



Activity 1: Choosing the better deal

Mathematical Goals

The student will use percentages to determine which coupon is better.

In part I the student will:

- Read an advertisement and interpret the information
- Perform operations with percentages
- Complete a table
- Work with percentages in a meaningful context familiar to students

In part II, appropriate for students who have been introduced to basic algebra, the student will:

- Transition to the use of Algebra to answer a question
- Evaluate an algebraic expression for different values of the variable
- Solve an algebraic equation

Before the lesson (5-10 minutes)**Number talk possibilities:**

Select two or three depending on student abilities.

- Find 10% of \$30.00.
- Find 10% of \$23.00.
- Find 10% of \$23.50.
- Find 5% of \$30.00.
- Find 5% of \$23.00.
- Find 5% of \$23.50.



Choosing the better deal

Jimmy's Coney Island sends out the coupon below in a weekly mailer.

Chris went to Coney for a quick lunch. His bill for the meal was \$5.00. He handed the cashier the 15% off coupon.

1. How much money did he save? How much did he pay for lunch?

His friend Clarissa wondered why Chris had not used the \$2 coupon instead. Chris told her to look carefully at the rule for using the \$2 coupon.

2. Why couldn't Chris use the \$2 coupon?
3. If Chris could have used the \$2 coupon what percent of the bill would he have saved?
4. Why do you think Coney Island limited the use of the \$2 coupon?

- Ramon, Jennifer and Marianne were having a hearty breakfast at Jimmy's and the total bill came to \$35. Which coupon should they use to save the most money? Justify your answer by finding the savings for both coupons and then comparing them.
- Donald was having breakfast alone and his total bill was \$10. Which coupon should he use to save the most money? Justify your answer by finding the savings for both coupons and then comparing them.

Chris' friend Clarissa came up with a different way to think about the problem. She wanted to organize her thinking. She let y represent the total bill for any meal. The letter y is called a *variable*, because its value can change. Different meals can have different total bills. To find 15% of a number, you can multiply the number by 0.15. She multiplies y by 0.15 to represent the amount taken off the total bill if they use the 15% off coupon:



$0.15y$ = the amount taken off the total bill if you use the 15% off coupon.

If a dinner costs \$30, the variable, y , is replaced by \$30 in the expression. Then the amount off is

$$0.15(\$30) = \$4.50, \text{ and the dinner costs } \$30.00 - \$4.50 = \$25.50$$

If a dinner costs \$18, then y is replaced in the expression by \$18. The expression representing the amount off is $0.15(\$18) = \2.70 , and the dinner costs $\$18.00 - \$2.70 = \$15.30$.

- Fill in Table 1 for $y = \$11.00$ and $\$15.00$.

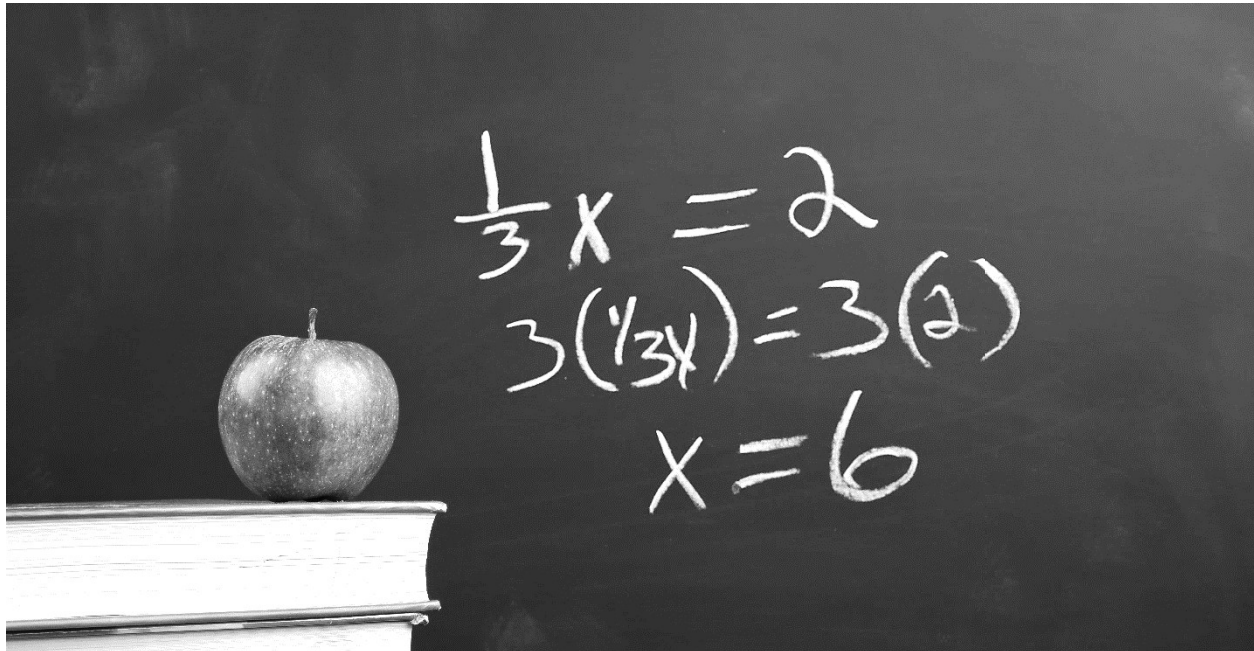
Total Bill y	15% off Coupon		\$2.00 off Coupon	
	Amount Off $0.15y$	Final Bill $y - 0.15y$	Amount Off \$2.00	Final Bill $y - 2.00$
\$5.00	$(0.15)\$5.00=\0.75	$\$5.00-\$0.75=\$4.25$	Not Applicable	Not Applicable
\$10.00	$(0.15)\$10.00=\1.50	$\$10.00-\$1.50=\$8.50$	\$2.00	$\$10.00-\$2.00=\$8.00$
\$11.00				
\$15.00				
\$18.00	$(0.15)\$18.00=\2.70	$\$18.00-\$2.70=\$15.30$	\$2.00	$\$18.00-\$2.00=\$16.00$
\$30.00	$(0.15)\$30.00=\4.50	$\$30.00-\$4.50=\$25.50$	\$2.00	$\$30.00-\$2.00=\$28.00$
\$35.00	$(0.15)\$35.00=\5.25	$\$35.00-\$5.25=\$29.75$	\$2.00	$\$35.00-\$2.00=\$33.00$

Table 1: Comparison of two coupons for different priced meals

8. Try some different values for y in the table above to find the prices when the \$2.00 off coupon is the better deal and when the 15% off coupon is the better deal. Is there any price when the two coupons result in the same deal? If so, what is that price?

Use the data in Table 1 to fill in the following two statements:

9. When the bill is less than _____ the better coupon is _____ off.
10. When the bill is more than _____ the better coupon is _____ off.

Part II – Algebra – Better than trial and error

By substituting numbers for the variable in the table, it is possible to see a pattern when one coupon is better than the other. However, this method does not easily find the exact value at which the two coupons are worth the same. In the above discussion, the representation $(0.15)y$ is called an algebraic expression. This algebraic expression is useful, because it represents the amount taken off any meal when the 15% off coupon is used. It also can be used to answer the question, “When is the amount taken off the same for both coupons?” To answer that question, we can write an *algebraic equation*. We set the 15% off algebraic expression equal to \$2, the constant amount taken off when using the other coupon.

$$0.15y = \$2$$

algebraic expression: a mathematical expression that consists of variables, constant numbers and mathematical operations. (Addition and multiplication are examples of operations.) The value of an algebraic expression changes as the value of the variable changes.

We now need to find the value of y that makes the algebraic expression equal to \$2. Finding the correct value of y is what solving an algebraic equation means. To do this, we apply the same mathematical operations to both sides of the equation until we are left with just $1y$ on the left hand side. In the equation, y has been multiplied by 0.15. To undo multiplying by 0.15, we use the inverse operation, division. When we divide both sides of the equation by 0.15, the left hand side becomes $1y$, because $0.15y/0.15 = 1y$. The two sides of the equation are still equal, so

$$1y = \$2 \div 0.15 \approx \$13.33.$$

11. To show that this answer is correct calculate $(0.15)(\$13.33)$. Is the answer \$2?

12. Which coupon would be better if the meal cost

- a. \$13.34?
- b. \$13.30?
- c. \$13.36?
- d. \$13.29?
- e. \$13.37?

Solving an algebraic equation. To solve an algebraic equation, change the equation so that the variable $1y$ is alone on one side of the equation, and the other side is a number. To do this, carry out the same mathematical operations (+, −, ×, ÷) in the same order on both sides of the equation. Anytime you carry out the same operation on both sides of the equation, the quantities will still be equal. We can subtract or add the same number to each side of an equation, and the two sides will still be equal. We can multiply or divide both sides of an equation by the same number, and the two sides will still be equal. This process of performing the same operations on both sides of an equation to reach the goal of just $1y$ on one side and a number on the other is one of part of learning algebra. When you learn the process, you have the ability to solve an equation. You will develop this skill as you study different kinds of algebraic equations. You will learn to recognize patterns to decide what set of operations should be applied to both sides of the equation.

13. Based on your previous answers, for which prices does
- the \$2.00 off coupon give the most off?
 - the 15% off coupon give the most off?
 - the two coupons give the same amount off?

Jimmy's Coney Island determined the coupons they were offering reduced their profits too much. They decided to offer coupons of 10% off or \$1.50 off.

14. For what priced meals should you use the 10% coupon? When should you use the \$1.50 coupon? When are the savings for both coupons equal?



Project Idea:

Look for an advertisement that has a restriction on using the discount. What is the restriction? Does it make sense?

Look for advertisements that offer both a percent discount and a fixed dollar discount. Determine the range of prices for which the percent coupon is better than the fixed amount.



Practice problems

1. You are purchasing a gift online and the total bill is \$24.52. The site offers a discount coupon of 20% off the total bill or free shipping and handling for orders over \$20. The shipping and handling fee for this order is quoted at \$5.29. Which offer saves you the most?

2. The online site above offers gift wrapping for \$2.00. You decide to have your gift wrapped which brings the total bill to \$26.52. Which offer saves you the most?
3. Rosie's Cafe offers a percentage discount on your birthday equal to your age. You must show valid ID with birthdate to qualify. You plan to eat at Rosie's on your 18th birthday. You also found a \$4 off coupon for meals at Rosie's over \$16.00. Your total bill is \$17.65. Which discount saves you the most?
4. On your 18th birthday at Rosie's, what price for the total bill is the discount with the \$4 off coupon and the 18% birthday discount the same?
5. A car dealership offers two choices as discounts. The first choice is \$2,016 dollars off the price for 2016 model year cars. The second choice is an 11% discount on your vehicle of choice. You have decided to purchase a slightly used Kia from 2016. The purchase price is \$18,500. Which discount offer saves you more money?

6. You are looking into buying a new car. You have a family and friends discount from Ford Motor Company and that will save you 17% off the sticker price. Ford is presently running a sale to reduce inventory. The sale involves a "cash discount" of \$4,000. The vehicle you have in mind has a sticker price of \$22,994. Which discount will save you more?