King's Deli

A-E Strand(s): Number and Data

Topic/Expectation

    N.A.1 Rational Numbers

        d. Know and apply effective methods of calculation with rational numbers.

        f.   Solve practical problems involving rational numbers.

    N.B.1 Estimation and approximation

        b. Develop, apply and explain different estimation strategies for a variety of common arithmetic problems.

Other Topic/Expectation(s)

    N.A.4 Ratios, rates, and derived quantities

        f. Identify and apply derived measures.

Rationale

This task allows students to see how calculations with rational numbers can help deal with practical problems from real-world situations, including working in a restaurant.

Instructional Task

Darien is the manager at King's Deli. The cash register at work has broken and Darien needs to calculate two customers' bills by hand. Use the menu below to answer questions 1–4.

KING'S DELI

APPETIZERS

Garlic Bread...$2.95
Soup De Jour...cup $2.25
                                                                                    bowl $3.50

SALADS

Greek Salad...$5.99
Mixed Green..$2.75
Chef Salad..$6.95
Garden Salad with Grilled Chicken $7.25

SANDWICHES

#1 Chicken, Ham, Swiss, Lettuce, Tomato, & Mayo...............$5.75
#2 Pepper Turkey, Muenster, Lettuce, Tomato, &
    Honey Mustard...$6.25
#3 Egg Salad, Lettuce, Tomato, & Mayo...................................$4.80
#4 Salami, Pepperoni, Ham, Provolone, Onions, Peppers,
    Italian Dressing..$6.75
#5 Hot Roast Beef, Mozzarella, Lettuce, Tomato, Onion,
    & Mayo..$6.25

SIDE DISHES

Potato Salad...$2.50
Pasta Salad...$2.50
Fresh Fruit Cup...$3.00
Small Salad..$3.75

DESSERTS
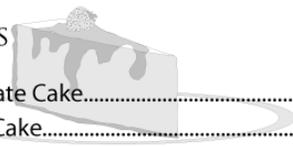
Chocolate Cake...$2.00
Carrot Cake...$2.00
Lemon Meringue Pie..$2.00
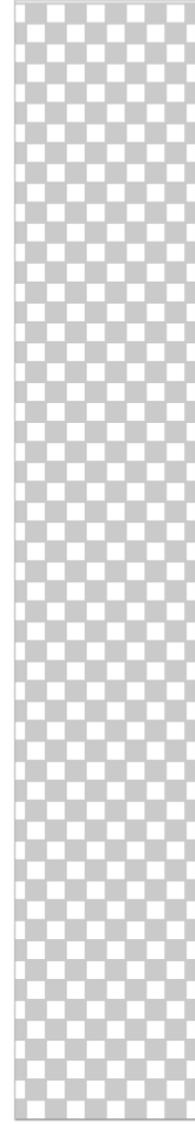
1. Customer 1 orders a cup of soup, a Greek salad, and sandwich # 4. Customer 2 orders sandwich # 5 and chocolate cake. Customer 1 has a coupon for 15% off the total price of a meal. Each customer must pay 7.5% sales tax. Describe how Darien could calculate the total bill for each customer.

2. When calculating the price of the first meal, Darien decides to try a short cut. He reasons that if the customer receives 15% off but must pay 7.5% in tax, it would be the same as receiving a 7.5% discount. Will Darien's shortcut yield the same result as first calculating a 15% discount and then adding 7.5% tax? Provide an explanation supporting your answer.

3. Customer 2 tells Darien he would like to leave an 18% tip after tax has been calculated. He asks Darien how much he should leave. Describe one way that Darien could estimate the tip.

4. Darien realizes that the restaurant is selling lots of sandwiches but is not selling very many side dishes. He decides to raise the price of each sandwich by 15% and lower the price of each side dish by 20% to see if customers will pay the increased price of sandwiches and if more customers will buy side dishes at the reduced prices. Describe how Darien calculated the new price for each sandwich and side dish.

Discussion/Extension/Notes

This task addresses content we might expect all algebra students to know, but it allows a review of computation with decimals in a real-life context without re-teaching math concepts. An actual menu from a local restaurant might also be used for a task like this.

One point of discussion might involve how restaurants actually determine their prices. Discuss with students whether the new prices found in question 3 are the kind of prices a restaurant might charge for menu items. For example, is it likely that a deli would charge an amount like $7.13 for a sandwich (rather than $7 or $7.49 or $6.99)? If not, what would be a more likely price for the sandwich?

The task also allows for a group discussion about how tips can be estimated mentally.

Sample Solutions

1. Customer 1 orders a cup of soup, a Greek salad, and sandwich # 4. Customer 2 orders sandwich # 5 and chocolate cake. Customer 1 has a coupon for 15% off the total price of a meal. Each customer must pay 7.5% sales tax. Describe how Darien could calculate the total bill for each customer.

Customer 1:	*cup of soup $2.25, Greek salad $5.99, sandwich # 4 $6.75*
	$2.25 + $5.99 + $6.75 = $14.99
Using the coupon:	*15% of $14.99 is → 0.15 • $14.99 = $2.25*
	$14.99 - $2.25 = $12.74
Calculate tax:	*7.5% of $12.74 is → 0.075 • $12.74 = $0.96*
	$0.96 + $12.74 = $13.70
Total Bill:	*$13.70*
Customer 2:	*sandwich # 5 $6.25, chocolate cake $2.00*
	$6.25 + $2.00 = $8.25
Calculate tax:	*7.5% of $8.25 is → 0.075 • $8.25 =$0.62*
	$0.62 + $8.25 = $8.87
Total Bill:	*$8.87*

2. When calculating the price of the first meal, Darien decides to try a short cut. He reasons that if the customer receives 15% off but must pay 7.5% in tax, it would be the same as receiving a 7.5% discount. Will Darien's shortcut yield the same result as first calculating a 15% discount and then adding 7.5% tax? Provide an explanation supporting your answer.

   The shortcut will not yield the same result as will the process used in question 1. The discount of 7.5% off $14.99 is $1.12. Subtracting this amount from $14.99 yields $13.87. Since $13.87 is not equal to $13.70 (calculated in question 1), it is clear that the shortcut does not yield the same result as taking 15% off the total price, then adding the tax to that amount. The reason for this is that the 15% discount is taken from the total price of the meal, and the 7.5% is added to the amount left after the discount is taken. When you use the shortcut, it does not account for the fact that the 7.5% tax is not added to the total bill, but rather to the bill after the discount has been taken.

3. Customer 2 tells Darien he would like to leave an 18% tip after tax has been calculated. He asks Darien how much he should leave. Describe one way that Darien could estimate the tip.

   Estimate an 18% tip on a total bill of $8.87. The price of the bill is approximately $9.00 and 10% of $9.00 is $0.90. Find half of $0.90 to calculate the approximate value for 5% of the total bill. This is half of $0.90 is $0.45. To find 15%, add $0.90 and $0.45, which equals $1.35. To find 20%, add $0.90 and $0.90, which equals $1.80. 18% must be between 15% ($1.35) and 20% ($1.80). In addition, since 17.5% is halfway between 15% and 20% and 18% is a little more than 17.5%, the tip estimate should be a little more than half way between $1.35 and $1.80. The difference between $1.80 and $1.35 is $0.45 and half of

$0.45 is $0.225. A little more than this value might round to $0.25. Therefore, an 18% tip is approximately $1.35 + $0.25 = $1.60.

4. Darien realizes that the restaurant is selling lots of sandwiches but is not selling very many side dishes. He decides to raise the price of each sandwich by 15% and lower the price of each side dish by 20% to see if customers will pay the increased price of sandwiches and if more customers will buy side dishes at the reduced price. Describe how Darien calculated the new price for each sandwich and side dish.

To increase each sandwich price by 15% multiply the current price by 1.15 (to represent 100% plus 15% of the original price.)

Sandwich # 1 → $5.75 • 1.15 = $6.61
Sandwich # 2 → $6.25 • 1.15 = $7.19
Sandwich # 3 → $4.80 • 1.15 = $5.52
Sandwich # 4 → $6.75 • 1.15 = $7.76
Sandwich # 5 → $6.25 • 1.15 = $7.19

To decrease the price of each side dish by 20% either multiply the current price by .80 or multiply the current price by .20 and subtract this value from the current price.

Potato Salad → $2.50 • 0.80 = $2.00
Pasta Salad → $2.50 • 0.80 = $2.00
Fresh Fruit Cup → $3.00 • 0.80 = $2.40
Small Salad → $3.75 • 0.80 = $3.00