SOLVING WORD PROBLEMS

Where is she going with this?

- Units
- Steps for solving word problems
- Example
- Practice

Using Units

If you know that 2/3 of those with a disease seek care and 2/5 of those who seek care are hospitalized, what percentage of those with a disease are hospitalized?

$$\frac{2\ \cancel{seek\ care}}{3\ disease} \times \frac{2\ hospitalized}{5\ \cancel{seek\ care}} = \frac{4\ hospitalized}{15\ disease} = 26.7\%$$

Using Units

To calculate a ratio (RECALL: These are unitless!)

$$\frac{14\ disease}{100\ at\ risk} \Big/ \frac{3\ disease}{200\ at\ risk}$$

$$\frac{14\ disease}{100\ at\ risk} \div \frac{3\ disease}{200\ at\ risk} = \frac{14\ \cancel{disease}}{100\ \cancel{at\ risk}} \times \frac{200\ \cancel{at\ risk}}{3\ \cancel{disease}}$$

$$= \frac{2800}{300}$$

$$= 9$$

Using Units

To solve for an unknown

$$\frac{38\ deaths}{216\ ill} = \frac{x}{1{,}000\ ill}$$

$$\frac{38\ deaths}{216\ \cancel{ill}} \times 1{,}000\ \cancel{ill} = \frac{x}{1{,}000\ \cancel{ill}} \times 1{,}000\ \cancel{ill}$$

$$\frac{38{,}000}{216}\ deaths = x$$

$$x = 176\ deaths$$

Problem Solving

1. Read all the information you're given
2. Identify the quantity being requested
3. Find useful information
4. Review remaining information
5. Formulate math expression and calculate
6. Reflect on your answer

EXAMPLE

In a population of 500,000, how many deaths would you expect in a year?

Age (years)	Persons (in 1000's)	Deaths (in 1000's)
Under 5	198	1
5 - 19	580	4
20 - 44	601	1.3
45 - 64	396	4.6
65 and over	185	11.4
All ages	1,960	18.7

Average annual deaths in a population

1. Read the whole problem
2. Identify quantity requested
   - **type:** number (count)
   - **units:** deaths
   - **conditions:** in one year, in certain population
3. Find useful information
4. Review remaining information
5. Formulate and calculate

$$\frac{x\ deaths}{500{,}000\ persons} = \frac{18{,}700\ deaths}{1{,}960{,}000\ persons}$$

$$x\ deaths = \frac{18{,}700\ deaths}{1{,}960{,}000\ \cancel{persons}} \times 500{,}000\ \cancel{persons}$$

$$x\ deaths = 4{,}770\ deaths$$

6. Reflect on your answer

EXAMPLE

- A manufacturer sells products for $5 per unit. Some retailers add $1 per unit to the price for consumers. Fixed costs are constant at $3,000 regardless of the number of units of product involved. Total cost is equal to the sum of fixed costs and variable costs. In this company, variable costs are estimated to be $2 per unit. What is the breakeven point (i.e. how many units must be sold so that the total costs equal total revenues) for the manufacturer?

1. Read the whole problem
2. Identify quantity requested
   - **type:** number (count)
   - **units:** units
   - **conditions**: where costs = revenues
3. Find useful information
4. Review remaining information
5. Formulate and calculate
   - $costs = revenue$
   - $costs = fixed + variable$
   - $costs = \$3000 + \left(\frac{\$2}{\text{unit}} \times x \text{ units}\right)$
   - $revenue = \frac{\$5}{\text{unit}} \times x \text{ units}$
   - $\$3000 + \left(\frac{\$2}{\text{unit}} \times x \text{ units}\right) = \frac{\$5}{\text{unit}} \times x \text{ units}$
   - $3000 + 2x = 5x \rightarrow 3x = 3000 \rightarrow x = 1000\ units$
6. Reflect on your answer

YOU TRY

The following data were obtained for children 6 months through 4 years from the Second NHANES survey, conducted February 1976-February 1980, among 27,801 persons in the United States.

Blood lead (micrograms/ deciliter)	No. examined	% with history of eating unusual substances
≥30	117	16.2
20-29	503	14.1
<20	1,752	5.2

How many children examined with blood lead levels greater than or equal to 20 mcg/dl had a history of eating unusual substances?

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Blood lead (micrograms/ deciliter)	No. examined	% with history of eating unusual substances
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<20	1,752	5.2

What percent of children examined had a history of eating unusual substances?

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Blood lead (micrograms/ deciliter)	No. examined	% with history of eating unusual substances
≥30	117	16.2
20-29	503	14.1
<20	1,752	5.2

What proportion of children with a history of eating unusual substances had a blood lead level ≥30 micrograms/deciliter?

YOU TRY

The following is from a newspaper article on seat belts:

Of the 649 people who died in traffic accidents in Washington last year, 55 percent were not wearing seat belts. In those same fatal crashes, 73 percent of people who were belted in survived.

Can you identify the percent of survivors who were *not* belted in?

If so, calculate it. If not, what quantity would you need to calculate this number?

YOU TRY

The rate of suicide among American physicians, relative to the corresponding rate in the population as a whole, varies by gender. Among men, the rate in physicians is 1.5 times higher, whereas among women the corresponding relative rate is 3.0. It turns out that the rate of suicide in American male and female physicians is identical. For American men and women in general, what is the relative rate of suicide in men compared to women?

Summary

- Variety of strategies that work
- In your toolbox:
  - *cross-tabulation*
  - *dimensional analysis (units)*
  - *algebra*
  - *keywords*
  - *others?*
- Check yourself by asking, Does this answer make sense?
- Remain calm (You *can* do this)