

# Introduction to Problem Solving

## I. The Five Step Problem Solving Plan

**U:** Understand the problem

**P:** Make a plan. (translate into an algebraic equation)

**S:** Solve the problem

**Check** your answer for reasonableness!

**State** your answer in a complete sentence.

**\*\* You WILL loose points if you fail to do the last step. \*\***

For a more detailed explanation of each of these steps, see the Five Step Plan for Word Problems [handout](#). (can also be found on the website under Basic Math pages)

## II. Problem Solving

Examples: Simplify (i.e. combine like terms)

1. pg. 36 #4 in Intermediate Algebra by Bittinger

Swimming. Fran swims at a rate of 5 km/h in still water. The Lazy River flows at a rate of 2.3 km/h. How long will it take Fran to swim 1.8 km upstream?

**U** Let  $t$  = the time, in hours, in hours it will take Fran to swim 1.8 km up river;  
Distance = rate x time  
Fran swims 5 km/h in still water. The river is moving at 2.3 km/h against her.  
Thus, her total rate of increase up the stream is  $(5 - 2.3)$  km/h

**P**  $1.8 = (5 - 2.3)t$

**S**  $1.8 = (5 - 2.3)t$

$$1.8 = 2.7t$$

$$\frac{1.8}{2.7} = \frac{2.7t}{2.7}$$

$$\boxed{0.67 = t}$$

**Check** Does the answer seem reasonable? Well, if we were to round the numbers and estimate the answer we would get a distance of 2 km divided by a speed of 3 km/h which would lead us to an answer of  $\frac{2}{3}$ . Hence, our answer is reasonable.

**State** It will take Fran 0.67 (or  $\frac{2}{3}$  hr or 40 mins) of an hour to swim 1.8 km upstream.

2. pg. 37 #10 in Intermediate Algebra by Bittinger

**Pricing.** Miller Oil offers a 5% discount to customers who pay promptly for an oil delivery. The Blancos' promptly paid \$142.50 for their December oil bill. What would the cost have been had they not promptly paid?

**U** Let  $c$  = the cost without the 5% discount, in dollars. Then the discounted rate was  $c - (5\%)c$  or  $c - 0.05c$ . The discounted rate was \$142.50

**P**  $c - 0.05c = 142.50$

**S**  $c - 0.05c = 142.50$

$$0.95c = 142.50$$

$$\frac{0.95c}{0.95} = \frac{142.50}{0.95}$$

$$\boxed{c = 150}$$

**Check** Is the answer reasonable? Work backwards to check your answer. 5% of \$150 is \$7.50.  $\$150 - \$7.50 = \$142.50$ . Thus, our answer checks.

**State** The cost for the Blancos' oil shipment would have been \$150 if they had not paid promptly.

3. pg. 37 #14 in Intermediate Algebra by Bittinger

**Angles in a Triangle.** One angle of a triangle is four times as great as a second angle. The third angle measures  $5^\circ$  more than twice the second angle. Find the measures of the angles.

**U** Since both the first and the third angle are given in terms of the second angle, let  $x$  = the measure of the second angle, in degrees.

The first angle =  $4x$  (shown in red below)

The third angle =  $2x + 5^\circ$  (shown in green below)

Recall from geometry, the sum of the measures of the three angles of a triangle is 180 degrees.

**P**  $4x + x + 2x + 5 = 180$

**S**  $4x + x + 2x + 5 = 180$

$$6x + 5 = 180$$

$$6x + 5 - 5 = 180 - 5$$

$$6x = 175$$

$$\frac{6x}{6} = \frac{175}{6}$$

$$\boxed{x = 29.2^\circ}$$

Recall that the problem asked for the measures of all the angles. So, we still have some solving to do.

$$\text{The first angle} = 4x = 4(29.2) = 116.8^\circ$$

$$\text{The second angle} = x = 29.2^\circ$$

$$\text{The third angle} = 2x + 5^\circ = 2(29.2) + 5 = 63.4^\circ$$

**Check** Is the answer reasonable? The easiest way to check this is to see if the angles actually add to 180 degrees. However, remember that we rounded the answer to the nearest tenth, so a little more or a little less than 180 degrees is ok.

$$116.8 + 29.2 + 63.4 = 209.4^\circ$$

Now, this answer is a lot more than 180 degrees! So I would NOT consider it reasonable! We made a mistake somewhere. If you look back, when we collected the  $x$  terms together, we did not combine correctly. The correct solution is shown below.

**State**

I made the mistake above because it is a common mistake to make and I wanted you to see how you could catch your error in the check step. This happens to be the most important step in the process, and it is the step most students skip!

**CORRECT SOLUTION:**

**U** Since both the first and the third angle are given in terms of the second angle, let  $x =$  the measure of the second angle, in degrees.

$$\text{The first angle} = 4x \text{ (shown in red below)}$$

$$\text{The third angle} = 2x + 5^\circ \text{ (shown in green below)}$$

Recall from geometry, the sum of the measures of the three angles of a triangle is 180 degrees.

**P**  $4x + x + 2x + 5 = 180$

**S**  $4x + x + 2x + 5 = 180$

$$7x + 5 = 180$$

$$7x + 5 - 5 = 180 - 5$$

$$7x = 175$$

$$\frac{7x}{7} = \frac{175}{7}$$

$$x = 25^\circ$$

Recall that the problem asked for the measures of all the angles. So, we still have some solving to do.

The first angle =  $4x = 4(25) = 100^{\circ}$

The second angle =  $x = 25^{\circ}$

The third angle =  $2x + 5^{\circ} = 2(25) + 5 = 55^{\circ}$

**Check** Now, Is the answer reasonable? The easiest way to check this is to see if the angles actually add to 180 degrees. However, remember that if you round the answers, the sum may be a little more or a little less than 180 degrees, but NOT more than 1 or 2 degrees off.

$$100^{\circ} + 25^{\circ} + 55^{\circ} = 180^{\circ}$$

Thus, our answers are reasonable.

**State** The three angles of the triangle are  $100^{\circ}$ ,  $55^{\circ}$ , and  $25^{\circ}$ .