Lesson 4: Percent Increase and Decrease

Classwork

Opening Exercise

Cassandra likes jewelry. She has five rings in her jewelry box.

    a.   In the box below, sketch Cassandra's five rings.

    b.   Draw a double number line diagram relating the number of rings as a percent of the whole set of rings.

    c.   What percent is represented by the whole collection of rings? What percent of the collection does each ring represent?

Example 1: Finding a Percent Increase

Cassandra's aunt said she will buy Cassandra another ring for her birthday. If Cassandra gets the ring for her birthday, what will be the percent increase in her ring collection?

Exercise 1

    a.   Jon increased his trading card collection by 5 cards. He originally had 15 cards. What is the percent increase? Use the equation $\text{Quantity} = \text{Percent} \times \text{Whole}$ to arrive at your answer, and then justify your answer using a numeric or visual model.

    b.   Suppose instead of increasing the collection by 5 cards, Jon increased his 15-card collection by just 1 card. Will the percent increase be the same as when Cassandra's ring collection increased by 1 ring (in Example 1)? Why or why not? Explain.

    c.   Based on your answer to part (b), how is displaying change as a percent useful?

Discussion

A sales representative is taking 10% off of your bill as an apology for any inconveniences.

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Example 2: Percent Decrease

Ken said that he is going to reduce the number of calories that he eats during the day. Ken's trainer asked him to start off small and reduce the number of calories by no more than 7%. Ken estimated and consumed 2,200 calories per day instead of his normal 2,500 calories per day until his next visit with the trainer. Did Ken reduce his calorie intake by no more than 7%? Justify your answer.

Exercise 2

Skylar is answering the following math problem:

The value of an investment decreased by 10%. *The original amount of the investment was* $75.00. *What is the current value of the investment?*

a. Skylar said 10% of $75.00 is $7.50, and since the investment decreased by that amount, you have to subtract $7.50 from $75.00 to arrive at the final answer of $67.50. Create one algebraic equation that can be used to arrive at the final answer of $67.50. Solve the equation to prove it results in an answer of $67.50. Be prepared to explain your thought process to the class.

b. Skylar wanted to show the proportional relationship between the dollar value of the original investment, x, and its value after a 10% decrease, y. He creates the table of values shown. Does it model the relationship? Explain. Then, provide a correct equation for the relationship Skylar wants to model.

x	y
75	7.5
100	10
200	20
300	30
400	40

Example 3: Finding a Percent Increase or Decrease

Justin earned 8 badges in Scouts as of the Scout Master's last report. Justin wants to complete 2 more badges so that he will have a total of 10 badges earned before the Scout Master's next report.

a. If Justin completes the additional 2 badges, what will be the percent increase in badges?

b. Express the 10 badges as a percent of the 8 badges.

c.   Does 100% plus your answer in part (a) equal your answer in part (b)? Why or why not?

Example 4: Finding the Original Amount Given a Percent Increase or Decrease

The population of cats in a rural neighborhood has declined in the past year by roughly 30%. Residents hypothesize that this is due to wild coyotes preying on the cats. The current cat population in the neighborhood is estimated to be 12. Approximately how many cats were there originally?

Example 5: Finding the Original Amount Given a Percent Increase or Decrease

Lu's math score on her achievement test in seventh grade was a 650. Her math teacher told her that her test level went up by 25% from her sixth grade test score level. What was Lu's test score level in sixth grade?

Closing

Phrase	Whole Unit (100%)
"Mary has 20% more money than John."	
"Anne has 15% less money than John."	
"What percent more (money) does Anne have than Bill?"	
"What percent less (money) does Bill have than Anne?"	

Lesson Summary

- Within each problem, there are keywords that determine if the problem represents a percent increase or a percent decrease.

- Equations can be used to solve percent problems using the basic equation

$$\text{Quantity} = \text{Percent} \times \text{Whole}.$$

- *Quantity* in the percent formula is the amount of change (increase or decrease) or the amount after the change.

- *Whole* in the percent formula represents the original amount.

Problem Set

1. A store advertises 15% off an item that regularly sells for $300.

   a. What is the sale price of the item?

   b. How is a 15% discount similar to a 15% decrease? Explain.

   c. If 8% sales tax is charged on the sale price, what is the total with tax?

   d. How is 8% sales tax like an 8% increase? Explain.

2. An item that was selling for $72.00 is reduced to $60.00. Find the percent decrease in price. Round your answer to the nearest tenth.

3. A baseball team had 80 players show up for tryouts last year and this year had 96 players show up for tryouts. Find the percent increase in players from last year to this year.

4. At a student council meeting, there was a total of 60 students present. Of those students, 35 were female.

   a. By what percent is the number of females greater than the number of males?

   b. By what percent is the number of males less than the number of females?

   c. Why is the percent increase and percent decrease in parts (a) and (b) different?

5. Once each day, Darlene writes in her personal diary and records whether the sun is shining or not. When she looked back though her diary, she found that over a period of 600 days, the sun was shining 60% of the time. She kept recording for another 200 days and then found that the total number of sunny days dropped to 50%. How many of the final 200 days were sunny days?

6. Henry is considering purchasing a mountain bike. He likes two bikes: One costs $500, and the other costs $600. He tells his dad that the bike that is more expensive is 20% more than the cost of the other bike. Is he correct? Justify your answer.

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7. State two numbers such that the lesser number is 25% less than the greater number.

8. State two numbers such that the greater number is 75% more than the lesser number.

9. Explain the difference in your thought process for Problems 7 and 8. Can you use the same numbers for each problem? Why or why not?

10. In each of the following expressions, c represents the original cost of an item.

   i. $0.90c$

   ii. $0.10c$

   iii. $c - 0.10c$

  a. Circle the expression(s) that represents 10% of the original cost. If more than one answer is correct, explain why the expressions you chose are equivalent.

  b. Put a box around the expression(s) that represents the final cost of the item after a 10% decrease. If more than one is correct, explain why the expressions you chose are equivalent.

  c. Create a word problem involving a percent decrease so that the answer can be represented by expression (ii).

  d. Create a word problem involving a percent decrease so that the answer can be represented by expression (i).

  e. Tyler wants to know if it matters if he represents a situation involving a 25% decrease as $0.25x$ or $(1 - 0.25)x$. In the space below, write an explanation that would help Tyler understand how the context of a word problem often determines how to represent the situation.