Sample Mathematics Learning Plan

Big Idea(s)/ Topic(s)

- Interpret relationships between quantities.
- Understand that “equivalent equations” are equations that have exactly the same solutions, and that multiple equivalent equations can represent the same relationship.
- Determine and explain whether two equations are equivalent.
- Identify operations that can be performed on an equation to create equivalent equations.

Standard(s) Alignment

MGSE9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context

MGSE9-12.A.SSE.2 Use the structure of an expression to rewrite it in different equivalent forms.

MGSE9-12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Diagnostic Assessment

When completing the diagnostic assessment task found at the link below, students will translate verbal expressions and area models into algebraic expressions.

Coordinate Algebra and Algebra I Diagnostic Exemplar Tasks

This assessment task can be used to diagnose students’ level of understanding of the big ideas and standards addressed in this learning plan.

Instructional Design

Many of these activities have been adapted from an Illustrative Mathematics lesson titled, "Equivalent Equations". Found here: https://curriculum.illustrativemathematics.org/HS/teachers/1/2/6/preparation.html

Engage

- **Synchronous** : Presented like a Number Talk, write an equation on the board and have students think of an equivalent equation. They should be encouraged to remain quiet and think of multiple equivalent equations so that all students have time to think about their responses. Example: 6x + 9 = 12. Responses might include: 2x + 3 = 4, 3x + 4.5 = 6, etc. After a few minutes, the teacher can record their responses and allow students to self-correct, listen to each other, and share strategies for finding equivalent equations. Extension: Ask students how they might represent the equation without using any numbers (i.e. pictorial representation). How do you know these equations are equivalent?
- **Asynchronous**

  Using a tool such as Flipgrid, present an equation to the students and instruct them to respond with an equivalent equation. They should then respond to a classmate with questions about their strategy, comments about how their equations are similar or different, an explanation of how their equations are equivalent, etc.
- **Unplugged/ Offline**

  Consider having students keep a journal for daily math entries. The prompt for this day could be: Given the following equation, write as many equivalent equations as you can. How do you know when two equations are equivalent? How do you know when two equations are NOT equivalent? Support your response with at least three examples.

Explore

- **Synchronous** – Seesaw 3-Act task by Graham Fletcher. Click here to read more about 3-Act tasks as a strategy for engaging students in more conceptual learning of mathematics.
- **Asynchronous** – The Seesaw 3-Act task has been reworked into an online Desmos activity, click here.
- **Unplugged/ Offline** -- The Seesaw 3-Act task has been adapted into an offline activity. Students can complete the activity like a worksheet. It would be great to encourage dialogue between the different questions, to whatever degree you have the ability to facilitate with your students.

The idea of a seesaw can be used throughout ongoing discussions about equivalent expressions. If two expressions are *equal*, they "weigh" the same on either side, and therefore, the seesaw is balanced.

Hands-On Card Sort Activity

Card sort activity, click HERE.

- **Synchronous** – Provide students the materials to complete this card sort activity in class. Students cut out the expressions and glue them to create a booklet of equivalent equations.
- **Asynchronous** - Students take a screenshot of the expressions and paste them to a new page to create a booklet of equivalent equations using a program such as Book Creator to create a digital page in a class equivalent equations booklet. Each student contributes a page of posts to the digital book with at least three equivalent equation pairs.
- **Unplugged/ Offline** – Provide students the materials to complete this activity at home. Students cut out the expressions and glue them to create a booklet of equivalent equations

Apply

Contextual Application Problem (Illustrative Mathematics – Mixing Candies)

A candy shop sells a box of chocolates for $30. It has $29 worth of chocolates plus $1 for the box. The box includes two kinds of candy: caramels and truffles. Carlita knows how much the different types of candies cost per pound and how many pounds are in a box. She said,

If x is the number of pounds of caramels included in the box and y is the number of pounds of truffles in the box, then I can write the following equations based on what I know about one of these boxes:

- $x + y = 3$
- $8x + 12y + 1 = 30$

Assuming Carlita used the information given and her other knowledge of the candies, use her equations to answer the following:

a. How many pounds of candy are in the box?

b. What is the price per pound of the caramels?

c. What does the term 12y in the second equation represent?

d. What does 8x+12y+1 in the second equation represent?

Reflect

Students will create a Frayer Model graphic organizer to describe what they know about Equivalent Equations.

- **Synchronous** Think-pair-share. First, students work independently to *think* about what they know and complete the Frayer Model. Next, students pair up and share their models with each other. Finally, students engage in a large group discussion to discuss their models. If you're working synchronously *online*, you might explore your ability to have breakout rooms to allow students to work in groups.

- **Asynchronous** Virtual Think-Pair-Share. First, students work independently to *think* about what they know and complete the Frayer Model. If you're able to group your students, you might consider having them work together to complete the Frayer on a program such as Padlet creating a class Frayer Model. The teacher would set up the Padlet like a Frayer Model and assign students to a quadrant to contribute to the class Frayer Model.
- **Unplugged/ Offline** Provide students a blank template of a Frayer Model and instruct them to complete it with information about Equivalent Equations.

Evidence of Student Success

Three formative assessments are suggested for during the learning process. The first occurs during the Engage portion of the lesson which provides insight on students' understandings and misunderstandings. The second formative assessment occurs during the Apply portion of the lesson whether conducted synchronously or asynchronously. The final formative assessment should be collected to inform future instruction.

To summatively assess students' understanding, consider a performance-based assessment such as the example below adapted from PBL Learning Media.

Choose a favorite recipe and rewrite it to change the number of servings it makes. For example, you could double the recipe or cut it in half. Be sure to use the correct measurement units. Share your revised receipt with someone to see if the reader understands the directions. Prove that your recipe is correct using mathematics to show how it is equivalent to the original receipt.

Student Learning Supports and Support Class Suggestions

At all grades, the mathematics big ideas encourage students to reason mathematically, to evaluate mathematical arguments both formally and informally, to use the language of mathematics to communicate ideas and information precisely, and to make connections among mathematical topics and to other disciplines. The following strategies are intended to support students who are struggling to progress towards this goal:

- ***Conceptual Processing:*** Utilize the Concrete-Representational-Abstract instructional sequence to support students in making connections among mathematical ideas, facts and skills, and reflecting upon and refining one's own understanding of relationships, generalizations and connections.
- ***Language:*** Strategically select language routines to support students in describing strategies, explaining their reasoning, justifying solutions and making persuasive arguments.

- ***Visual-Spatial Processing:*** Provide opportunities for students to engage with visual representations and manipulatives (virtual or concrete) as they solve problems, explore concepts and communicate ideas.
- ***Organization:*** Teach problem-solving strategies and problem types, as seen in the Mathematics Glossary: K – 12, in order to support students in figuring out how to get started, carrying out a meaningful sequence of steps while solving problems, keeping track of the information from prior steps, monitoring their own progress and adjusting strategies accordingly.
- ***Memory:*** Focus on conceptual strategies and patterns for computation, providing a scaffold for students who struggle with basic facts and carrying out written algorithms.

Sample activities for Support classes:

Reinforcing the concept that equations are like balanced seesaws, students may benefit from additional practice *solving equations*. Math is Fun has a nice review, Solving Equations, that is easy for students to read. At the bottom of the page are ten practice problems.

In this lesson from PBS Learning, students apply mathematical reasoning, critical thinking, and problem-solving techniques to work-related problems. Great use of unit conversions throughout this lesson!

Here the activity has been adapted into an offline activity that students can complete synchronously or asynchronously.

Discussion questions to pose throughout the activity:

- The people in the "Conversions and Benchmarks" video segment talk about conversions that they have memorized. Discuss any benchmark conversions that you already know.
- After viewing "Conversions and Benchmarks," discuss strategies for memorizing some common conversions. Talk about how memorizing these conversions could be useful in a variety of workplaces.
- After viewing "Interest," discuss the concept of compound interest.
- The "Interest" video segment shows people calculating discounts of items. Look at discounted rates that you have seen recently in magazines or commercials, at stores, or online. Calculate the actual value of those discounts, and discuss the results.

Desmos Activity: Equivalent Expressions

Students sort cards to strengthen their understanding of equivalent expressions. In particular, this activity uses visual representations of algebraic expressions to help students see that expressions are equivalent when they correctly count the same thing.

Desmos Activity: Expression Mashup

In this activity, students sort cards to strengthen their understanding of multiple representations, including: algebraic expression, verbal description, table of values, and algebra-tile model. After the

card sort, students discuss whether a given student has sorted two pairs of cards correctly, and in the process consider equivalence and commutativity.

Algebra Tiles, virtual manipulatives. Students can practice solving, substituting, expanding, and factoring equations.

Below are examples of activities that could be used to further engage and support students during the learning process:

- Algebra Tiles, virtual manipulatives. Students can practice solving, substituting, expanding, and factoring equations.
- 2-minute video on equivalent expressions and the distributive property. Could be used to engage in discussion at any point during the lesson.
- Optional Engagement activity (would make a good warm-up type activity), "Would You Rather?"

Engaging Families

Students may find it helpful to review the concepts of solving equations alongside their parents, siblings, or friends at home. Math is Fun has a nice review, with practice problems at the bottom of the page. Here's a nice video review.

Algebra Tiles, virtual manipulatives. With this resource, students can practice solving, substituting, expanding, and factoring equations.

There are several great tutorials for creating homemade balances. Balances can reinforce the concept of equations because when both sides are equal you can actually see that the balance is level.

- DIY Weigh Station video tutorial
- How to Make a Simple [balance] Scale for Kids

Algebra Balance Scales (online): With this online resource, students can solve simple linear equations through the use of a virtual balance beam.

If families really want to take it to the next level, they could work together to build their own seesaw! Here's a video tutorial.