



Activity 1: Teachers' guide

Thinking through a lesson protocol**Standards:**

6.RP.A.3.C: Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

6.EE.A.2.A: Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as $5 - y$.*

6.EE.A.2.C: Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

6.EE.A.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.A.7: Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.

Mathematical Practices:

MP1: Make sense of problems and persevere in solving them.

MP2: Reason abstractly and quantitatively.

MP3: Construct viable arguments and critique the reasoning of others.

MP6: Attend to precision.

Setting up the problem - Launch	
Selecting tasks/goal setting	(15-20 minutes) Briefly discuss or ask students in a whole group setting for ideas when percentages are used in real life. Prior to working this scenario, students should read the "Introduction to Percentages."
Questions	Can you think of a time that percentages are used? Think on your own, what is the relationship between 25% and a quarter? Share it with a friend. Students could build a table similar to the one given in the "Introduction to Percentages."

Monitoring student work - Explore		
Strategies and misconceptions- Anticipating	Who - Selecting and sequencing	Questions and statements - Monitoring
(20 minutes) Have students look at coupon from Jimmy's Coney Island and answer questions #1-6. Share results with whole group.		Explain the differences and the similarities between the coupons in the flyer. Note: Be sure to mention that the \$2.00 off coupon may only be used when the total bill is \$10 or more.
(20 minutes) Read text section after question #6 and before question #7 as a whole class. Then solve and discuss questions #6-10.		
(20 minutes) Read text section in Part II as a whole class. Then solve questions #11-14.		Depending on students' prior knowledge of algebraic expressions the time spent on this section may vary. Spend more time if this is their first exposure, less if they are comfortable with expressions.
		When solving equations, stress the importance of inverse operations (undoing) and performing the same operation on both sides of the equation sign to keep the quantities equal.

Monitoring individual student work - Explore		
Strategies and misconceptions- Anticipating	Who - Selecting and sequencing	Questions and statements - Monitoring
For off-task students or for students that seem to be self-conscious about you listening to them share.		<p>I am just listening or looking to find out how you are working on the problem.</p> <p>This helps me think about what we will do later.</p> <p>What do you think is the Big Idea in the Introduction to Percentages reading?</p>
For students that appear to be stuck.		<p>Can you tell me a little about your reading? How could you describe the relationship between percents and coins/dollars?</p> <p>How would you describe the problem in your own words?</p> <p>What facts do you have?</p> <p>Could you try it with simpler numbers? Fewer numbers?</p>
For students that want to ask you questions, these are ways to uncover their thinking and judge to what extent you want to respond.		<p>Tell me what you've thought about so far. What do you know?</p> <p>Why are you interested in more information about that?</p> <p>Let me say a little about that part.</p>

Managing the discussion – Summarize	
Parts of discussion - Connecting	Questions and statements - Connecting
Launching the discussion: Select the problems in questions #7-10 that students are struggling with or you wish to share out.	<p>Will team 1 start us off by sharing one way of working on this problem?</p> <p>Please raise your hand when you are ready to share your solution.</p> <p>What did you do first when you were working on this problem?</p> <p>Let's start by clearing up a few things about the problem.</p> <p>Let's list some key parts in this problem?</p> <p>What was unclear in the problem?</p>
Eliciting and uncovering student strategies	<p>Joe would you be willing to start us off?</p> <p>What have you found so far?</p> <p>Can you repeat that?</p> <p>Can you explain how you got that answer? How do you know?</p> <p>Walk us through your steps. Where did you begin? Can you show us?</p>
Focusing on mathematical ideas	<p>Can you explain why this is true? Does this method always work?</p> <p>How is Bob's method similar to Kelly's method?</p> <p>What do all the solutions have in common?</p> <p>What would happen if I changed the numbers to _____?</p>
Encouraging interactions	<p>Do you agree or disagree with Kahlil's idea?</p> <p>What do others think?</p> <p>Would someone be willing to repeat what Tom just said?</p> <p>Would anyone be willing to add on to what Sue just said?</p>
Concluding the discussion	<p>Can anyone tell me some of the big ideas that we learned today?</p> <p>How would you explain what we learned today to a 5th grader?</p> <p>Some of the key points from our discussion today are . . .</p> <p>Tomorrow we will continue our exploration of _____ beginning with the idea from today that _____.</p>
Post lesson notes	You may wish to assign the practice problems that you feel would benefit the students.

Answers – choosing the better deal

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

Saved $0.15 \times \$5 = \0.75 . Total cost = $\$5.00 - \$0.75 = \$4.25$

2. Why couldn't Chris use the \$2 coupon?

The \$2 coupon can only be used for purchases of \$10 or more.

3. If Chris could have used the \$2 coupon what percent of bill would he have saved?

$(\$2/\$5)$ (100%) = 40% savings

4. Why do you think Coney Island limited the use of the \$2 coupon?

The restaurant would make no money on the meal when the percent discount is large compared to the bill. Only when the bill is \$10 or more do they feel there is enough profit to afford a \$2 discount.

5. 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.

Solution 1

15% OFF Coupon: \$2.00 OFF Coupon:

You will save 15% of \$35.00? You will save \$2.00

*$0.15 * \$35.00 = \5.25*

You save more with the 15% OFF Coupon

Solution 2

15% OFF Coupon: \$2.00 OFF Coupon:

You will pay 85% of the bill. You will get \$2.00 off your bill.

$0.85 \times \$35.00 = \29.75 $\$35.00 - \$2.00 = \$33.00$

The 15% OFF Coupon results in a smaller bill and saves the most money.

6. 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.

Solution 1

15% OFF Coupon: \$2.00 OFF Coupon:

You will save 15% of \$10.00? You will save \$2.00

$0.15 \times \$10.00 = \1.50

The \$2.00 OFF Coupon results in a smaller bill and saves the most money.

Solution 2

15% OFF Coupon: \$2.00 OFF Coupon:

You will pay 85% of the bill. You will get \$2.00 off your bill.

$$0.85 \times \$10.00 = \$8.50 \quad \$10.00 - \$2.00 = \$8.00$$

The \$2.00 OFF Coupon saves you the most money.

7. Fill in the Table 1 below 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	$0.15(\$11.00) = \1.65	$\$11.00 - \$1.65 = \$9.35$	\$2.00	$\$11.00 - \$2.00 = \$9.00$
\$12.00	$0.15(\$12.00) = \1.80	$\$12.00 - \$1.80 = \$10.20$	\$2.00	$\$12.00 - \$2.00 = \$10.00$
\$13.00	$0.15(\$13.00) = \1.95	$\$13.00 - \$1.95 = \$11.05$	\$2.00	$\$13.00 - \$2.00 = \$11.00$
\$15.00	$0.15(\$15.00) = \2.25	$\$15.00 - \$2.25 = \$12.75$	\$2.00	$\$15.00 - \$2.00 = \$13.00$
\$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?

Answers will vary. See the calculations added to the Table 1.

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

When the bill is less than \$10 the better/only coupon is 15% off. For bills between \$10 and approximately \$13.29, the better coupon is the \$2.00 off coupon.

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

When the bill is more than \$13.37, the better coupon is the 15% off.

Part II Algebra

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

$(0.15)(\$13.33) = \$1.9995 \approx \$2.00$; yes, when rounded-off to the nearest penny, which is the smallest coin denomination.

12. Which coupon would be better if the meal cost is

- \$13.34? $(0.15)(\$13.34) = \$2.001 \approx \$2.00$; the coupons are equal in value
- \$13.30? $(0.15)(\$13.30) = \$1.995 \approx \$2.00$; the coupons are equal in value
- \$13.36? $(0.15)(\$13.36) = \$2.004 \approx \$2.00$; the coupons are equal in value
- \$13.29? $(0.15)(\$13.29) = \$1.9935 \approx \$1.99$; the \$2.00 off coupon is better
- \$13.37? $(0.15)(\$13.37) = \$2.0055 \approx \$2.01$; the 15% off coupon is better

13. Based on your answers to questions 5 and 6, for which prices does

- the \$2.00 off coupon give the most off? *Prices \leq \$13.29*
- the 15% off coupon give the most off? *Prices \geq \$13.37*
- the two coupons give the same amount off?

Because of rounding to the nearest penny, the discount is the same for prices from \$13.30 to \$13.36

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?

To answer that question, we can write an algebraic equation. We set the 10% off algebraic expression equal to \$1.50, the constant amount taken off when using the other coupon.

$$0.1y = \$1.50$$

We divide both sides by 0.1.

$$0.1y / 0.1 = \$1.50 / 0.1$$

$$y = \$15.00$$

However, because of rounding, values close to \$15.00 will also yield a \$1.50 discount.

Solutions to 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?

20% of \$24.52 is \$4.90. That discount is less than \$5.29, therefore, it would be better to take the discount for the shipping and handling of \$5.29.

2. The online site above offers gift wrapping for \$2.00. You decide to have your gift wrapped bringing the total bill to \$26.52. Which offer saves you the most?

20% of \$26.52 is \$5.30. That is one penny more than the shipping and handling discount of \$5.29, therefore, to save the one penny, you would take the 20% off discount.

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?

The discount for the \$17.65 bill would be 18% of \$17.65 which is \$3.177. The \$4.00 off coupon would be more of a savings.

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?

18% of "n" is \$4.00 then $4.00/.18 = \$22.22$. In order for the 18% discount to match the \$4.00 discount, the bill would have to be \$22.22.

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?

11% of \$18,500 is \$2,035. Comparing that to the \$2,016 cash giveaway, the \$2,035 saves you more, precisely \$19 more.

6. You are looking into buying a new car. You have a family and friends discount for 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?

17% of \$22,994 is \$3,908.98. That is less than the \$4,000 discount, so that would save you more, exactly \$91.02 more.