

Journey of the Isolated Variable, Part 1

Solving Two-Step Equations

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Grade Level	7th Grade	**Time Frame**	1-2 class period(s)
Subject	Mathematics	**Duration**	80 minutes
Course	Algebra 1, Pre-Algebra		

Essential Question

How do I isolate a variable in a two-step equation?

Summary

This lesson introduces students to properties of real numbers, equality, and inverse operations for solving linear equations. The objective is for students to understand how to isolate a variable in two-step equations by applying properties of rational numbers. In the next lesson, students will advance to multi-step equations. This is the first of four lessons in the "Journey of the Isolated Variable" series.

Snapshot

Engage

Students explore algebraic properties through a card matching activity.

Explore

Students practice isolating the variable *x* using a weighted scale.

Explain

Students analyze their understanding through a foldable.

Extend

Students create more challenging equations using dice as a randomizer.

Evaluate

Students' new knowledge is evaluated through an Exit Ticket.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

AF201: Solve problems in one or two steps using whole numbers and using decimals in the context of money
AF301: Solve routine one-step arithmetic problems using positive rational numbers, such as single-step percent
AF302: Solve some routine two-step arithmetic problems
A 202: Solve equations in the form x + a = b, where a and b are whole numbers or decimals

Oklahoma Academic Standards Mathematics (7th Grade)

7.A.3.1: Write and solve problems leading to linear equations with one variable in the form px + q = r and p(x + q) = r, where p, q, and r are rational numbers.

Attachments

- Algebraic Properties Card Matching—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Algebraic Properties Card Matching—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Algebraic Properties Card Matching—Journey of the Isolated Variable, Part 1.docx
- Algebraic Properties Card Matching—Journey of the Isolated Variable, Part 1.pdf
- Exit Ticket—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Exit Ticket—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Exit Ticket—Journey of the Isolated Variable, Part 1.docx
- Exit Ticket—Journey of the Isolated Variable, Part 1.pdf
- Extend Activity—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Extend Activity—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Extend Activity—Journey of the Isolated Variable, Part 1.docx
- Extend Activity—Journey of the Isolated Variable, Part 1.pdf
- Extend Cards—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Extend Cards—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Extend Cards—Journey of the Isolated Variable, Part 1.docx
- Extend Cards—Journey of the Isolated Variable, Part 1.pdf
- Foldable—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Foldable—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Foldable—Journey of the Isolated Variable, Part 1.docx
- Foldable—Journey of the Isolated Variable, Part 1.pdf
- Lesson Slides—Journey of the Isolated Variable, Part 1 .pptx
- Practice—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Practice—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Practice—Journey of the Isolated Variable, Part 1.docx
- Practice—Journey of the Isolated Variable, Part 1.pdf
- Weighted Scale Activity—Journey of the Isolated Variable, Part 1 - Spanish.docx
- Weighted Scale Activity—Journey of the Isolated Variable, Part 1 - Spanish.pdf
- Weighted Scale Activity—Journey of the Isolated Variable, Part 1.docx
- Weighted Scale Activity—Journey of the Isolated Variable, Part 1.pdf
- Weighted Scale and Variable Cards—Journey of the Isolated Variable, Part 1.docx
- Weighted Scale and Variable Cards—Journey of the Isolated Variable, Part 1.pdf

Materials

- Lesson Slides—Journey of the Isolated Variable, Part 1 (attached)
- Algebraic Properties Card Matching (attached; one per group)
- Weighted Scale and Variable Cards (attached; one per group)

- Weighted Scale Activity (attached; one per group)
- Foldable (attached; one per student)
- Extend Activity (attached; one per group)
- Practice (attached; one per student)
- Exit Ticket (attached; half-sheet per student)
- Extend Cards (optional)
- Polyhedral dice (three per group, one of a different color)
- Paper, Pencils, Scissors, Glue Stick
- Student devices with internet access (optional)

15 minutes

Engage

Teacher's Note: Preparation

Before beginning the lesson, print and prepare the **Algebraic Properties Card Matching Activity** by cutting out and shuffling the cards for each group. Consider arranging students in pairs or small groups to maximize discussion and engagement.

Introduce the lesson using the attached **Lesson Slides**. Display **slide 3** to share the lesson's essential question: *How do I isolate a variable in a two-step equation?* Then, display **slide 4** to review the lesson's learning objective. Adjust your presentation of these slides based on student familiarity.

Move to **slide 5**. Have students analyze their understanding of algebraic properties through the Card Matching strategy. Group students in pairs or trios and provide each group with a set of cut-out cards from the Algebraic Properties Card Matching Activity. The cards include three categories: terms, definitions, and examples. Ask students to match each term with its correct definition and example, encouraging discussion on why each match is correct based on their prior knowledge.

After groups have discussed and completed their matches, invite each group to share their answers with another group. As a class, review each property to clarify definitions and address any misunderstandings by revealing the correct answers. Reinforce the importance of these definitions as foundational to solving equations.

Optional Technology Integration

To conduct this activity digitally, use the linked Desmos Classroom activity. Follow these steps to set up:

Select the "Journey of the Isolated Variable, Part 1" activity link and log in. Under "Activity Sessions," choose "Assign" > "Single Session Code." After customizing settings, select "Create Invitation Code" and share the session code with students. Information about previewing and assigning a Desmos Classroom activity.

Students can go to student.amplify.com/join/ and enter the session code. Note that students do not need to sign in unless they plan to resume the activity later.

More detailed information about Desmos features and how-to tips.

Card Matches

The correct matches for the card matching activity are provided in the **Algebraic Properties Card Matching handout**.

20 minutes

Explore

Teacher's Note: Preparation

For this activity, students will work in pairs. Print the attached **Weighted Scale and Variable Cards**. Cut out the variable cards on the second page and place them in bags for each pair. Be mindful of the number of variable cards each activity requires. For example, if the equation is $x + 5 = -7$, students will need one positive variable card, five positive number cards, and seven negative number cards.

Display **slide 6**. Begin with a discussion on what the different variables mean without yet explaining how to solve the equation. Show students the weighted scale, variable pieces, and the equation displayed at the base of the scale. Explain the function of each symbol, emphasizing that the squares represent variables (positive and negative), while circles represent numbers (positive and negative).

Teacher's Note: Exploration

As a class, talk about what the different variables mean, but don't show students how to solve the equation using the weighted scale activity just yet.

Allow students to explore the materials and familiarize themselves with the symbols and instructions before attempting to solve the equation. Arrange students in pairs, using their original pairings or assigning new ones, depending on class needs.

Distribute the **Weighted Scale Activity** handout along with the first page of the Weighted Scale and Variable Cards and the bagged variable cards. One partner will manipulate the scale and cards, while the other will draw the process on the handout.

After each partner solves the first problem, they should verify their answers. Have partners discuss their processes, then switch roles. Each student will complete problems using both the cards and handout by the end of the activity.

Optional Technology Integration

If you would like an option to complete the Weighted Scale Activity digitally, Desmos Classroom has Polypad for virtual manipulatives. Polypad tutorials and Using the Balance Scale.

25 minutes

Explain

Display **slide 7** and pose the question: *How do you isolate a variable?* Use the Think-Pair-Share strategy to facilitate class discussion on solving equations using the weighted scale. Address any misconceptions and reintroduce academic vocabulary discussed in the Engage section to help students build a conceptual understanding of equation-solving.

Teacher's Note: Preparation

Once the discussions come to a close, introduce the **Foldable** handout and guide students in its assembly. Depending on time, you may lead students through the assembly or prepare the foldables in advance. Students will need scissors and glue to complete this task.

To assemble the foldable, cut each of the three “layer” strips, then glue or staple them in order, ensuring that the solving equations layer, “Yes,” and “No” are visible. Cut the dotted lines between rows to complete the foldable.

After assembling, display **slide 8**. Use the provided example and foldable steps to demonstrate solving an equation. The first example will allow students to answer "no" to the first step.

Proceed to **slide 9**. As students gain familiarity with the foldable, introduce more challenging problems requiring "yes" responses for each step, such as the example on this slide. Adjust problems to best meet student needs.

10 minutes

Extend

Teacher's Note: Preparation

Before beginning, print the **Extend Activity** handout for each pair. If you want students to solve the problems sequentially, use the handout as is. Alternatively, cut the handout in half to randomize the equations.

Optional Technology Integration

Students are to use the dice to generate coefficients and constants for their equation. If you prefer that students use a digital version, you can use the CPM Probability Generators and select the dice or the random number generator. If you recommend the random number generator, be sure to let the students know what maximum value to use.

Instruct pairs to work togetherbut make sure each partner has their own copy of the attached **Practice** handout to work on. Each pair also receives a copy of the Extend Activity handout. If printing the handout is not preferred, students may use blank paper.

Provide each pair with three polyhedral dice—two of the same color and one of a different color to represent a negative number. Have "Student A" roll first to generate an equation.

Display **slide 10** and outline the following steps:

1. Roll a die and place the number in the first equation slot.
2. Roll a second die and place the number in the second slot.
3. Roll the final die and place the number in the third slot.

Both students should write the equation on their Practice handout under the "Student A" column. Have pairs work together to solve for x, alternating roles after each round. Encourage students to complete 10 rounds.

Optional Activity: Extended Equation Manipulation

For advanced students, offer an extension activity using the **Extend Cards**. Have them create more complex equations by adding additional variables or symbols, such as $5x - 2 + 7x = 10$ or $4x + 3 = 7 - 6x$. Although multi-step equation solving is covered in Journey of the Isolated Variable, Part 2, some students may enjoy this additional challenge.

10 minutes

Evaluate

Display **slide 11**. Have students complete an Exit Ticket to close this lesson. Provide each student with a half-sheet from the attached **Exit Ticket** handout and have them respond to the following prompt: *Create two different equations that will give you a solution of x = -7*.

Encourage students to be creative when writing their equations instead of picking easy equations just to get the assignment finished. Once they pick their equations, have them justify their answers by solving the problems and describing their steps. This quick assessment will give you a good indication that students are understanding the concept if they can create their own problem, solve it, and give an explanation of the process.

Resources

- *Getting Started*. (n.d.). Polypad. https://polypad.amplify.com/help
- K20 Center. (n.d.). Bell Ringers and Exit Tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Card Matching. Strategies. https://learn.k20center.ou.edu/strategy/1837
- K20 Center. (n.d.). CPM Probability Generators. Tech Tools. https://learn.k20center.ou.edu/tech-tool/2317
- K20 Center. (n.d.). Desmos Classroom. Tech Tools. https://learn.k20center.ou.edu/tech-tool/1081
- K20 Center. (n.d.). Journey of the Isolated Variable, Part 2. 5E Lessons. https://learn.k20center.ou.edu/lesson/1255
- K20 Center. (n.d.). Think-Pair-Share. Strategies. https://learn.k20center.ou.edu/strategy/139
- Mathigon. "Using the Balance Scale - Polypad Pointers." *YouTube*, 20 Feb. 2023, www.youtube.com/watch?v=1pz-jB0ayFM.
- Stokes, A. (n.d.). Journey of the Isolated Variable, Part 1 [Interactive activity]. Desmos Classroom. *https://teacher.desmos.com/activitybuilder/custom/5ec289300ddf040f35680d93*