



3 HOURS



- Calculations with Percents (whole/part, part/whole)
- Rounding
- Adding Decimals

# Restaurant Management Math: Menu Pricing

Students work in groups to solve a real-world math problem of determining the menu prices for items at a restaurant that offers catering services.

## PREP

- Prior knowledge of calculating with percents is helpful, but not necessary.
- Complete all worksheets for this activity to be used as answer keys.
- Watch *Real-Life Math: Chef*—Look for 30/30/30/10 explanation. <https://ny.pbslearningmedia.org/resource/mkaet.math.rp.chef/real-life-math-chef>
- Be prepared to discuss the vocabulary terms: **Food cost, overhead, payroll, profit, wholesale, retail**

## MATERIALS

It is recommended that students be allowed to use calculators for this activity.

- *Food Cost and Menu Prices* worksheet
- *Using Benchmarks to Calculate Percents* worksheet
- *Setting Menu Prices* worksheet (3 pages)
- *Pricing Orders for a Catering Business, Part One* worksheet
- *Wholesale Food Order Spreadsheet, with Coffee Spill* worksheet
- *Pricing Orders for a Catering Business, Part Two* worksheet
- *Wholesale Food Order Spreadsheet, Completed* handout
- *Support and Push—For Pricing Orders for a Catering Business* (cut along the dashed lines)

## EXPLAIN

- 1 How many people like to cook? How many people like to eat? What mathematics can be used when cooking at home?
  - › *Responses include: Measuring for recipes (cups, teaspoons, ounces, etc.), shopping for food, managing money, keeping a household budget. Fractions, decimals, adding, subtracting, estimating.*
- 2 What if you were a restaurant manager? What mathematics do you need to run a restaurant?

## VOCABULARY

food cost  
overhead  
payroll  
profit  
wholesale  
retail

› *Responses include: Writing recipes, accounting, daily receipts, taxes, payroll, buying food and supplies, paying rent and utilities. Fractions, decimals, percents, estimation. Spreadsheets, accounting software.*

**3** Restaurants make money by selling food and beverages. Money comes in from sales, but restaurants have to pay for food supplies, rent, utilities, insurance, and payroll for their employees. In order to make a profit, they have to make sure they have money left over after all these expenses are paid. How do restaurant managers set the menu prices and determine the profit they would like to make? Distribute *Food Cost and Menu Prices* worksheet.

**4** Items to discuss before letting students work independently:

- People in restaurants sometimes refer to the “**30/30/30/10 rule**”. They use this rule to think about budgeting their business. When thinking about the money collected by the restaurant through menu prices, the first 30% refers to food cost. What would be included in this cost? Ingredients for dishes on the menu, beverages, cooking oil, condiments, etc. The second 30% refers to overhead. What would be included in this cost? Rent, repairs, insurance, equipment, etc. The last 30% refers to payroll, unemployment insurance, health insurance (possibly) and other costs related to employees. The 10% is the profit that restaurants hope to collect after all the expenses are paid.
  - › Wholesale cost per unit is the price the restaurant pays in bulk orders for ingredients and items that it sells. Cost per serving is how much the ingredients in one menu item (the bun on a veggie burger, for example) costs the restaurant.
- **How is the cost per serving determined?**
  - › *The restaurant manager divides the wholesale cost per unit by the number of servings in the wholesale unit (pack, case, etc.). For example, a pack of 8 buns costs \$2.50 and the veggie burger requires 1 bun, so the manager divides \$2.50 by 8 to get .3125, which is the cost in dollars for 1 bun.*
- **Rounding decimals:** When we look at money, we usually see just two places to the right of the decimal point, which represents tenths (dimes) and hundredths (pennies). However, some calculations will give us answers that will have more decimal places than that. When calculating with money, we will often want to round off to the nearest penny (the hundredths place). To round off to the nearest penny, we look at the digit in the thousandths place to see if it is 5 or more. If it is, we round up to the next penny. If it isn't, we discard the digits after the penny.
- Ask students to try  $\$2.50 \div 8$  on their calculators. How much money is .3125? Rounding to the nearest penny gives us 31 cents, since the 2 in the thousandths place is less than 5.

- $\cong$  means “approximately equal to.” We use this symbol instead of the equals sign because rounding changes the original number so that the two numbers are no longer exactly equal to each other.

- 5 Ask students to complete the worksheet independently. When students are finished, take volunteers for the total food cost and write them on the board.

Do different students agree? What would account for differences in the answer?

#### **Veggie Burger Patties**

\$9.80 divided by 12 = \$0.81667  $\cong$  \$.82

#### **Tomatoes**

\$1 divided by 4 slices per tomato = \$0.25

1/4 of a tomato is used on each veggie burger

#### **Cheese**

10 pounds, 8 servings per pound = 80 servings of cheese

1/8 of a pound of cheese is used on each veggie burger

(2 ounces out of 16 ounces in every pound)

\$9.50 divided by 80 = \$0.11875  $\cong$  \$.12

#### **Potato Chips**

\$12 divided by 40 = \$0.30

**Total Food Cost for Menu Item = .31 + .82 + .25 + .12 + .30 = 1.80**

Is \$1.80 the price the restaurant should charge for the veggie burger and chips? Why or why not?

Some students may say yes, since that’s how much the food costs to make the veggie burger and chips. Eventually students should understand that \$1.80 isn’t high enough, because that wouldn’t leave any money to pay for expenses and make a profit. We’ll return to this question later in the class.

Let students know they are going to be doing some work with that 30/30/30/10 rule that restaurants often use to calculate prices. Just a reminder that each of those numbers refer to a percent of the menu price. First, we’ll do a quick review. Write 1/10 on the board and have the class turn to a partner and discuss what it means. Walk around and listen to the different ways your students explain 1/10.



- 11 We are going to be doing some work to understand how the menu price for an item is calculated from the food cost, which is where 30% of the money that comes into a restaurant usually goes. First, let's review/practice using 10% to find 30%.
- 12 Distribute the *Using Benchmarks to Calculate Percents* worksheet and ask students to fill in the table.
- 13 There may be students who already know that when you divide any number by ten, you can move the decimal point one place to the left. At first, let students divide it any way they can, including using a calculator. After they have completed the table, you can ask the whole class to see what they notice when they look at the **100% (Whole)** column and the **10%** column. This will give all students a chance to practice using the calculator, more time to think about what they are actually doing when they move the decimal (dividing by ten) and then to identify a pattern that will let them make more efficient calculations in the future.
- 14 Once they are done, have students check their answers with a partner.
- 15 The *Setting Menu Prices* worksheet presents the menu price situation in terms of a function. Functions are emphasized in recent high school equivalency exams, where they are often presented in workplace situations. We can use functions to show the relationship between two quantities. The repeated step of dividing by 30% to get the menu price shows a relationship between food cost and the menu price which we can represent with the function:

$$\frac{c}{.30} = p$$

The variable  $c$  represents the food cost, which works as the input in this function. The variable  $p$  is the menu price and works as the output. We put each item's food cost into the function, run the calculation and we get the menu price as our answer.

For a complete set of lessons introducing functions to adult education students, see the CUNY HSE Curriculum Framework ([www.collectedny.org/hseframework](http://www.collectedny.org/hseframework)).

- 16 Restaurant managers use the 30/30/30/10 rule as a guide to help them set menu prices in their restaurants. When following the rule, they know that the food cost should be 30% of the menu price. In order to find out the menu price, they need to figure out what 100% would be if the food cost is 30%. In order to do this, many restaurants use the function: *Food cost divided by 30% equals the menu price.*

- 17 Hand out the *Setting Menu Prices* worksheet.
- 18 Review answers with students.
- Questions **1-2** use food cost as the input in order to calculate the menu price. Veggie burger and chips, \$6.00 & Fried chicken dinner, \$10.00
  - Notice that Question **3** requires students to find out the food cost given the menu price. The fish sandwich has a food cost of \$1.50. Some students may give an answer of \$16.67 as the menu price. Really? But isn't the menu price \$5.00? We encourage you to let students struggle a bit with this one before providing help. Can they use the work they did in the Benchmarks Percent worksheet to help answer this question?
  - Ask for volunteers to share their menu items and food costs from question **4**. Students should feel free to estimate the food cost. Ask the rest of the class to figure out the menu prices for these items.
  - In Question **5**, students should complete the table with missing values. For most of the items, they will need to divide the food cost by 30% to get the menu price. Notice that they will need to move the opposite direction for the milkshake and the pizza slice. Some students may want to continue dividing by .30 and write \$5.00 as the food cost for the milkshake. You might ask, How much are you charging for the milkshake on the menu? \$1.50. Okay, how much does it cost to make the milkshake? \$5.00? Does it seem right that it costs more to make the milkshake than what you charge? No. So, if the price is \$1.50, how much do you think it costs to make it? Whatever the food cost is has to be divided by .30 to get \$1.50. What number divided by .30 equals 1.50?
  - In Question **6**, students should calculate the profit on 4 of the menu items from the table in Question **5**. If students finish early, they can do calculations for the rest of the items.
- 19 **Optional:** Watch the *Real-Life Math Chef and Restaurant Manager* videos together in class or assign videos to students to watch outside of class. Assign the restaurant manager video to half the class and the chef video to the other half. As students watch, they should think about the types of mathematics that these two people use in their daily work. Ask them to take notes to share with the class. (Note that there are additional classroom materials at the links below.)
- **Real-Life Math: Chef**  
<https://ny.pbslearningmedia.org/resource/mkaet.math.rp.chef/real-life-math-chef>
  - **Real-Life Math: Restaurant Manager**  
<https://ny.pbslearningmedia.org/resource/mkaet.math.md.restaurantmanager/real-life-math-restaurant-manager/>

- 20 Distribute *Pricing Orders for a Catering Business, Part One*. Have students read it and make sure the instructions are clear.
- 21 Distribute *Wholesale Food Order Spreadsheet, with Coffee Spill* and give students five minutes to record what they notice and what they wonder. Ask students to work solo on this—they will have time to collaborate soon.
- 22 After about 3 minutes, if students haven't moved on to wondering, prompt them to do so.
- 23 After five minutes, ask students to take a couple of minutes and share what they noticed and what they wonder with a partner.
- 24 In a whole class discussion, have students share what they noticed and what they wonder. Record their observations and questions on the board. Here are some things they might notice:
  - › *There are different measurements used in the Units column and in the Serving size column (packs, cups, tablespoons, lbs., fl. oz, quarts, slices, etc.)*
  - › *Hot dogs are the most expensive item on the list*
  - › *More than half of the Costs per Serving are missing. The Servings per Unit for the last 5 items is missing for the chart.*

If no one notices that the Unit Cost divided by the Servings per Unit gives the Cost per Serving, you might give students a few more minutes with their calculators to see if they observe any relationships between the numbers in each row. If students don't realize the connection, you can remind them that on the *Food Cost and Menu Prices* worksheet, they were dividing the Wholesale Cost per Unit by the number of items in the unit to get the Cost per Serving.

- 25 Here are some things they might wonder:
  - › *Can we figure out the missing numbers?*
  - › *What does Wholesale Cost per Unit/Serving Size/Servings per Unit/Cost per Serving mean?*
  - › *Why are the items so cheap?*

At this point in the lesson, it is important to only answer the questions that are about clarifying what is in the table. Questions about the missing numbers should be allowed to linger.

- 26 If the question doesn't come up, thank your students for their thoughtful questions, and ask for their help solving a question you have: **We are on our way to this meeting and we need the information lost by the coffee spill. Can we use the information in the table and fill in the missing numbers?**
- 27 Have students get into groups of 2-3, but ask them to work individually for a few minutes first. This will give students to have a moment to make their own sense of things.
- 28 Once group work begins, walk around the room and look for students who may be struggling. Here are some things to look out for:
- Students may need some support understanding what each of the columns in the chart mean.
  - Students who are working on cheese and divide the Wholesale Cost per Unit (\$9.50) by the Servings per Unit (80) and get 0.11875 for the cost per serving. Teachers can refer students back to the earlier conversation during the *Food Cost and Menu Prices* worksheet.
  - Students working on the turkey slices will need to know that there are 16 ounces in a pound.
  - Students who need more support making the connection between their work on the *Food Cost and Menu Prices* worksheet and how the Cost per Serving is calculated.
- 29 If any students finish early, this question can help extend the problem for them, while keeping them engaged with the same activity:  
Design a sandwich using any of the items from the *Wholesale Food Order Spreadsheet*. Determine the menu price for your sandwich.  
This question requires students first calculate the food cost and then use that number to calculate the menu price.
- 30 Now that we have a complete *Wholesale Food Order Spreadsheet*, we are ready to take orders from customers. Hand out *Pricing Orders for a Catering Business, Part Two* with the *HSE Catering Menu* (back to back). Each group will now get an order from a client. Give each group order A, B, or C. Some groups will probably have the same order, but you may want to have them work in separate parts of the room, at least at first.
- 31 You can use the *Support and Push Cards* to help students who need more support and extend the problem for students who move quickly through the initial activity. We recommend cutting out the cards in advance, so that you can give them out quickly in response to the progress you see in different student groups.



- 32** Possibilities for reviewing student work:
- If two student groups had the same order, ask them to check with each other to see if they came up with the same total price in their quote. If not, ask them to find out why.
  - Students can make posters to present their calculations and explain their pricing to the rest of the class as if they were the client.
- 33** The following list showing the food cost and menu price for different items is for teacher's reference in reviewing student work.

<b>Cheeseburger:</b>	food cost \$1.54 (bun \$.31, patty \$.56, cheese \$.12, tomato \$.25, chips \$.30), menu price \$5.13
<b>Veggie Burger:</b>	food cost \$1.80 (bun \$.31, patty \$.82, cheese \$.12, tomato \$.25, chips \$.30), menu price \$6.00
<b>Turkey Sandwich:</b>	food cost \$1.30 (bread \$.28, turkey \$.50, cheese \$.12, tomato \$.25, potato \$.15), menu price \$4.33
<b>Hot Dogs:</b>	food cost \$.96 (hot dogs \$.67, buns \$.29), menu price \$3.20
<b>Salad:</b>	food cost \$.88 (lettuce mix \$.63, tomato \$.25), menu price \$2.93
<b>Soda:</b>	food price \$.26, menu price \$.87
<b>Iced Tea:</b>	food price \$.28, menu price \$.93
<b>Water:</b>	food price \$.10, menu price \$.33
<b>Ice cream:</b>	food price \$.25, menu price \$.83
<b>Cake:</b>	food price \$.37, menu price \$1.23



## Food Cost and Menu Prices

In order to make a profit, restaurant managers have to make sure they have money left over after buying food, paying rent and utilities and paying employees. But how do they know how to set menu prices and determine how much profit they will make?

If everything is working well, restaurants often use the following breakdown for how to spend the money that comes in:

- 30% goes to food cost
- 30% goes to overhead
- 30% goes to payroll
- 10% goes to profit

**Food cost** refers to the wholesale cost of food and beverages

**Overhead** refers to equipment, rent, repairs, etc.

**Payroll** refers to employees, unemployment insurance, etc.

**Profit** refers to money remaining after expenses are paid for

**Wholesale cost** refers to what stores and restaurants pay for an item (as opposed to retail cost, which is what customers pay)

### Determining Food Cost

When a restaurant wants to put a new item on its menu, they first determine the wholesale cost of the food in the item.

For example, let's say a restaurant wants to sell a veggie burger with a side of potato chips. The food cost is the amount of money the restaurant spends on food supplies to make that dish. The recipe calls for 1 bun, 1 tomato slice ( $\frac{1}{4}$  of a tomato), 1 veggie burger patty, and  $\frac{1}{4}$  pound of cheddar cheese. Use the chart below to calculate the total food cost for the veggie burger.

Wholesale prices are included below for the items in this dish.

Ingredient	Wholesale Cost per Unit	Cost per Serving
Buns	\$2.50 per pack of 8 buns	$\$2.50 \div 8 = .3125 \cong \$0.31$
Veggie Burger Patties	\$9.80 per pack of 12 patties	
Tomatoes	\$1.00 per tomato	
Cheese	\$9.50 per 10 pound block	
Potato Chips	\$12.00 for 40 small bags	
<b>Total Food Cost for Menu Item</b>		

Is this the price the restaurant should charge for the veggie burger? Why or why not?

## Using Benchmarks to Calculate Percents

There are different ways to calculate percents. One way is to use common percents called benchmarks. 50%, 25% and 10% are all common benchmark percents. Let's focus on 10%.

10% is equivalent to .10 or  $1/10$ . Each of these mean we are talking about a whole divided into ten equal parts.

Let's imagine we have a total of 360 plates in our restaurant. That 360 represents 100% of the plates we have. If we divide those 360 plates into 10 equal groups, we would have 10 groups of 36. ( $360 \div 10 = 36$ )

36	36	36	36	36	36	36	36	36	36
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

So we can see that 10% of 360 is 36. Once we determine 10% of a number, we can use that information to figure out other percents. For example, if 10% of 360 is 36 plates, 20% would be 72 plates. 30% would be 108 plates, etc.

*(continued on next page)*



In this exercise, you will use the benchmark of 10% to determine 30% of a number.  
Complete the table.

100% (Whole)	10%	30%
10	1	3
50	5	
100		
70		
25		
12	1.2	
	3	
		6
2.50		
1.50	.15	
6.00		1.80

## Setting Menu Prices

When figuring out how much to charge for an item on the menu, many restaurants use the following function: *Food cost divided by 30% equals the menu price*

or  $\frac{c}{.30} = p$ , where  $c$  is the food cost and  $p$  is the menu price.

- 1 Using this function and your work from page 1, what should the menu price be for the veggie burger and chips? Explain how you determined your answer.
- 2 Let's say the food cost of a fried chicken dinner is \$3.00. What should the menu price be? How do you know?
- 3 When you are looking at the menu in a restaurant, you might wonder what the food cost is for a particular menu item. For example, if a fish sandwich is listed in a menu for \$5.00, about how much is the food cost of that sandwich? How do you know?
- 4 Make up your own menu item for a restaurant you might open. Decide on the food cost and calculate the menu price.



- 5 Functions are a big part of high school equivalency exams. We can use functions to show the relationship between two quantities.

The function above can be used to describe the relationship between the food cost and the menu price of various food items. Use the rule to complete the function table below.

**RULE:**

$$\frac{c}{.30} = p$$

*(Food cost divided by 30% equals the menu price)*

Menu Item	Food Cost (c)	Menu Price (p)
Bubble Tea	\$0.90	\$3.00
Lasagna	\$2.40	
Burrito	\$1.65	
Taco	\$0.45	
Potato salad	\$0.30	\$1.00
Baked Ziti	\$1.05	
Milkshake		\$1.50
Ramen	\$2.00	
Pizza slice		\$2.00

- 6 If all is going well, using the 30/30/30/10 rule, 10% of the menu price would go towards profit. Choose 4 menu items from the table above and calculate the profit for each one.

## Pricing Orders for a Catering Business, Part One

Congratulations, you have started your very own catering business! A local business would like to hire you to provide food for their annual company picnic. They are looking to provide sandwiches, sides, beverages and dessert for 50 people.

You are on your way to meet with the client to go over your menu, discuss their order and calculate a total price quote. But, oh no! You spill coffee on your Wholesale Food Order Spreadsheet, which has information you will need to calculate your food costs and your menu prices.

Take a look at the Wholesale Food Order Spreadsheet.

I notice...	I wonder...



## Wholesale Food Order Spreadsheet

Ingredients/Menu Items	Unit	Wholesale Cost per Unit	Serving Size	Servings per Unit	Cost per Serving
Cake, half sheet	54 servings	\$20.00	1 piece	54	\$0.37
Cheese	10 lb.	\$9.50	2 ounces	80	\$0.12
Hamburger buns, whole grain	pack of 8	\$2.50	1 bun	8	\$0.31
Hamburger patties	pack of 48	\$27.00	1 patty	48	\$0.56
Hot dog buns, whole grain	pack of 24	\$3.50	2 buns	12	\$0.29
Hot dogs	pack of 24	\$8.00	2 hot dogs	12	\$0.67
Ice cream	5 quarts	\$5.00	1 cup	20	\$0.25
Iced tea cans	36 pack	\$10.00	1 can	36	\$0.28
Ketchup	114 fl. oz.	\$4.00	1 tablespoon	228	\$0.18
Lettuce mix	1 lb.	\$5.00	2 ounces	8	\$0.63
Mayonnaise	128 fl. oz.	\$7.00	1 tablespoon	256	\$0.27
Mustard	105 fl. oz.	\$4.25	1 teaspoon	630	\$0.07
Potato chips	pack of 40 bags	\$12.00	1 bag	40	\$0.30
Potatoes	10 lb.	\$6.00	4 ounces	40	\$0.15
Salad dressing	128 fl. oz.	\$7.00	2 tablespoons	128	\$0.05
Soda cans	35 pack	\$9.00	1 can	35	\$0.26
Tomatoes	10 tomatoes	\$10.00	1/4 of tomato	40	\$0.25
Turkey sliced, oven rstd	3 lb.	\$8.00	3 ounces	12	\$0.67
Veggie burger patties	pack of 12	\$9.80	1 patty	12	\$0.82
Water bottles	40 pack	\$4.00	1 bottle	40	\$0.10
Whole grain bread	loaf with 16 slices	\$2.25	2 slices	8	\$0.28



## Pricing Orders for a Catering Business, Part Two

Now that you have your full *Wholesale Food Order Spreadsheet*, you are ready to hear your client's order.

Using *Wholesale Food Order Spreadsheet* and your client's order, your task is to complete the HSE Catering Menu and determine the total price quote for your client.

**USE THE SPACE BELOW TO DO ALL YOUR CALCULATIONS:**



## Client Catering Orders

Make copies of this sheet and cut out the orders below. You will need one order per group. Some groups may have the same order.

Order A	
Item	# of Servings
Cheeseburger	10
Veggie Burger	20
Turkey Sandwich	15
Hot Dogs	15
Salad	30
Soda	30
Iced Tea	20
Water	20
Ice cream	50
Cake	0

Order B	
Item	# of Servings
Cheeseburger (includes bun, patty, cheese, tomato and potato chips)	20
Veggie Burger (includes bun, patty, cheese, tomato and potato chips)	10
Turkey Sandwich (includes bread, turkey, cheese, tomato and potato salad)	10
Hot Dogs (includes two hot dogs and buns)	20
Salad (includes lettuce mix and tomatoes)	20
Soda	20
Iced Tea	20
Water	30
Ice cream	0
Cake	50

Order C	
Item	# of Servings
Cheeseburger (includes bun, patty, cheese, tomato and potato chips)	10
Veggie Burger (includes bun, patty, cheese, tomato and potato chips)	10
Turkey Sandwich (includes bread, turkey, cheese, tomato and potato salad)	20
Hot Dogs (includes two hot dogs and buns)	20
Salad (includes lettuce mix and tomatoes)	40
Soda	20
Iced Tea	10
Water	40
Ice cream	25
Cake	25



# HSE Catering Menu

This is our menu for company picnics and other corporate events. Please choose the items and quantity you would like for your event. We will provide an estimated cost of your event within 24 hours.

Item	# of Servings	Menu price	Total Price
<b>LUNCH MENU</b>			
<b>Cheeseburger</b> (includes bun, patty, cheese, tomato and potato chips)			
<b>Veggie Burger</b> (includes bun, patty, cheese, tomato and potato chips)			
<b>Turkey Sandwich</b> (includes bread, turkey, cheese, tomato and potato salad)			
<b>Hot Dogs</b> (includes two hot dogs and buns)			
<b>Salad</b> (includes lettuce mix and tomatoes)			
<b>BEVERAGES</b>			
<b>Soda</b>			
<b>Iced Tea</b>			
<b>Water</b>			
<b>DESSERT</b>			
<b>Ice cream</b>			
<b>Cake</b>			
<b>Total Price Quote</b>			



## Support and Push For Pricing Orders for a Catering Business

Cut out these cards before class. Share a card with a group of students only if they need it to keep working productively.



CUT

### SUPPORT

What is the food cost for each ingredient in the cheeseburger?

What's the difference between food cost and menu price?

### PUSH

If everything is going well, your profit should be 10% of the menu price. What would be your profit for this job?

Your client wants to know exactly how you calculated your total price quote. On a piece of newsprint, explain your method in a way your client will understand.

Your client reviewed your proposal for the catered picnic and has determined that the price is beyond their budget. As a group, consider whether you can offer a lower price. How much lower would you be willing to go? Explain your reasoning.

Your client reviewed your proposal for the catered picnic and has determined that the price is beyond their budget. What 2 suggestions could you make to the client that would lower the total price quote? Explain your reasoning.