equations symbolically, relating the symbolic notation to their models. Eventually challenge student to solve some of the equations using symbolic manipulation only. Have the students write about their strategies when they are using integers and how those strategies compare to those they used when integers weren’t involved. The students should come to realize the symbolic solution strategies for equations involving integers involve the same processes and reasoning as equations that didn’t involve integers: application of inverse operations on additive inverses (note: multiplication and division is left out because students have not yet looked at multiplying and dividing integers), and the preservation of equality. Encourage the students to use these terms when describing their solution process to their partners, a group, the class, or in their journals. 5. Give the students a problem (with a negative answer) and ask them to write an equation to represent the problem and solve it. Ask the students to explain what the answer tells them. Have the students share their strategies for writing the equation to represent the problem. Watch for students who are relying on key words as they can often mislead the student’s interpretation of the signs to use in the equation. If this happens, have the students consider specific cases or ask them to describe what they would have to do with one value in the problem to get to the other. In these discussions it is important for the students to be thinking about the actual context and moving away from individual words or phrases. If they understand the problem in context, they can write an equation. 6. Give the students a mix of problems, some that involve integers in equations, and some that involve two-step equations involving whole numbers. Have the students solve the problems, verify their solutions and confirm their equations with a partner. 7. Give the students an equation that involves integers and ask them to create a problem that the equation would represent. Have the students share their problems with the class. Discus the similarities and differences in the problems they have created. Have the students pick their favourite problem situation from what is shared. |