SOLVING BASIC WORD PROBLEMS

An Introduction to Problem Solving

The best way to attack word problems is with a systematic method, step by step. Here's one that works for many people.

Interpret the problem. You must read and understand the problem. Determine what information is given, what is extra, what you are actually asked to find, and what information you need to supply.

Decide on a method for solving the problem. Do you have to add, subtract, multiply or divide? There are sometimes several different ways to approach a problem. Decide which way will work best. Can you solve the problem directly, or must you solve for a piece of information first and then use it to find the answer?

Apply the method. Perform the actual computations in the proper order to obtain an answer.

Look back and reason. Once you have an answer, go back and check two things:

1. Check your calculations to make sure that you have not made any computational errors.
2. Reread the original question to make sure your answer is reasonable and valid. (An answer of $2\frac{1}{2}$ might be computationally accurate, but if you were asked for the number of children in a family, it would not be a reasonable answer.

All together, these four steps are:

Four Steps for Problem Solving

1. **INTERPRET** the problem
2. **DECIDE** on a method for solving the problem
3. **APPLY** the method
4. Look back and **REASON**

EXAMPLE 1:
Blood flows through kidneys at a rate of 1.3 liters per minute. How much blood flows through the kidneys in 1 hour?

SOLUTION
INTERPRET We are given the amount of blood that flows each minute (1.3 liters). We are asked how much blood flows in 1 hour. We know there are 60 minutes in an hour.

DECIDE To find the amount of blood flowing in 1 hour, we must multiply the amount of blood that flows in 1 minute by 60 minutes.

APPLY Multiplying yields: $\frac{1.3\ liters}{\cancel{minute}} \times \frac{60\ \cancel{minutes}}{hour} = 78\ \frac{liters}{hour}$

REASON Rereading the problem, we see that the blood flows at slightly more than 1 liter per minute, and our results shows the amount per hour to be slightly more than 60 liters per hour (60 minutes). The answer is reasonable. We can check the result by dividing 78 by 60. The answer checks. So 78 liters of blood flow through kidneys each hour.

EXAMPLE 2:

A certain roller coaster ride last $1\frac{5}{6}$ minutes. If the entire ride is 3250 feet long, what is the average speed in feet per second?

SOLUTION

INTERPRET The ride is 3250 feet long and takes $1\frac{5}{6}$ minutes to complete. We want the speed in feet traveled per second. We know there are 60 seconds in a minute. (From here on, we will not indicate the units throughout the computations; however, we will always include them in our answer.)

DECIDE To find the time the ride takes in seconds, we must multiply $1\frac{5}{6}$ minutes by 60 seconds per minute. Then we can divide the distance traveled (3250 feet) by the time traveled in seconds. We will do the computations and then indicate the answer in feet per second.

APPLY First we find time in seconds.

$$(1\tfrac{5}{6}) \text{ x } 60 = (\tfrac{11}{6})\ (60) = 110 \text{ seconds}$$

Then we divide the length of the ride (3250 feet) by the time needed to travel it (110 seconds).

$$\frac{3250}{110} = 29\frac{60}{110} = 29\frac{6}{11}$$

The roller coaster travels at $29\frac{6}{11}$ feet per second.

REASON According to the original problem statement, the roller coaster travels about 30 feet per second. The answer, $29\frac{6}{11}$ feet per second, is reasonable.

EXAMPLE 3

A coat costs retailers $180. It is sold for $230. What is the markup rate?

SOLUTION

INTERPRET In this example, you will need to know things about the markup rate (the percent by which a dealer increases the cost to obtain the selling price) as well as discount rate (the percent by which the original cost is reduced) and the percent of increase or decrease (the ratio of the amount of change to the original amount).

We are being asked, “What percent of the cost is the given markup amount?” Because the amount the coat has been marked up is $230 - $180, or $50, we must find

“What percent of $180 is $50?”

Here, the *percent* is the missing value, the *base* is $180, and the *amount* is $50.

DECIDE We substitute the known values into the *percent equation*.

Percent (as a decimal) x base = amount

$$n \text{ x } 180 = 50$$

A good estimate of the answer is 50 ÷ 200, or 0.25. So 25% is the estimated markup rate.

APPLY We solve the equation by dividing both sides by 180.

$$\frac{180n}{180} = \frac{50}{180}$$

$$n = 0.277\overline{7}$$

Rounded to the ten-thousandths place, *n* is 0.2778.

REASON The solution thus far is a decimal, but we are asked for a *percent.* So we must move the decimal point two places to the right and add a percent sign. Thus the markup rate is 27.78%.

EXAMPLE 4

An inventory of spare parts showed that 168 had rusted. This represented 56% of the total number of parts. How many parts had <u>not</u> rusted?

SOLUTION

INTERPRET In this example we are given the parts that had rusted and are asked to find the parts that had not rusted.

DECIDE Solving this problem requires two steps. First, we must find the total number of parts. Then we can subtract the number of rusted parts from the total number t to find the number that did not rust. We know that 168 is 56% of the total number of parts.

The *percent* is 56%, which gives us the ratio $\frac{part}{whole} = \frac{56}{100}$. The *base* (or *whole*) is the missing value, and the *amount* (or *part*) is 168; they give us the ratio $\frac{168}{n}$.

APPLY These fractions are equal. We set up a proportion and solve.

$\frac{56}{100} = \frac{168}{n}$	The proportion (equal fractions)
56 x *n* = 100 x 168	Cross-multiplying (If $\frac{a}{b} = \frac{c}{d}$, then ad = bc)
56 x *n* = 16, 800	Multiplying out
$\frac{56n}{56} = \frac{16{,}800}{56}$	Dividing by 56
$n = \frac{16{,}800}{56} = 300$	Simplifying

REASON The total number of parts is 300 but we are asked for the number of not rusted. We must subtract the number of rusted parts from the total: 300 – 168 = 132
So 132 parts were not rusted.

<u>PRACTICE PROBLEMS</u>

1. In the 1988 summer Olympics in Seoul, Korea, the American who won the heptathlon, Jackie Joyner-Kersee, had come to the high jump with previous personal-best jump of 6 feet 4 inches. In the Olympic event, however, she jumped 6 feet $1\frac{1}{4}$ inches. By how much did she miss her personal best?

2. The most points ever scored by one team over another football game was scored by Georgia Tech in 1916. The total number of points scored was 222. If a touchdown gives a team 6 points, what is the greatest number of touchdowns that could have been scored by Tech?

3. A certain stock has fluctuated as follows: up $\frac{4}{8}$, down $\frac{3}{8}$, up $\frac{2}{8}$, up $\frac{1}{8}$. If the opening price was $3\frac{5}{8}$, what is the current price?

4. Your heart rate changes with the amount for energy that you exert. If your heart rate was 70 beats per minute (bpm) before you exercised, increased 40 bpm during exercise, and then dropped 10 bpm after exercise, what was your heart rate after exercise?

5. The stock for a certain company closed yesterday at $31\frac{1}{8}$. Today it opened $3\frac{3}{8}$ points lower than yesterday's closing, and then it went to a level $6\frac{2}{8}$ points higher than yesterday's closing price. What is the range of these fluctuations?

6. The changes in a reading on a scale were -2, $3\frac{1}{2}$, 10.5, -16. -15.5, and -4.5. What does the scale read now in relation to its starting point?

7. Find the sales tax on a dress that costs $124.80 if the tax rate is 5.5%.

8. A coat is marked "20% off." How much money will you save if the coat was originally priced at $175?

9. Dr. Callaham drives from Dahlonega to Athens for a class (70 miles), then to Atlanta for a meeting (65 miles), and then back through Athens to Dahlonega. If he gets $0.23 reinbursment per mile driven for travel expenses when he drives back and forth to meetings and classes, how much should he be paid for this trip?

10. Long-Distance Charges One long-distance phone company advertises that on the weekend, it costs 11 cents a minute to call anywhere in the United States. Stacie and A.J speak long-distance from Twenty-nine Palms to Sacramento for 1 hour and 28 minutes one weekend, using this phone plan. How much does this call cost?

11. Albuquerque is 4944 feet above sea level. Mexico City is about 1.463 times as high. How much higher is Mexico City? Give your answer to the nearest 10 feet.

PRACTICE PROBLEM SOLUTIONS

1. *2* $\frac{3}{4}$ inches   2. 37 touchdowns   3. $4\frac{1}{8}$ 4. 100 bpm

5. $9\frac{5}{8}$ 6. 24 less than at the start   7. $6.87 (Note: We will always round money up)

8. $35   9. $62.10   10. $9.68   11. 2290 feet higher