Lesson 2: Costs of Running a Restaurant

Goals

- Comprehend the term "spreadsheet" (in written and spoken language) is a computer program in which data is arranged in the rows and columns of a grid and can be manipulated and used in calculations.

- Create formulas in a spreadsheet to perform repeated calculations.

- Use a spreadsheet to calculate the cost per serving of all the ingredients in a recipe.

Lesson Narrative

This lesson is optional. In this lesson, students gain experience using a spreadsheet program to perform repeated calculations. After exploring how spreadsheets work, students calculate the cost per serving of all the ingredients in a recipe. Students make use of structure (MP7) as they explore the syntax of how formulas are written in spreadsheet programs. Students see that spreadsheets are an appropriate tool (MP5) for organizing and performing repeated calculations. Students reason quantitatively (MP2) while deciding what formula they need for each column in their spreadsheet.

As with all lessons in this unit, all related standards have been addressed in prior units. This lesson provides an *optional* opportunity to go deeper and make connections between domains. If students have already completed the previous lesson, they can continue using the same recipes in this lesson. However, it is also possible to do this lesson without having completed the previous lesson.

Alignments

Addressing

- 7.RP.A.3: Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

Instructional Routines

- MLR8: Discussion Supports

Required Materials

Internet-enabled device   **Recipes**

Required Preparation

Prepare to provide each student access to a spreadsheet program. It is recommended for them to use a program with which you have previous experience.

If students have not completed the previous lesson or do not still have access to the recipes they used for it, provide access to recipes.

2.1 Introducing Spreadsheets

Optional: 15 minutes

The purpose of this activity is for students to learn about formulas in spreadsheets through hands-on experience. This exploration prepares students for using a spreadsheet to calculate the cost of recipe ingredients in the next activity.

Launch

Explain what spreadsheets are and how they work, including the following features:

- A spreadsheet is a computer program that lets you organize information in a grid of rectangles, called cells, and to do calculations. There are many different spreadsheet programs, but they all work in basically the same way. The rows are labeled with numbers and the columns are labeled with letters.

- Display this image of a sample spreadsheet.

	A	B	C	D
1	Ingredient	Weight (lb)	Unit cost ($ per lb)	Cost ($)
2	Cheese	3.6	$4.50	$16.20
3	Raisins	1.6	$2.50	$4.00
4	Peanuts	2	$3.00	$6.00

Ask the students "What information is in cell B3? What does this piece of information tell us about the situation?" (1.6, how many of pounds of raisins).

- It is helpful to put headings in the first row that describe what information goes in each column (and headings in the first column to describe each row). It is also helpful to organize the information in the spreadsheet to be read from left to right and from top to bottom.

- If you type a formula correctly into any cell of a spreadsheet, the program will calculate and display the value of the expression. Formulas must start with an equal sign. If the answer is not a whole number, the spreadsheet will display the value as a decimal. It is possible to program each cell to round decimal values.

Note that spreadsheets on tablets are a bit different.

- The "enter" key on the keyboard is usually at the lower right, marked with a right-angle arrow pointing down and left.

- The Numbers spreadsheet involves less typing. Instead of typing = and a formula, tap the = button; tap a cell whose address you want in the formula; type numbers and operations. If you have typed headings, the words will appear in the formula, such as Amount (lb) Cheese.
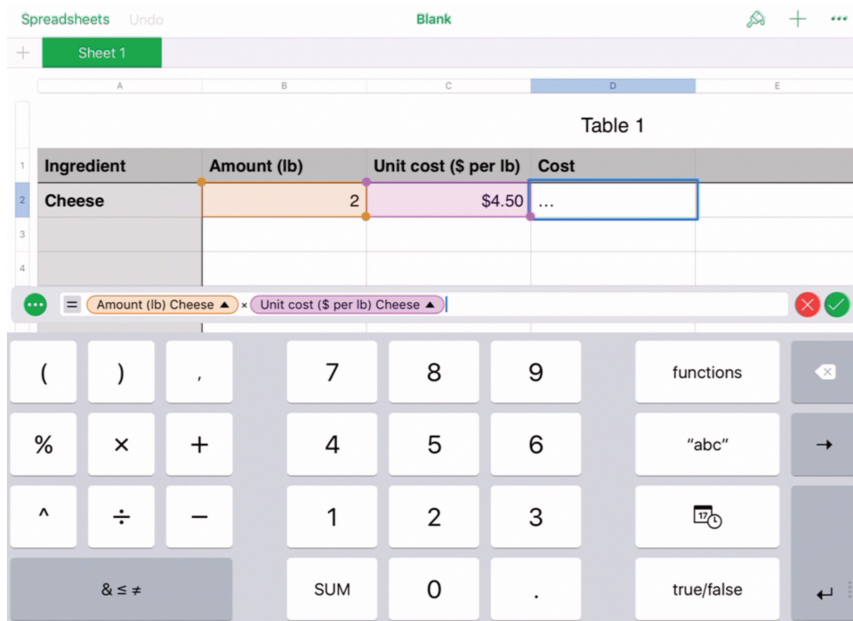
Provide access to spreadsheets. Give students quiet work time followed by whole-class discussion.

Anticipated Misconceptions

Some students may not understand what happened when they completed the last instruction. The fact that copying a formula from one cell and pasting it in another cell updates the row and column references in the formula can be counter-intuitive. Prompt students to double click on the cell where they pasted the formula so they can see what the formula now says.

Student Task Statement

1. Type each formula into the cells of a spreadsheet program and press enter. Record what the cell displays. Make sure to type each formula exactly as it is written here.

	A	B	C	D
1	=40-32	=1.5+3.6	=14/7	=0.5*6

2. a. Predict what will happen if you type the formula =A1*C1 into cell C2 of your spreadsheet.

   b. Type in the formula, and press enter to check your prediction.

3. a. Predict what will happen next if you delete the formula in cell A1 and replace it with the number 100.

   b. Replace the formula with the number, and press enter to check your prediction.

4. a. Predict what will happen if you copy cell C2 and paste it into cell D2 of your spreadsheet.

b. Copy and paste the formula to check your prediction.

Student Response

1. ○ Cell A1 displays the number 8 because that is the answer to the subtraction problem $40 - 32$

   ○ Cell B1 displays the number 5.1 because that is the answer to the addition problem $1.5 + 3.6$

   ○ Cell C1 displays the number 2 because that is the answer to the division problem $14 \div 7$. Division is represented with the slash character in spreadsheet programs.

   ○ Cell D1 displays the number 3 because that is the answer to the multiplication problem $(0.5) \cdot 6$. Multiplication is represented with the asterisk symbol in spreadsheet programs.

2. Cell C2 displays the number 16 because it is multiplying the value in cell A1 times the value in cell C1 and $8 \cdot 2 = 16$.

3. Cell A1 just displays the number 100 because we entered a number, not a formula, but cell C2 updates to display 200, even though we didn't do anything to that cell, because it is still multiplying the values in cell A1 times C1, and A1 is now 100 instead of 8, so $100 \cdot 2 = 200$.

4. Cell D2 displays the number 15.3 because it is multiplying the value in cell B1 times the value in cell D1 and $(5.1) \cdot 3 = 15.3$. When the formula in C2 was copied and pasted into D2, it moved one cell to the right, so the letters in the formula automatically adjusted to refer to one cell to their right. In other words, A1 changed to B1 and C1 changed to D1. If we had pasted the formula into a different row, above or below, the numbers as well as the letters in the cell addresses would have updated.

Activity Synthesis

If possible, display a spreadsheet program and go through the steps described in the students' books or devices. Ask students to explain why each step has the result it does. (See student response for explanations.)

The most important things for students to remember from this activity are:

- Formulas in spreadsheets start with the equal sign and use * and / for multiplication and division, respectively.

- You can refer to the value in another cell of the spreadsheet within your formulas. For example, the formula =A3+B2 will display the sum of the values in cells A3 and B2, as long as those cells contain just numbers and no words.

- If you copy a formula from one cell and paste it into another cell, the program will automatically adjust any cell addresses in the formula by the number of rows and columns between the cells where the formula was copied from and pasted into.

2.2 Cost per Serving

Optional: 30 minutes
In this activity, students use a spreadsheet program to compute the cost for one serving of each meal they want to serve at their restaurant. Students have to find or estimate the cost of each ingredient. Since ingredients are sold in different units, they have to convert units from the ones they find for the cost to the ones used in the recipe. For example, olive oil is sold in 1 quart bottles, but the recipe asks for tablespoons. The calculations can be done in the spreadsheet, and entering the formulas into the cells of the spreadsheet is an important mathematical step.
Another important step in this activity is to plan the set-up of the spreadsheet.

Addressing

- 7.RP.A.3

Instructional Routines

- MLR8: Discussion Supports

Launch

If possible, have students refer back to the recipes they selected in the previous lesson. Otherwise, provide recipes for students to refer to here. Give students quiet work time followed by partner and whole-class discussion.

Access for Students with Disabilities

Representation: Internalize Comprehension. Activate or supply background knowledge about measurement. Students may benefit from watching a quick demonstration of the set-up of the spreadsheet. Review terms such as: spreadsheet formulas and converting units.
Supports accessibility for: Memory; Conceptual processing

Access for English Language Learners

Speaking, Listening: MLR8 Discussion Supports. Use this routine to support understanding and use of the language of spreadsheets, including the terms "cell," "column," "row," "formula," "copy," and "paste." Invite students to use these words when stating their ideas. Ask students to chorally repeat the phrases that include these words in context of the problem. This helps students use spreadsheet terms while verbalizing calculation predictions.
Design Principle(s): Optimize output (for explanation); Maximize meta-awareness

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Anticipated Misconceptions

Some students may struggle to know what formulas they should type into columns D, H, J, and K. Prompt them to write down on paper what calculation they would do for the first one or two ingredients and look for patterns that could help them figure out the other rows automatically.

Student Task Statement

1. Set up a spreadsheet with these column labels in the first row.

	A	B	C	D
1	ingredient	unit in recipe	amount in recipe	amount per serving
2				

   a. Type the information about the ingredients in your recipe into the first 3 columns of the spreadsheet.

   b. Type a formula into cell D2 to automatically calculate the amount per serving for your first ingredient.

   c. Copy cell D2 and paste it into the cells beneath it to calculate the amount per serving for the rest of your ingredients. Pause here so your teacher can review your work.

2. Add these column labels to your spreadsheet.

E	F	G	H
purchase price	purchase amount	purchase unit	cost per purchase unit

   a. Research the cost of each ingredient in your meal, and record the information in columns E, F, and G.

   b. Type a formula into cell H2 to automatically calculate the cost per purchase unit for your first ingredient.

   c. Copy cell H2, and paste it into the cells beneath it to calculate the cost per purchase unit for the rest of your ingredients.

3. Add these column labels to your spreadsheet.

	I	J	K
	conversion from purchase units to recipe units	cost per recipe unit	cost per serving

a. Complete column I with how many of your recipe unit are in 1 of your purchase unit for each ingredient. For example, if your recipe unit was cups and your purchase unit was gallons, then your conversion would be 16 because there are 16 cups in 1 gallon.

b. Type a formula into cell J2 to calculate the cost per recipe unit for your first ingredient.

c. Type a formula into cell K2 to calculate the cost per serving for your first ingredient.

d. Compare formulas with your partner. Discuss your thinking. If you disagree, work to reach an agreement.

e. Copy cells J2 and K2, and paste them into the cells beneath them to calculate the cost per recipe unit and cost per serving for the rest of your ingredients.

4. Type a formula into the first empty cell below your last ingredient in column K to calculate the total cost per serving for all of the ingredients in your recipe. Record the answer here.

Student Response

Answers vary. Sample response:

	A	B	C	D	E	F	G	H	I	J	K
1	ingredient	units in recipe	amount in recipe	amount per serving	purchase price	purchase amount	purchase units	cost per purchase unit	conversion factor from purchase units to recipe units	cost per recipe unit	cost per serving
2	spaghetti noodles	c	6	1	$1.99	6	c	$0.33	1	$0.33	$0.33
3	ground beef	lb	1	0.166667	$3.99	1	lb	$3.99	1	$3.99	$0.67
4	pasta sauce	c	3	0.5	$1.99	4	c	$0.50	1	$0.50	$0.25
5	onion	c	0.5	0.083333	$0.99	1	onion	$0.99	1	$0.99	$0.08
6	garlic	cloves	2	0.333333	$0.50	1	head	$0.50	12	$0.04	$0.01
7	olive oil	tbsp	1.5	0.25	$3.99	1	quart	$3.99	64	$0.06	$0.02
8	basil	tsp	2	0.333333	$4.99	1	c	$4.99	48	$0.10	$0.03
9	oregano	tsp	2	0.333333	$4.99	1	c	$4.99	48	$0.10	$0.03
10										Total	$1.43
11											

Here are the formulas that were used to create this sample spreadsheet:

D	H	J	K
=C2/6	=E2/F2	=H2/I2	=J2*D2
=C3/6	=E3/F3	=H3/I3	=J3*D3
etc.	etc.	etc.	etc.
			=sum(K2:K9)

The formulas in rows 4–9 follow the same pattern as those shown for rows 2 and 3.

The formulas in column D use 6 as the divisor here because the sample recipe made 6 servings. This number needs to be adjusted to match the number of servings in the student's recipe.

If students do not know about the formula shown for cell K10 above, they could also use =K2+K3+K4+K5+K6+K7+K8+K9 to accomplish the calculation.

Activity Synthesis

Poll the class on the cost for one serving of their recipe.

Invite student to share their experiences using the spreadsheet:

- "What was the most difficult part of setting up your spreadsheet to do these calculations for you?"

- "What strategies did you use to help you decide on the formulas for columns D, H, J, and K?"

- "Which method do you prefer for this type of problem, using paper, pencil, and a calculator or using a spreadsheet? Why?"