**Prerequisite Skills:**

* Understand that a variable represents an unknown number/quantity.
* Understand integer arithmetic.

**Learning Goals:**

* Evaluate equations that are more than one step.
* Recognize that solving an equation is like maintaining a balanced scale.
* Utilize inverse operations to work backwards in order to identify an unknown value.

**Common Core Standards:**

7.EE.B. Expressions & Equations: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

**Mathematical Practices:**

MP1. Make sense of problems and persevere in solving them.

MP2. Reason abstractly and quantitatively.

MP5. Use appropriate tools strategically.

MP6. Attend to precision.

**Materials:**

* Phet *Equality Explorer* simulation:
* <https://phet.colorado.edu/sims/html/equality-explorer/latest/equality-explorer_en.html?screens=2,3,4> (link to Basics, Numbers, Variables, Operations screens)
* <https://phet.colorado.edu/sims/html/equality-explorer/latest/equality-explorer_en.html?screens=5> (link to Solve It! screen)
* Computers/Chromebooks/iPads/Tablets for each student or pair of students
* Solving Equations Activity Sheet (1 per student)

**Estimated Time:**

Approximately 80 minutes or two 40 minute classes

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| --- | --- |
| Balancing Act | |
| **Warm Up** | **5 minutes** |
| Use this problem to explore an informal situation implementing pouches and coins to get students starting to think algebraically:    Ask students to consider this picture. Then ask them to determine how many coins should be in each pouch and to explain their reasoning. | |

|  |  |
| --- | --- |
| **Simulation Introduction** | **5-10 minutes** |
| *Teacher will...* | *Students will...* |
| * Wait to distribute activity sheet until after students have had their 5-10 minutes of exploration * Encourage students to take a few minutes to explore the Equality Explorer simulation * Circulate the room and ask students about what they are working on or any interesting discoveries they made | * Explore the simulation however they choose * Respond to teacher’s informal questioning * Jot down three discoveries on the activity sheet |
| **Guided Exploration** | **30-40 minutes** |
| *Teacher will...* | *Students will...* |
| * Prior to allowing students to work through the activity sheet facilitate a discussion around interesting discoveries students made about the functionality of the sim. Make sure key components of the sim are discussed such as: snapshot tool, how to change the value of *x*, lock button, how to use the operators within the operations screen, creating zero pairs * Encourage students to begin working on #2-8 in pairs or individually. Try to give students at least 5 minutes where the teacher is silent before probing/aiding. * Circulate the room to be available for questions and ask probing/pushing questions. | * Complete #2-8 on the activity sheet. * Respond to teacher questions. * Ask questions or ask for help as needed. |
| **Discussion and Summary** | **10-15 minutes** |
| *Teacher will...* | *Students will...* |
| * Ask for student volunteers to share their solutions, processes, and reasoning to solving the equations from #7. * Model how to setup and record work. | * Answer questions and question answers: students should be able to determine if they agree/disagree with others’ claims and justify their own responses. * Some students may go to the board to share findings, then summarize and record main ideas. |
| **Informal Assessment** | **5-10 minutes** |
|  | *Students will...* |
| **Exit Ticket:**  On an index card, determine the value for *x* that will make each equation true. Additionally, include the mathematical steps taken to reach each solution:   |  |  | | --- | --- | | **Front of Index Card** | | |  |  | | **Back of Index Card** | | |  |  | | * Complete exit ticket |
| ***Going Forward...*** | |
| * Teachers can refer to the Equality Explorer sim to introduce solving equations with fractional coefficients, then asking how you get rid of a fractional coefficient? * While not possible in the Equality Explorer sim, teachers should discuss whether or not expressions like are the same as | |