Lesson 1

Cost of a Meal

Goals

- Comprehend the term "spreadsheet" (in written and spoken language) as 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

In this optional 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. This can be a recipe students bring from home or a recipe provided by the teacher. Students make use of structure as they explore the syntax of how formulas are written in spreadsheet programs. Students reason quantitatively while deciding what formula they need for each column in their spreadsheet. This lesson relies on skills developed in Unit 2.

Student Learning Goal

Let's explore how much a recipe's ingredients cost.

Lesson Timeline

15 min	30 min
Activity 1	Activity 2

Access for Students with Diverse Abilities

- Representation

Access for Multilingual Learners

- MLR2: Collect and Display (Activity 1, Activity 2)

Instructional Routines

- MLR2: Collect and Display (Activity 2)

Required Materials

Materials to Gather

- Internet-enabled device: Activity 1, Activity 2
- Recipes: Activity 1, Activity 2

Required Preparation

Activity 1:
For the digital version of the activity, acquire devices that have access to a spreadsheet program.

Activity 2:
For the digital version of the activity, acquire devices that have access to a spreadsheet program. Students will need access to a variety of recipes to choose from. Students can bring in recipes from home, the teacher can provide a variety of recipes, or students can be given time to search the internet for a recipe.

Instructional Routines (Activity 1)

MLR2: Collect and Display

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Access for Multilingual Learners (Activity 1, Narrative)

MLR2: Collect and Display
This activity uses the *Collect and Display* math language routine to advance conversing and reading as students clarify, build on, or make connections to mathematical language.

Activity 1
Introducing Spreadsheets

15 min

Activity Narrative

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. This activity gives students the opportunity to explore how the structure of a spreadsheet can be used to solve problems.

Launch

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

- A spreadsheet is a computer program that lets one organize information in a grid of rectangles, called cells, and 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,

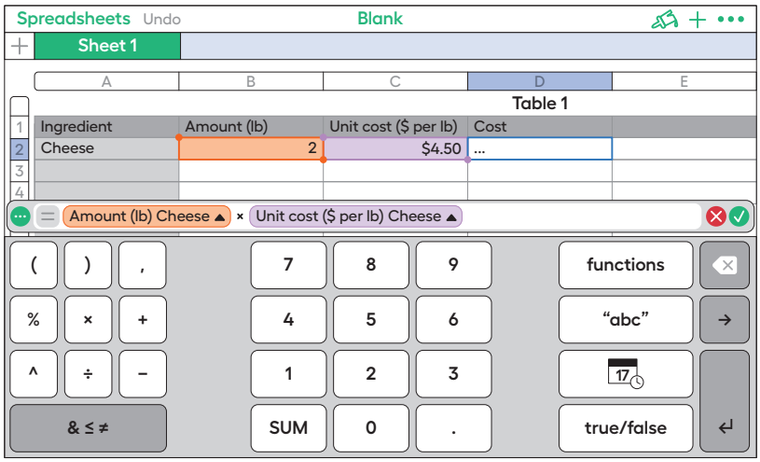
💬 *"What information is in cell B3? What does this piece of information mean in terms of the situation?"*

1.6; how many pounds of raisins there are

- 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 a formula is typed 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 is wanted in the formula; type numbers and operations. If there are 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.

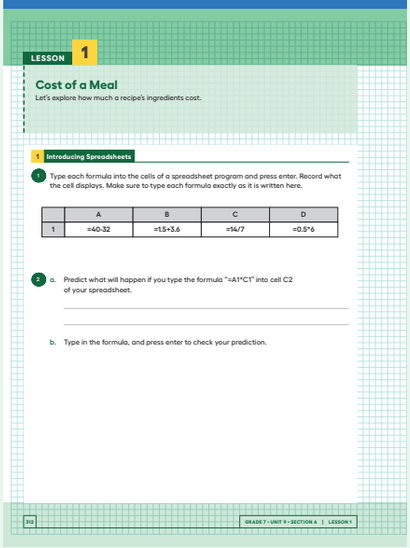
Use *Collect and Display* to create a shared reference that captures students’ developing mathematical language. Collect the language students use to discuss spreadsheets. Display words and phrases such as “cell,” “box,” “formula,” “number,” “row,” and “column.”

Building on Student Thinking

If students find the last instruction counter-intuitive, consider asking:

"Tell me more about what happened when you copied cell C2 and pasted it into cell D2."
"What is the same and what is different about the formula in cell C2 and the formula in cell D2?"

Student Workbook



LESSON 1

Cost of a Meal

Let's explore how much a recipe's ingredients cost.

1 Introducing Spreadsheets

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

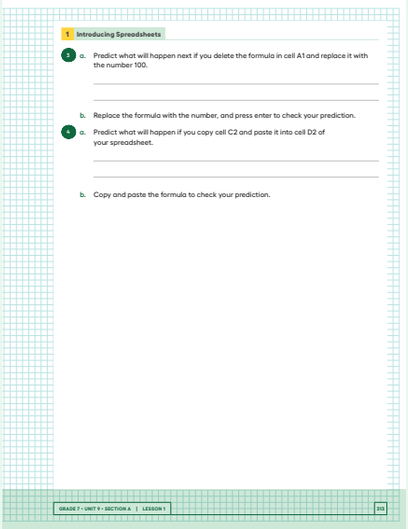
2. a. Predict what will happen if you type the formula "=A1*C1" into cell C2 of your spreadsheet.

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

312

GRADE 7 • UNIT 9 • SECTION A | LESSON 1

Student Workbook



1 Introducing Spreadsheets

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.

GRADE 7 • UNIT 9 • SECTION A | LESSON 1

313

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

- 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 ÷ 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) · 6. Multiplication is represented with the asterisk symbol in spreadsheet programs.

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

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

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.

Cell A1 just displays the number 100 because a number was entered, not a formula. Cell C2 updates to display the number 200, even though nothing was done to that cell, because it is still multiplying the values in cell A1 and C1, and A1 is now 100 instead of 8, so 100 · 2 = 200.

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.

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) · 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 the formula was pasted into a different row, above or below, the numbers as well as the letters in the cell addresses would have updated.

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

Activity Synthesis

Direct students' attention to the reference created using *Collect and Display*. 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.) Invite students to borrow language from the display as needed and update the reference to include additional phrases as they respond.

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.
- The value in another cell of the spreadsheet can be referred to within 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 a formula is copied from one cell and pasted 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.

Activity 2

Cost per Serving

30 min

Activity Narrative

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, students reason abstractly and quantitatively as they convert units from the ones they found 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.

Launch

If desired, explain to students that they are starting a series of activities that are based on the idea of imagining they could open their own restaurant. Ask students to choose from the recipes in the Blackline Master in the student workbook or, if students brought recipes from home, ask them to get them out.

Use *Collect and Display* to direct attention to words collected and displayed from an earlier activity. Invite students to borrow language from the display as needed, and update it throughout the lesson. Give students quiet work time followed by partner and whole-class discussion.

Instructional Routines

MLR2: Collect and Display

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Access for Multilingual Learners (Activity 1, Narrative)

MLR2: Collect and Display
This activity uses the *Collect and Display* math language routine to advance conversing and reading as students clarify, build on, or make connections to mathematical language.

Access for Students with Diverse Abilities (Activity 2, Student Task)

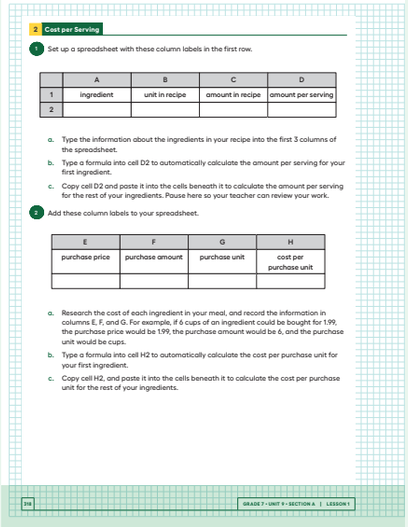
Representation: Internalize Comprehension.
Activate or supply background knowledge. Demonstrate for students who are unfamiliar with the setup of a spreadsheet.
Supports accessibility for: Conceptual Processing, Language

Building on Student Thinking

If students struggle to know what formulas to use, consider asking:

"Can you explain how you would do this calculation by hand?"
"How can you use a spreadsheet to do those calculations for you?"

Student Workbook



2 Cost per Serving

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.

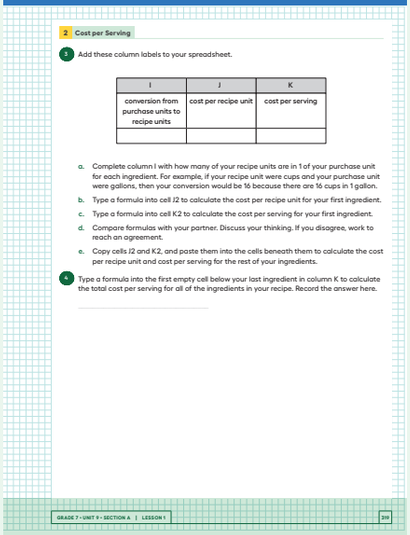
2 Add these column labels to your spreadsheet.

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. For example, if 6 cups of an ingredient could be bought for 1.99, the purchase price would be 1.99, the purchase amount would be 6, and the purchase unit would be cups.
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.

316 GRADE 7 • UNIT 9 • SECTION A | LESSON 1

Student Workbook



2 Cost per Serving

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 units are in 1 of your purchase unit for each ingredient. For example, if your recipe unit were cups and your purchase unit were 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.

GRADE 7 • UNIT 9 • SECTION A | LESSON 1 317

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. For example, if 6 cups of an ingredient could be bought for 1.99, the purchase price would be 1.99, the purchase amount would be 6, and the purchase unit would be cups.

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 units are in 1 of your purchase unit for each ingredient. For example, if your recipe unit were cups and your purchase unit were 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.

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

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

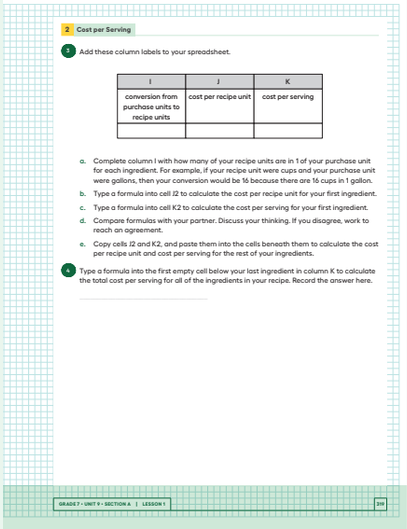
D	H	J	K
=C2/6	=E2/F2	=H2/I2	=J2*D2
=C3/6	=E3/F3	=H3/I3	=J3*D3
etc.	etc.	etc.	etc.
			=sum(K2:K9)

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 complete the calculation.

Student Workbook



2 Cost per Serving

3 Add these column labels to your spreadsheet.

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a. Complete column I with how many of your recipe units are in 1 of your purchase unit for each ingredient. For example, if your recipe unit were cups and your purchase unit were 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.

GRADE 7 • UNIT 9 • SECTION A | LESSON 1 219

Activity Synthesis

Ask a few students to share 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?"*