

Name \_\_\_\_\_

Date \_\_\_\_\_

## Percent Increase and Decrease

Erin wants to raise her math grade to a 95 to improve her chances of winning a math scholarship. Her math average for the last marking period was an 81. Erin decides she must raise her math average by 15% to meet her goal. Do you agree? Why or why not? Support your written answer by showing your math work.

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 through 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.

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.

Erin wants to raise her math average to a 95 to improve her chances of winning a math scholarship. Her math average for the last marking period was an 81. Erin decides she must raise her math average by 15% to meet her goal. Do you agree? Why or why not? Support your written answer by showing your math work.

*No, I do not agree. 15% of 81 is 12.15.  $81 + 12.15 = 93.15$ , which is less than 95. I arrived at my answer using the equation below to find 15% of 81.*

*Quantity = Percent  $\times$  Whole*

*Let  $G$  stand for the number of points Erin's grade will increase by after a 15% increase from 81. The whole is 81, and the percent is 15%. First, I need to find 15% of 81 to arrive at the number of points represented by a 15% increase. Then, I will add that to 81 to see if it equals 95, which is Erin's goal.*

$$G = 0.15 \times 81$$

$$G = 12.15$$

*Adding the points onto her average:  $81.00 + 12.15 = 93.15$*

*Comparing it to her goal:  $93.15 < 95$ .*

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

- a. What is the sale price of the item?

*$(0.85)300 = 255$ ; the sale price is \$255.*

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

*In both cases, you are subtracting 15% of the whole from the whole, or finding 85% of the whole.*

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

*$(1.08)(255) = 275.40$ ; the total with tax is \$275.40.*

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

*In both cases, you are adding 8% of the whole to the whole, or finding 108% of the whole.*

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.

*The whole is 72.  $72 - 60 = 12$ . 12 is the part. Using Quantity = Percent  $\times$  Whole, I get*

*$12 = p \times 72$ , where  $p$  represents the unknown percent, and working backward, I arrive at  $\frac{12}{72} = \frac{1}{6} = 0.1\bar{6} = p$ . So, it is about a 16.7% decrease.*

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.

*The number of players that showed up last year is the whole; 16 players are the quantity of change since  $96 - 80 = 16$ .*

*Quantity = Percent  $\times$  Whole. Let  $p$  represent the unknown percent.*

$$16 = p(80)$$

$$p = 0.2$$

$$0.2 = \frac{20}{100} = 20\%$$

*The number of players this year was a 20% increase from last 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?

*The number of males ( $60 - 35 = 25$ ) at the meeting is the whole. The part (quantity) can be represented by the number of females (35) or how many more females there are than the number of males.*

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

$$35 = p(25)$$

$$p = 1.4$$

*$1.4 = 140\%$ , which is 40% more than 100%. Therefore, there were 40% more females than males at the student council meeting.*

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

*The number of females (35) at the meeting is the whole. The part (quantity) can be represented by the number of males, or the number less of males than females (10).*

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

$$10 = p(35)$$

$$p \approx 0.29$$

$$0.29 = 29\%$$

*The number of males at the meeting is approximately 29% less than the number of females.*

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

*The difference in the number of males and females is the same in each case, but the whole quantities in parts (a) and (b) are different.*

5. Once each day, Darlene writes in her personal diary and records whether the sun is shining or not. When she looked back through 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?

*To find the number of sunny days in the first 600 days, the total number of days is the whole.*

*Quantity = Percent  $\times$  Whole. Let  $s$  represent the number of sunny days.*

$$\begin{aligned}s &= 0.6(600) \\ s &= 360\end{aligned}$$

*There were 360 sunny days in the first 600 days.*

*The total number of days that Darlene observed was 800 days because  $600 + 200 = 800$ .*

$$\begin{aligned}d &= 0.5(800) \\ d &= 400\end{aligned}$$

*There was a total of 400 sunny days out of the 800 days.*

*The number of sunny days in the final 200 days is the difference of 400 days and 360 days.*

*$400 - 360 = 40$ , so there were 40 sunny days of the last 200 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.

*Yes. Quantity = Percent  $\times$  Whole. After substituting in the values of the bikes and percent, I arrive at the following equation:  $600 = 1.2(500)$ , which is a true equation.*

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

*Answers will vary. One solution is as follows: Greater number is 100; lesser number is 75.*

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

*Answers will vary. One solution is as follows: Greater number is 175; lesser number is 100.*

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?

*No. The whole is different in each problem. In Problem 7, the greater number is the whole. In Problem 8, the lesser number is the whole.*

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.

$$c - 0.10c$$

$$1c - 0.10c \quad \text{Multiplicative identity property of 1}$$

$$(1 - 0.10)c \quad \text{Distributive property (writing a sum or difference as a product)}$$

$$0.90c$$

$$\text{Therefore, } c - 0.10c = 0.90c.$$

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

*Answers will vary. The store's cashier told me I would get a 10% discount on my purchase. How can I find the amount of the 10% discount?*

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

*Answers will vary. An item is on sale for 10% off. If the original price of the item is  $c$ , what is the final price after the 10% discount?*

- 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.

*If the word problem asks you to find the amount of the 25% decrease, then  $0.25x$  would represent it. If the problem asks you to find the value after a 25% decrease, then  $(1 - 0.25)x$  would be a correct representation.*