

## Algebra and Algebraic Manipulation - Remedial Lesson 3

**Grade:** Applicable Knowledge and Skills to All High School Math Courses

**Subject:** Remedial Math

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**Driving Question:** Why are the numbers zero and one so important to algebraic manipulation? How can I use them to isolate variables?

**Purpose:** An exceptional amount of difficulty in high school mathematics is due to inadequate algebraic manipulation skills. The amount of students that have difficulty solving a simple linear equation is staggering. The purpose of this Algebra Mini Series is to address these gaps in skills and hopefully increase student achievement by allowing them to focus on the curriculum without getting caught up in prerequisite skills.

In this particular lesson, more of an emphasis is made towards understanding how zero can help us to 'undo' addition or subtraction, and how one can 'undo' multiplication or division. This lesson does not focus on solving equations, but merely how we can 'undo' specific operations within an equation to isolate a variable.

**Prior Knowledge:** Students should be aware of the natural, whole, integer, and rational number systems, as well as basic arithmetic operations with these systems. Basic number sense is also assumed. The students should have a very firm grasp of the order of operations.

Ideally the students would have also studied the previous lessons or have a strong concept of what algebra is and understand what is meant by evaluation. Student would also benefit from understanding collecting like terms and understanding that multiplying by a reciprocal is equivalent to dividing.

**Screencast Link(s):**

**The Importance of Zero** - [https://www.youtube.com/watch?v=xw-c\\_r4pzGI](https://www.youtube.com/watch?v=xw-c_r4pzGI)

**The Importance of One** - <https://www.youtube.com/watch?v=wX2FFxBtKvA>

**Expected Time:** The design of this lesson is to be an individualized system of instruction, thus time would depend directly on the students' progress. If attempting as an entire class the lesson would likely take one 75-minute period (this includes assessment tasks).

**Resources:**  
(Tools &  
Tech)

**Lesson Procedure**

<p>Internet Access</p>	<p>Due to the nature of the lesson, the educator’s role becomes addressing issues after the student has had time to work through the lesson. The Resource in that sense is a truly flipped lesson, but the resources within could easily be used within a blended model.</p> <p>I do: Assess the student’s current skills with basic algebraic concepts and operations and if required, direct the to the student instruction form.</p> <p><a href="#">Student Instruction Form:</a></p> <p>If possible, find some time to go over the students assessments and show them how their difficulties with basic algebra is directly impacting the achievement of their outcomes. You should be prepared for this to be the majority of errors. It may be helpful to target particular operations (for example undoing addition and subtraction, etc.).</p> <p>You may ask students to point out areas where they believe algebraic manipulation have cost them the opportunity to demonstrate the outcome. Again, this is likely to be a high percentage of errors, and thus most students could benefit from such work. This provides the students and opportunities to find, analyze, and evaluate their skills with guidance.</p> <p><input type="checkbox"/> <b>find, validate</b> - <i>Let the students find areas on assessments that were difficult due to algebraic manipulation</i></p> <p><input type="checkbox"/> <b>critically think and analyze</b> - <i>Look at what skills in particular would’ve benefited your ability to demonstrate understanding</i></p> <p><input type="checkbox"/> <b>collaborate and communicate</b> - <i>The teacher should direct the student to the remedial lesson and then both should trouble shoot any difficulties, technology or otherwise, the student might have in completing the lesson</i></p> <p><b>You do:</b> The students should began by watching the screencasts listed above.</p> <p>The first video focuses on the idea that creating zero can help us to isolate a variable that is being affected by addition or subtraction. Because zero has the properties of an additive identity, it is incredible valuable to solving equations.</p> <p>The second video focuses on the idea that creating one can help us to isolate a variable that is affected by multiplication or division. Because one has the properties of a multiplicative identity, it is incredibly valuable in solving equations.</p>
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It should be noted that in these examples, there are no multi-step equations addressed. The goal of this lesson is just to focus on individual properties before combining them to solve more complex problems.

Now the student needs time to assess their understanding. The following links will take the student to a variety of web resources directed at one step equations. The activities that have been selected should provide the necessary formative feedback and practice for the student to master the skills and knowledge.

On the Khan academy resource, the students are provided a series of questions. They are encouraged to try and get 5 in a row correct (reflecting understanding and possibly mastery). The students are provided a scratch pad option to write on, a hint button that provides help, and easy access to additional videos/examples to assist.

The students should attempt the activities until they feel they've reached a level of mastery...and then do a few more to be sure. The following screen shots and links show where to find the selected activities.

**Algebra Lab – Solving One Step Equations:**

[http://www.algebralab.org/lessons/lesson.aspx?file=Algebra\\_OneVariableOneStep.xml](http://www.algebralab.org/lessons/lesson.aspx?file=Algebra_OneVariableOneStep.xml)

**Hot Math – solving One Step Equations with Multiplication or Division:**

[http://hotmath.com/help/gt/genericalg1/section\\_1\\_2.html](http://hotmath.com/help/gt/genericalg1/section_1_2.html)

**Khan Academy – Solving One Step Equations with Addition and**

**Subtraction:** [https://www.khanacademy.org/math/algebra-basics/core-algebra-linear-equations-inequalities/core-algebra-solving-basic-equations/e/one\\_step\\_equations](https://www.khanacademy.org/math/algebra-basics/core-algebra-linear-equations-inequalities/core-algebra-solving-basic-equations/e/one_step_equations)

**Khan Academy – Solving One Step Equations with Multiplication and**

**Division:** [https://www.khanacademy.org/math/algebra-basics/core-algebra-linear-equations-inequalities/core-algebra-solving-basic-equations/e/linear\\_equations\\_1](https://www.khanacademy.org/math/algebra-basics/core-algebra-linear-equations-inequalities/core-algebra-solving-basic-equations/e/linear_equations_1)

**remember, understand, evaluate and leverage** - the students are being asked to connect the knowledge and skills remembered from the screencasts to understanding the tasks in the activities. In solving the tasks of the activities, the students are leveraging the remembered knowledge to meet the goal. If they need additional support from the provided examples or supplementary videos, they must evaluate the information being presented before leveraging it.

**collaborate** – the apps could easily be done in groups or with parents. The possibilities for collaboration exist. The 'challenge' idea mentioned above



could easily be done in groups.

***We do:***

On the student instruction form, there is a section where the student must submit up to five questions the student still has concerning the topic. The student should submit these to the teacher and when possible (extra help, during a work period, etc.) the teacher should address these.

After this the student should complete a small creative piece demonstrating their understanding of the content. This piece should be something that can be shared either physically or electronically. The goal of the piece is for the student to step in the role of the educator and create something that they feel would help others who struggled as they did.

If the student has completed a task like this from a previous lesson, they should be encouraged to choose a different method of presentation from there last OR combine multiple pieces into one larger resource.

Some suggestions for creative pieces:

ScreenCast                      Show Me Composition                      Weebly or Blog Site  
PowerPoint / Prezi                      Poster                      NearPod Lesson                      A song/Poem

**critically think, analyze, synthesize** - the students need to critically analyze their understanding and skill to synthesize questions they still have.

**create** - the students need to create a piece that demonstrates their understanding and can be used as a teaching tool for others.

**communicate** - the piece that they develop has to communicate clearly their understanding and be accessible by those who would struggle with the topic also.

***We share:***

***The student should then meet with the teacher to receive feedback on it. If the piece is satisfactory, and if the student is comfortable, they should find a forum to share their piece. This could be accessible online or displayed in the classroom.***

**collaborate, communicate** – the student should be able to communicate to all audiences what they have learned and how to apply the skills and knowledge.

**publish** – together, the teacher and student should find a way to publish the work if the student is comfortable.

**citizenship** – through sharing their work, the student is contributing to their classroom and other’s education.

**WRAP UP/REMINDERS:**

With respect to the creative piece developed by the student, the nature of this piece could easily be adapted. For example, the student may choose to demonstrate their knowledge of evaluation, and then extrapolate this showing applications to word problems or general cases in the curriculum. In this way the student is linking the remedial knowledge directly to applicable outcomes within your specified course.

**Evaluation:** Ideally, the teacher should see a reduction in the amount of algebraic manipulation related errors that the student commits while attempting to demonstrate outcomes requiring this prerequisite knowledge.

**Evaluation:**

Alternatives: If students are not keen on the idea of video education or would benefit from a more text based approach, the following sites are recommended for their simplicity and content.

Solving One Step Equations – Shmoop: <http://www.shmoop.com/basic-algebra/solving-one-step-equations.html>

Prerequisite Resources: Within this algebra series of lessons, a mastery of the order of operations is exceptionally important. The following link provides some refresher on this topic:

<https://www.khanacademy.org/math/pre-algebra/order-of-operations/order-of-operations/v/introduction-to-order-of-operations>