**M2C3 Math Modeling Lesson Overview**

**LESSON TITLE: GIRL SCOUT COOKIES**

**STANDARDS ALIGNMENT:**

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| **GRADE 3** | **GRADE 4** | **GRADE 5** |
| **3.NF.A.1** Understand a fraction (1/*b*) as the quantity formed by one part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by *a* parts of size 1/*b*  **3.NF.A.2** Understand a fraction 1/*b* as a special type of fraction that can be referred to as a unit fraction (e.g. 1/2, 1/4). | **4.NF.B.3** Understand a fraction *a/b* with *a* > 1 as a sum of unit fractions (1/*b*). a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.  **4.NF.B.3, 4.NF.B.4** Build fractions from unit fractions. Use this understanding to multiply a whole number by a fraction (n x a/b). Solve word problems involving multiplication of a whole number by a fraction. | **5.NF.A.2** Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators by using a variety of representations, equations, and visual models to represent the problem.  **5.NF.B.4** Apply and extend previous understandings of multiplication to multiply a fraction by a whole number and a fraction by a fraction. |
| **MP: 1**  Make sense of problem and persevere in solving them.  **MP: 2** Reason abstractly and quantitatively.  **MP: 3** Construct a viable argument and critique the reasoning of others.  **MP: 4**  Model with mathematics. | **MP: 1**  Make sense of problem and persevere in solving them.  **MP: 2** Reason abstractly and quantitatively.  **MP: 3** Construct a viable argument and critique the reasoning of others.  **MP: 4**  Model with mathematics. | **MP: 1**  Make sense of problem and persevere in solving them.  **MP: 2** Reason abstractly and quantitatively.  **MP: 3** Construct a viable argument and critique the reasoning of others.  **MP: 4**  Model with mathematics. |

***CONNECTIONS (Consider while planning):***

• Previous Math Knowledge: *What prior math knowledge and experiences does this lesson consider and/or build on?*

Fractions are parts of a whole.

Fractions can be used to find a part of a set (e.g., ½ of the 20 boxes of cookies are Thin Mints)

Note: Some of the graphics depicted in this task use percentages to describe cookie preferences. Students are not expected to use percentages to answer the questions. Teachers of students for whom the concept and notation of percentages are not prior knowledge, can briefly state that this is another way to represent a fraction whose denominator is 100.

*•* Cultural/Community/Family Connections: *How does the lesson connect to, or build on the knowledge, practices, or experiences of children and families? On community contexts??*

Students may have experiences buying/consuming girl scout cookies, and may have ideas about cookie preferences/most popular cookies, etc.. Students may also have prior knowledge about cost of boxes, and the number of boxes that a typical person/family is likely to buy. Some students may have experience selling girl scout cookies, either via regular sales or “booth sales” outside of grocery stores.

***TASK VARIATIONS:***

**Opening** **Routines: What do you notice? Wonder?**

* Use initial slides to connect to students’ knowledge and experiences with girl scout cookies
* What do you notice? What does this picture make you wonder about? Brief class discussion.
* Some images are of girls preparing for a sale. Elicit questions related to -> How many boxes will the girls sell? How much profit will they make? How do they know which kinds of cookies to bring to the sale, and how many boxes of each?
* There is also data about most popular girl scout cookies. One figure shows most popular cookie by state, the other shows the top ten most popular cookies overall – ask students to describe what they notice and wonder about these representations, and whether the data presented is consistent with their own experiences/preferences.

***HOW MANY BOXES TO BRING TASK: ANTICIPATED STUDENT STRATEGIES:***

**Relevant considerations that should come out during the initial discussion of this task** **(some information might be available, some will need to be assumed):**

How long is the sale?

How busy will the sale be?

What are the most popular flavors of cookies?

Do you want to bring “just enough” boxes of cookies? Is it ok to bring many extra boxes?

***Warm Up Claim Task 1: Should ½ of the boxes be Thin Mints?***

In each of the data representation, the Thin Mints account for approximately ¼ of sales or preferences. Students should recognize that if ½ of the boxes are Thin Mints, this would be TOO many, and not enough of the other cookies.

Students might use ONE data representation for this task, OR they might reason about two different representations. All of the representations should lead students to the same conclusion.

The main goal of this warm up task is to help students start to think about the data in terms of fractions of the total (50 out of 100 is like 1/2 of the total, 25% of total sales is like ¼ of the total, etc..)

***Warm Up Task 2: Which are reasonable assumptions?***

This warm up task is an assumption routine, designed to get students thinking about the number of boxes that might be sold at a cookie sale outside a super market.

NOTE if you decide to provide a total number of boxes in the main task, then this warm up routine is not needed. If you want students to estimate the total number of boxes that will be sold, as part of their solution to the task, then this warm up routine would be helpful.

***How many boxes? Task: SPECIFIC SCENARIO***

There are two possible components to this task.

***Component 1: Estimating the total number of boxes that will be sold.***

Students might estimate a number of boxes sold each 15 minutes (drawing on the discussion from the assumption routine) and then use that amount to estimate the number of boxes that will be sold each hour, and then across the multiple hours of the sale.

For example: (10 boxes each 15 minutes) x 4) = boxes that will be sold in an hour.

(Boxes sold in an hour) x 3 = Boxes that will be sold in a 3-hour sale.

Students should recognize that as they change the assumptions about the number of boxes that they will sell in each segment of the sale, the total estimate will change.

Students will need to explain how their assumptions informed their model – i.e., they assumed a really busy time and location, which led them to estimate X boxes per 15 minutes; or they assumed a slow Sunday morning sale with minimal customers, so X boxes per 15 minutes.

***Component 2: Determining what portion of the total boxes each kind of cookie should be***

Students will need to use the data representations (given as numbers, percents or fractions) to determine how to divide the total number of boxes among the different kinds/flavors of cookies.

For example, they may notice that Thin Mints are the most popular and decide that approximately ¼ of the total boxes should be Thin Mints. If they estimate 200 boxes total, they could calculate ¼ of 200. They might notice that Samoas are the next most popular and estimate that 1/5 of the total number of boxes should be Samoas. Using 200 boxes as the total, they could calculate 1/5 of 200. They might estimate that 1/10 of the total boxes should be shared among “other” flavors – lemons, trefoils, gluten free, etc. They could calculate 1/10 of 200, which is 20, and then decide how to distribute the 20 “other” boxes among the remaining flavors.

Students should be encouraged to use FRACTIONS in their solutions, and even to draw a visual representation that shows the portion of the total number of boxes assigned to each flavor. NOTE: students must ensure that all fractional parts add exactly to one whole – as the whole here represents the total number of boxes.

***Component 3: Generalizing the Plan***

Here students are asked to record their plan in a generalizable form that could be sharable and reusable by other girl scout troops and leaders. The plan should include instructions for estimating the total number of boxes sold, and the portion of the boxes assigned to each of the cookie flavors.

***ESTIMATING PROFITS TASK: ANTICIPATED STUDENT STRATEGIES***

This task will involve operations with decimals (to calculate/estimate profits with precision) or operations with whole numbers (to estimate profits with less precision –decimal amounts can be rounded to whole dollars).

Students can use the estimate for the total number of boxes that will be sold (from prior task) and then multiply by the profit that stays with the troop (approximately.82 per box) to estimate total profits.

Younger students could round per box profits to $1.00 per box, and then multiply by estimated number of boxes sold, and compensate at the end to account for/adjust for the initial rounding.

Students might also discuss whether they agree with the profit margins, or whether they want to propose a different profit margin structure to the Girl Scout organization.

***MATERIALS NEEDED:***

Lesson Slides ppt –

Student task handout –

Blank fraction circles -