5.5 Proportional and Nonproportional Relationships

Two quantities are proportional if they have a
__constant ratio__ or rate.

The constant ratio is called the
__constant of proportionality__.

For relationships in which the ratios or rates are not constant, the two quantities are said to be
__nonproportional__.

Example: Determine whether the cost of coffee is proportional to the number of pounds. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

Coffee (pounds)	Cost (dollars)
1	3
2	6
3	9
4	12

$$\frac{cost}{pound}$$

yes, the constant of proportionality is $\frac{3}{1}$.

$$\frac{3}{1} \qquad \frac{6}{2} = \frac{3}{1} \qquad \frac{9}{3} = \frac{3}{1}$$

$$\frac{12}{4} = \frac{3}{1}$$

Example: Determine whether the cost of baseballs is proportional to the number of baseballs. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

$$\frac{Cost}{\# \, baseballs}$$

Number of Baseballs	Total Cost
1	2
2	3
3	4
4	5

$$\frac{2}{1} \qquad \frac{3}{2} \qquad \frac{4}{3} \qquad \frac{5}{4}$$

Non proportional, because they all do not have the same ratio.

Example: Determine whether the distance is proportional to the time traveled. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

$$\frac{miles}{hr}$$

Time (hours)	Distance (miles)
1	50
2	70
3	90

$$\frac{50}{1} \qquad \frac{70}{2} = \frac{35}{1} \qquad \frac{90}{3} = \frac{30}{1}$$

Non proportional because they all do not have the same ratio.

Proportional relationships can also be described using equations of the form $y = kx$, where k is the constant ratio of the constant of proportionality.

Example: The cost for 2.5 pounds of meat is $7.20. Find the constant of proportionality. Then write an equation relating cost to pounds.

$$\frac{\$7.20 \div 2.5}{2.5 \div 2.5} = \frac{2.88}{1}$$

$$k = 2.88$$

$$2.5 \overline{)7.20}$$

$$\begin{array}{r} 2.88 \\ 25\overline{)72.00} \\ -50 \\ \hline 220 \\ -200 \\ \hline 200 \\ -200 \\ \hline 0 \end{array}$$

$$y = kx$$

$$y = 2.88x$$

Example: Nina charges $34.50 for 6 days of pet sitting.

a.) Find the constant of proportionality.

$$\frac{\$34.50 \div 6}{6 \div 6}$$

$$k = 5.75$$

$$\begin{array}{r} 5.75 \\ 6\overline{)34.50} \\ -30 \\ \hline 45 \\ -42 \\ \hline 30 \\ -30 \\ \hline 0 \end{array}$$

b.) Write an equation relating the cost of pet sitting to the number of days.

$$y = 5.75x$$

c.) What would be the cost of pet sitting for 4 days?

$$x = 4$$

$$y = 5.75x = 5.75(4)$$

$$\begin{array}{r} ^{3\ 2} \\ 5.75 \\ \times \quad 4 \\ \hline 23.00 \end{array}$$

$$y = \$23$$