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Lesson C2

Solving Problems with Expressions

The Gender Wage Gap

Learning Goals

After this lesson, you should understand

- expressions allow us to represent relationships between real-world quantities.
- to evaluate a variable expression we must substitute in a value for the variable.

After this lesson, you should be able to

- create an expression to describe a quantity based on given information.
- evaluate an expression to solve a specific problem.
- interpret terms in an expression.

Creating Expressions

To create a variable expression that represents a quantity, we must carefully consider the definition of the variable contained in the expression, and the meaning of each term in the expression.

For example, suppose we know that a new car can drive **27.5 miles** on one gallon of gasoline. If we let ***g*** represent the number of gallons of gas in the tank, the expression **27.5*g*** describes the number of miles that the car can drive. Note that this expression only contains one term.

(Q1) For each situation, create an expression involving the given variable that answers the question. After finding an expression for each situation, discuss what you created with a partner or in your group..

(a) A concert sells tickets for $25 per ticket. How much money does the concert make for selling *x* tickets?

(b) For every $2 that Kevin spends on entertainment, he plans to save $1. How much money does Kevin save if he spends *x* dollars on entertainment?

(c) Lisa's plant grew by 1 inch per week. When she purchased the plant it had a height of 1 foot. What is the height, in inches, of Lisa's plant after x weeks?

(d) At 6 pm, the temperature outside was 52 degrees Fahrenheit. The temperature dropped 1.5 degrees each hour for over the next 8 hours. What is the outside temperature x hours after 6 pm?

(e) Each year the cost of a movie and television streaming platform increased by $0.85. In 2015, the cost was $8.99. What is the cost of the movie streaming platform x years after 2015?

Consider This: When we *evaluate* an expression, we find the numerical value of an expression when a variable is replaced by a specific value.

Suppose the expression **90.99 + 0.05*n*** represents the monthly cost of using a smartphone (in dollars) when a person sends *n* text messages beyond 1000. What is the monthly cost if a person sends out **1,420** text messages? 1,420 text messages is 420 messages more than 1000, so the variable *n* equals 420. We can substitute in 420 for *n*.

90.99 + 0.05(420) = 90.99 + 21 = $111.99

So, if a person sends 1,420 text messages, the monthly cost will be $111.99.

(Q2) The expression **$75.99 + 0.08m$** describes the cost of renting a car (in dollars) when a person drives m miles over 150 miles.

(a) What is the rental cost if a person drives 180 miles?

(b) What is the rental cost if a person drives 100 miles?

(c) What is the meaning of the term 75.99 in the expression?

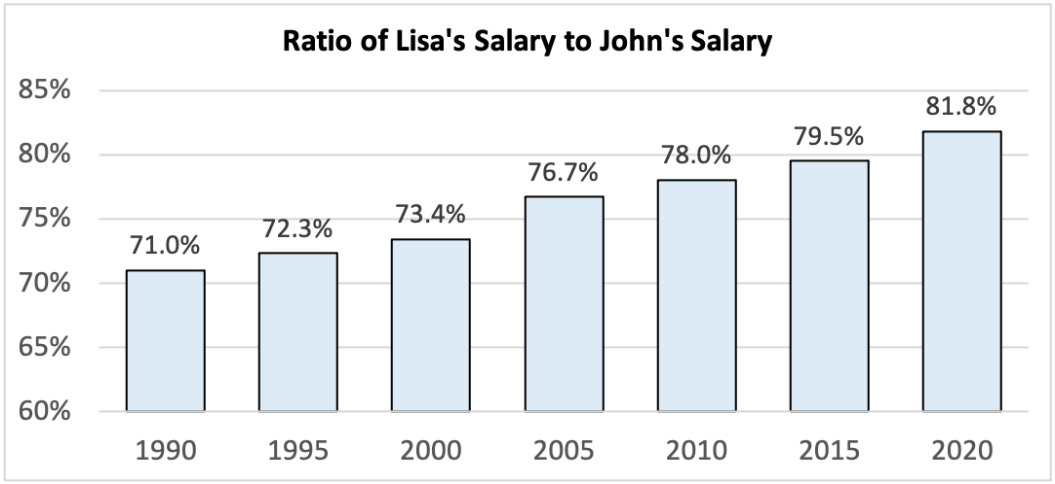
(d) What is the meaning of the coefficient 0.08 in the expression?

Exploring the Gender Wage Gap

Historically, women in the United States earn less money than men, often when performing the same work. This difference in pay is referred to as the ***gender pay gap***. When comparing adults of the same race, same education level, and same occupation, men, on average, earn more money than women. Fortunately, over time, the gender pay gap is getting smaller.

To explore this topic, let's consider one woman, Lisa, and one man, John, who both work in sales positions. The graph below shows how the ratio of Lisa's salary to John's salary has changed from 1990 to 2020. In 1990, Lisa had an annual salary of $30,000, while John had an annual salary of $42,200.

$\frac{\$30{,}000}{\$42{,}000}$ is approximately 0.71, or 71%.



(Q3) Discuss the following questions with a partner.

(a) What do you notice about the ratio of Lisa's salary to John's salary? What does this mean?

(b) What are some reasons for the gender pay gap? Discuss this with a partner or in your small group and share one reason why you think this exists.

(Q4) The expression **0.37x + 71** describes the ratio of Lisa's salary to John's salary, where *x* is the number of years since 1990. This expression was created using the information in the graph.

(a) A student, Kris, used this expression to find the ratio of Lisa' salary to John's salary in 2003. He said that the year 2003 is 13 years after 1990, so *x* equals 13. He substituted 13 for *x*.

0.37(13) + 71 = 75.8

Kris concluded that in the year 2003, Lisa's salary was 75.8% of John's salary. Did Kris use the expression correctly? Explain.

(b) What is the meaning of the coefficient **0.37** in the expression? **Hint**: Use the expression to find the values of the ratio in two subsequent years. For example, find the ratios in the years 1990 and 1991. What do you notice?

(c) What is the meaning of the number **71** in the expression? **Hint**: What is the value of the expression when $x = 0$?

(d) Use this expression to find the ratio of Lisa' salary to John's salary in the year **2024**? Interpret your answer. Show your work.

(Q5) At Heartland Bank, the savings account has an APY of 2.3% for investments over $3000 (Tier I), and 1.8% for investments under $3000 (Tier II). Suppose John invests ***x*** dollars in a Tier I investment for 1 year, and ***y*** dollars in a Tier II investment for 1 year.

(a) Create an expression for the total amount of interest earned by both investments. Show your work.

Hint: The interest earned on an investment is the amount of money invested multiplied by the APY. For example, if a person invests $2000 at a 2.7% APY for one year, the interest earned is (0.027)(2000) = $54.

(b) What is the total amount of interest earned if John invests **$3500** in a Tier I account for 1 year and invests **$1250** in a Tier II account for 1 year? Show your work.

Closing Reflections

Please reflect on the following questions **independently** and ***then discuss*** them with your group:

- What is the benefit of using a variable expression to represent the relationship between two quantities?