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February 13, 2020
EDCI-405

Mini Lesson: Long Division (Singapore Method)

Grades: 4, 5

Learning Objective: By the end of the lesson, students will be able to visually represent and apply the Singapore method of long division to solve division of two-digit numbers by single-digit numbers, scaffolded into more complex problems.

Introduction:

We have chosen to create a lesson based on long division as it is a math skill that many in our cohort have admitted to having forgotten or to not understanding the process. While we concede that long division is a very rarely used method in adult life, we also feel that long division strategies can be used as a tool to deepen one's understanding of division as a mathematical concept and reinforce the relationships division has with multiplication and subtraction.

In an attempt to use long division as a tool for conceptual understanding, as well as a computational means to an answer, we have chosen to focus on the Singapore method of long division. This method emphasizes division as a separation into "equal groups" and an expansion of large numbers into their place values. The numerical steps associated with this method can be easily represented visually in either a picture or with manipulatives.

For our division lesson, we have created a story called, "One Perfect Cookie," in which three friends decide to bake chocolate-chip cookies and must figure out how to share them evenly between themselves. By rooting our lesson in a detailed narrative, we hope to engage students, provide authentic examples for the application of division, and honor the storytelling traditions represented in the First People's Principles of Learning.

To prepare students for this specific lesson, we will have preceded with a number talk. It feels important for students to be given the chance to explore their understanding of division on their own and share their pathways with each other before diving deep into one method of solving a more complex division problem. Additionally, this lesson is one of many that provides students with strategies for exploring division; we are focusing on the Singapore method in this lesson and would focus on other strategies more in-depth in following lessons.

One Perfect Cookie

Lesson Details:

Big Idea: Development of computational fluency and multiplicative thinking requires analysis of patterns and relations in multiplication and division

Curricular Competencies:
- Develop mental math strategies and abilities to make sense of quantities
- Visualize to explore mathematical concepts
- Develop, demonstrate, and apply mathematical understanding through play, inquiry, and problem solving
- Communicate mathematical thinking in many ways

Curricular Content:
- Multiplication and division of two- or three-digit numbers by one-digit numbers (using multiplication and division in real life contexts and problem-based situations)
- Multiplication and division facts to 100 (introductory computational strategies)

Material Required:
- Math Booklet: *The Perfect Cookie,* illustrated by Katrina Brooke
- 10 magnetized pictures of single cookies
- 10 magnetized pictures of 10 cookies on a plate
- Base ten blocks or other manipulatives for students
- White boards or placemats for each student
- White board markers and erasers for each student

Before this Lesson, Students should understand:

- *Place value*
- *The relationship between division and multiplication
(namely that division is the inverse of multiplication)*
- *Basic multiplication and division facts from 12 x 12 times table*
- *Vocabulary related to division (quotient, divisor and dividend)*
- *The symbols of division*

  (÷ and $\overline{)}$)
- *Placement of numbers within the division symbol*
- *Subtraction*

Procedure:

1. Narrative Outline, "*One Perfect Cookie*"

Started on a rainy day when you were enjoying a cup of hot chocolate

Sara thought to herself, "you know what would go great with this? A chocolate chip cookie - one *perfect* chocolate chip cookie!"

She found grandpas' famous chocolate chip cookie recipe - The recipe makes 24 cookies, but she only wants one cookie. She decides instead to make *one GIANT* cookie

Sara hears a knock on the door - It's her friend Adrien**,** who wants *one* perfect cookie too

> *What does Sara need to do to the cookie dough so that she can make 2 cookies?*
>
> *Teacher gathers ideas from students before carrying on with the story. (She will need to split the dough into two equal parts).*

They were about to add the flour when the cat jumped on the table and knocked hot chocolate onto the *ONLY* copy of grandpa's chocolate chip cookie recipe!!! "OH NO!!!," they say.

They put their heads together and decide that between the two of them could probably figure out how to make the best chocolate chip cookie ever

> Sara adds milk – it's too wet
>
> Adrien adds flour – it's too dry
>
> Sara adds salt– "Blegh!"

A few ingredients later and they finally did it! They made the cookie dough! Except, something still didn't taste quite right….

Suddenly there was a knock on the door - it's Tobi!

Tobi notices Sara and Adrien forgot chocolate chips!

> "Of course!!! Now we have the PERFECT batter for the PERFECT cookies!"

After adding all those ingredients they had soooo much dough! So much so that they ended up baking **48** cookies!! "What are we gonna do with all these cookies?!"

The three friends decide to split the cookies between them evenly to take home.

> *Teacher writes question on the board: How many cookies does each friend get?*

2. Development of Concept

- Ask students for the number sentence needed in this problem: 48 ÷ 3 = ?
- Ask them to *estimate* how many cookies they think each friend will receive.
- Provide students with manipulatives, base 10 blocks or pencils to visualize the problem. Allow time for students to solve the problem themselves.
- Once each student has had an opportunity to come up with an answer, offer the Singapore strategy as a method for solving.
- Go through Singapore method on board using cookie pictures and numeric representation
  - When we're working with long-division method, really what we're asking is how many groups of 1s, 10s, 100s, etc will be in each group if we are dividing the total into 3 equal groups.

Numeric Representation	Cookie Pictures
1. Write numeric equation → 3) 48 2. Ask students to look at the tens value (40): ask how can we break 40 into 3 equal groups? Write 10 on top explaining that each friend gets one group of ten or 10 cookies 3. Ask students, how many cookies have we grouped (30) 4. Write 30 underneath 48 and subtract. 5. Ask students how can we break 18 into three equal groups? Using their multiplication facts, students should know that each friend will receive 6 cookies 6. Write 6 on top of 10 in the ones place 7. Ask students, how many more cookies did we take away from the total amount? (18) 8. Write 18 underneath and subtract and show there are 0 cookies remaining. 9. Look at the top part of equation: add 10 and 6 to show each friend gets 16 cookies	1. Show 4 groups of ten cookies and 8 single cookies on board to represent the 48 cookies in total 2. Share the 4 plates of ten cookies among the 3 friends, with 1 plate of ten cookies leftover 3. Ask students, how many cookies have we grouped (30) 4. Ask students to count how many cookies are still left over (18) 5. Ask students how can we break 18 into three equal groups? 6. Students should know that they need to *exchange* the remaining group of ten cookies for 10 single cookies 7. Share the 18 cookies between the three groups, putting 6 cookies in each 8. Ask students how many cookies are remaining - 0. 9. Explain to students that each friend gets a total of 16 cookies.

3. Learning Activity

Moving to more independent work, students will work on their own or in pairs to work through one of the following problems. Students should use base ten blocks or visual representations to represent the number or cookies they are working with.

If there are 6 cookies per tray, how many trays of cookies did they bake?
$$6 \times ? = 48 \rightarrow 48 \div 6 = ? \qquad\qquad \textbf{Answer: 8}$$

Imagine the friends made 126 cookies. If there are 6 cookies per tray, how many trays of cookies did they bake?
$$6 \times ? = 126 \rightarrow 126 \div 6 = ? \qquad\qquad \textbf{Answer: 21}$$

Students who feel more confident in the long-division method may choose to work through the second equation involving three-digit numbers. If students still feel like they need a challenge they can attempt to work through some of the extension questions.

Extension Questions:

Double-digit into double-digit problem:
If there are 24 cookies per recipe, how many recipes did they bake?
$$24 \times ? = 48 \rightarrow 48 \div 24 = ? \qquad\qquad \textbf{Answer: 2}$$

Problem with remainders:
If the friends made 46 cookies, how many cookies does each friend get?
$$46 \div 3 = ? \qquad\qquad \textbf{Answer: 15, R 1}$$

Financial Literacy Problem: Students could use Monopoly money (1s, 10s, and 100s) as manipulatives to help them solve the following problem.
After Sara, Adrien and Tobi each ate their one perfect cookie, they decided to sell the rest. After selling all of their cookies they made counted their money and discovered that they made $51 dollars. If they share the money equally, how much money will Sara, Adrien and Tobi each receive?
$$51 \div 3 = ? \qquad\qquad \textbf{Answer: 17}$$

Assessment:

The following are examples of exit slips that could be used as formative assessment at the end of this lesson. Our lesson objective is to provide students with one (among many) strategies to use when solving complex division questions. As such, we have chosen to focus on assessment that relates to overall conceptual understanding as opposed to the steps of the strategy reviewed. By asking students to come up with their own quiz question and answer, we allow them to work at a level that they feel comfortable while still applying the concepts covered during the lesson.

Exit Slips:

Name:_____ Date: _____

Learning Frame

Today I learned about _____ with my class.

The tricky part is _____,

but it helps when I_____.

It's important that I know this because
_____
_____.

Name:_____ Date: _____

Possible Quiz Question	Answer

Additional Resources:

Division in Singapore Math - **https://www.youtube.com/watch?v=Gyvt0G4EzEs&t=86s**
Singapore Long Division - **https://www.youtube.com/watch?v=cndpooBj99Q**

Cookie recipe:

Tasty Vegan Chocolate Chip Cookies

Ingredients
(for 10 servings)

- ½ cup sugar(100 g)
- ¾ cup dark brown sugar(165 g), packed
- 1 teaspoon salt
- ½ cup refined coconut oil(120 g), melted
- ¼ cup non-dairy milk(60 mL)
- 1 teaspoon vanilla extract
- 1 ½ cups gluten free flour(185 g)
- ½ teaspoon baking soda
- 4 oz vegan semi-sweet chocolate(115 g), chunks
- 4 oz vegan dark chocolate(115 g), chunks

Preparation

1. In a large bowl, whisk together the sugar, brown sugar, salt, and coconut oil until combined.
2. Whisk in non-dairy milk and vanilla, until all sugar has dissolved and the batter is smooth.
3. Sift in the flour and baking soda, then fold the mixture with a spatula, being careful not to overmix.
4. Fold in the chocolate chunks evenly.
5. Chill the dough for at least 30 minutes.
6. Preheat oven to 350°F (180°C).
7. Scoop the dough with an ice cream scoop onto a parchment paper-lined baking sheet. Be sure to leave at least 2 inches of space between cookies and the edges of the pan so cookies can spread evenly.
8. Bake for 12-15 minutes, or until cookies just begin to brown.
9. Cool completely.
10. Enjoy!

Problem Solving Placemat:

Let's Do Long Division!

Equation	Manipulative Groups
⌐	