Section 2.2: Linear Equations and Problem Solving

Objectives:
- Use mathematical modeling to write algebraic equations representing real-life situations.
- Solve percent problems.
- Use ratios to compare unit prices for products.
- Solve proportions.

Which is the better deal?
A 12-pack of soda for $3.50 or a 2-liter bottle for $1.29?
Percent Problems

1. What is 58% of 800?

\[
x = 0.58 \times 800
x = 464
\]

2. 18 is 2.4% of what?

\[
\frac{18}{x} = \frac{0.024}{0.024}
750 = x
\]

3. 900 is what percent of 500?

\[
\frac{900}{x} = \frac{500}{500}
1.8 = x
180\% = x
\]
EXAMPLE
Write an equation for each problem and solve.

a) You spent $748 of your monthly income of $3400 for rent. What percent of your monthly income is your monthly rent?

\[
\frac{748}{3400} \times \frac{x}{2} = \frac{3400}{3400} \Rightarrow x = \frac{748}{3400} = 0.22 = 22\% 
\]

b) The price of soft drinks has gone up 2.5% in the last year. How much would you expect to pay for the 2-liter bottle which was formerly priced at $1.59?

\[
\frac{x}{1.59} = \frac{1025}{100} \Rightarrow x = 1025 \times 1.59 = 1630.45 
\]

\[
x = 1.63 
\]
Ratios and Unit prices

"a to b"

Ratio \( a:b = \frac{a}{b} \) unitless

comparison of 2 #s; use same units of measure

Examples of ratios: 36 inches to 5 ft.

\[
\frac{36 \text{ in}}{5 \text{ ft}} = \frac{3 \text{ ft}}{5 \text{ ft}} = \frac{3}{5}
\]

Examples of unit prices: 64 ounces of juice for $1.29

\[
\frac{$1.29}{64 \text{ oz}} = $0.02/\text{oz}
\]
EXAMPLE:

Which is a better buy? 10.5 oz package of cookies for $1.79 or 16 oz package of cookies for $2.39?

\[
\text{unit price} = \frac{\$1.79}{10.5 \text{ oz}} = \frac{\$2.39}{16 \text{ oz}}
\]
Proportions (an eqn)

A proportion is a statement that equates two ratios.

\[ \frac{a}{b} = \frac{c}{d} \]

2 EXAMPLES: Solve for x.

a) \( \frac{x}{36} = \frac{6}{7} \)

\[ x = \frac{6(36)}{7} = \frac{216}{7} \]

b) \( \frac{x-3}{3} = \frac{x+8}{12} \)

\[ 4(x-3) = x+8 \]
\[ 4x-12 = x+8 \]
\[ 3x = 20 \]
\[ x = \frac{20}{3} \]

LCM = 12

3c) Given these similar triangles, find the value of z.