

Develop projection forecasts = Write functions or sequences that model relationships between two quantities

Program Task: Students will make sales projection forecasts and measure sales.

Program Associated Vocabulary:
SALES PER HOUR, CUSTOMERS PER HOUR, REVENUE, EXPENSES

Program Formulas and Procedures:
News organizations use numbers to communicate information daily. These numbers help people put the information being reported into perspective.

Example:
You have been watching a newscast and the following information has been reported: four houses in the United States go into foreclosure every 20 seconds. Use this information to answer the following questions:

1. How many houses are foreclosed on in one minute?
2. How many houses are foreclosed on in a time span of 25 minutes?
3. At the stated rate of foreclosure how many houses would be foreclosed on in the month of June?

Solution:

1. $\frac{4 \text{ homes}}{20 \text{ seconds}} = \frac{x \text{ homes}}{60 \text{ seconds}}$
 $4(60) = 20x$
 $240 = 20x$
 $\frac{240}{20} = \frac{20x}{20}$ $x = 12 \text{ homes per minute}$
2. $\frac{12 \text{ homes}}{1 \text{ minute}} = \frac{x \text{ homes}}{25 \text{ minutes}}$ $x = 12(25)$
 $x = 300 \text{ homes every 25 minutes}$
3. $60(24) = 1440$ (number of minutes in 1 day)
 $30(1440) = 43,200$ (number of minutes in June)
 $\frac{12 \text{ homes}}{1 \text{ minute}} = \frac{x \text{ homes}}{43,200 \text{ minutes}}$
 $1x = 12(43,200)$
 $x = 518,400 \text{ houses foreclosed in the month of June.}$

PA Core Standard: CC.2.2.HS.C.3

Description: Write functions or sequences that model relationships between two quantities.

Math Associated Vocabulary:
RATIO, PROPORTION, CROSS MULTIPLY, SCALE, COEFFICIENT

Formulas and Procedures:
A proportion states that two ratios are equal.

$$\frac{a}{b} = \frac{c}{d}$$

Example: Girls outnumber boys 5 to 3. If there were 21 boys in the class, how many girls would one expect to find?

Solution:

1. Identify the proportional relationship and label the units:
 $5 \text{ girls to } 3 \text{ boys: } \frac{5 \text{ girls}}{3 \text{ boys}}$
2. Set up the proportional relationship, using a variable for the missing value.
 $\frac{5 \text{ girls}}{3 \text{ boys}} = \frac{x \text{ girls}}{21 \text{ boys}}$
3. Cross multiply.
 $(5)(21) = 3x \rightarrow 105 = 3x$
4. Divide by the coefficient.
 $\frac{105}{3} = x$ $x = 35$
 One would expect to find 35 girls.

Sales, Distribution, and Marketing Operations (52.1801) T-Chart

Instructor's Script - Comparing and Contrasting

A proportion consists of two ratios that are equal. Ratios are used in many career and technical programs and typically represent a rate. For instance the rate of home foreclosures in the marketing example on page one is four homes in 20 seconds. When the denominator (bottom number) is 1, the problem is easier to solve and does not require that the student set up a proportion to solve.

For instance, if you make \$20 per hour, your ratio of $\frac{\$20}{1 \text{ hour}}$ is your rate of pay. If you want to calculate how much money you would make in 5 hours, you would simply multiply 5 by 20 to get the \$100 you would make for that given time. When the denominator is not 1, setting up a proportion is an option.

Common Mistakes Made By Students

Students do not write each ratio consistently. For example, students may write hours/minutes = minutes/hours.

Conversions of units: In many cases, the student must convert between units before setting up the proportion. For example, if one ratio is money per hour and the student must use that ratio to set up a proportion to solve for money in a given number of days, the student must convert the number of days to hours before proceeding.

CTE Instructor's Extended Discussion

Proportions are used in the field of Marketing and Business to compare and contrast information as well as to estimate. A common proportion used in Marketing is sales and time. An important measure of a retail store is sales and sales per hour. This helps a retailer with forecasting and personnel that are needed to maintain the sales projections of a store.

Averages are also calculated using proportions. This can help a store determine the average number of pieces being sold with each transaction. This concept can be used to calculate the average sales per hour for a store which in turn, can be used to help predict personnel needs for a store. Average sales per hour can be used to measure the success of a sales associate to determine bonuses and raises.

Sales, Distribution, and Marketing Operations (52.1801) T-Chart

Problems	Career and Technical Math Concepts	Solutions
1. An auditor charges \$1400 per 8 hour day to prepare financial statements for the IRS. It will take the auditor 42 hours to complete the job. How much will the company pay the auditor for the financial statements?		
2. The Malt Shop has 35 customers per hour. Each customer spends \$5.75; calculate the daily sales figure for the Malt Shop. The store's business hours are from 8:00 am – 9:00 pm.		
3. Nikki takes home \$400.00 per week. Her expenses each week make up 63% of her weekly income. What is the dollar amount of her income used to pay weekly expenses?		
Problems	Related, Generic Math Concepts	Solutions
4. One oil change takes $\frac{1}{4}$ hr. How many changes can be done in an hour?		
5. Luke can print five posters in 15 minutes. How many can he print in one hour?		
6. Mark works 35 hours and makes \$420. How much does he make if he works 25 hours at the same rate?		
Problems	PA Core Math Look	Solutions
7. Vincent buys four burgers for \$ 20. What is the cost of 10 burgers?		
8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases?		
9. Margie can buy seven shirts for \$94.50. What would it cost if she only bought four?		

Sales, Distribution, and Marketing Operations (52.1801) T-Chart

Problems	Career and Technical Math Concepts	Solutions
1. An auditor charges \$1400 per 8 hour day to prepare financial statements for the IRS. It will take the auditor 42 hours to complete the job. How much will the company pay the auditor for the financial statements?		$\frac{\$1400}{8 \text{ hours}} = \frac{x}{42 \text{ hours}} \rightarrow 8x = 1400(42) \rightarrow 8x = 58,800$ $\frac{8x}{8} = \frac{58,800}{8} \rightarrow x = \7350.00
2. The Malt Shop has 35 customers per hour. Each customer spends \$5.75; calculate the daily sales figure for the Malt Shop. The store's business hours are from 8:00 am – 9:00 pm.		$35(\$5.75) = \$201.25 \text{ sales per hour, 13 hours of business,}$ $\frac{\$201.25}{1 \text{ hour}} = \frac{x}{13 \text{ hours}} \rightarrow 1x = 201.25(13) \rightarrow x = \2616.25
3. Nikki takes home \$400.00 per week. Her expenses each week make up 63% of her weekly income. What is the dollar amount of her income used to pay weekly expenses?		$\frac{x}{400} = \frac{63}{100} \rightarrow 100x = 400(63) \rightarrow 100x = 25,200$ $\frac{100x}{100} = \frac{25,200}{100} \rightarrow x = \252.00
Problems	Related, Generic Math Concepts	Solutions
4. One oil change takes $\frac{1}{4}$ hr. How many changes can be done in an hour?		$\frac{\frac{1}{4} \text{ hour}}{1 \text{ oil change}} = \frac{1 \text{ hour}}{x \text{ oil changes}} \rightarrow \frac{1}{4}x = 1$ $(4)\frac{1}{4}x = 1(4) \rightarrow x = 4 \text{ oil changes}$
5. Luke can print five posters in 15 minutes. How many can he print in one hour?		$\frac{5 \text{ posters}}{15 \text{ minutes}} = \frac{x \text{ posters}}{60 \text{ minutes}} \rightarrow 15x = 5(60) \rightarrow 15x = 300$ $\frac{15x}{15} = \frac{300}{15} \rightarrow x = 20 \text{ posters}$
6. Mark works 35 hours and makes \$420. How much does he make if he works 25 hours at the same rate?		$\frac{35 \text{ hours}}{\$420} = \frac{25 \text{ hours}}{x} \rightarrow 35x = 420(25) \rightarrow 35x = 10,500$ $\frac{35x}{35} = \frac{10,500}{35} \rightarrow x = \300.00
Problems	PA Core Math Look	Solutions
7. Vincent buys four burgers for \$20. What is the cost of 10 burgers?		$\frac{4 \text{ burgers}}{\$20} = \frac{10 \text{ burgers}}{x} \rightarrow 4x = 20(10) \rightarrow 4x = 200$ $\frac{4x}{4} = \frac{200}{4} \rightarrow x = \50
8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases?		$\frac{27 \text{ pairs}}{1 \text{ case}} = \frac{x \text{ pairs}}{12 \text{ cases}} \rightarrow 1x = 27(12) \rightarrow x = 324 \text{ pairs}$
9. Margie can buy seven shirts for \$94.50. What would it cost if she only bought four?		$\frac{7 \text{ shirts}}{\$94.50} = \frac{4 \text{ shirts}}{x} \rightarrow 7x = 4(94.50) \rightarrow 7x = 378$ $\frac{7x}{7} = \frac{378}{7} \rightarrow x = \54