

## Fun Word Problems Sheet Ten Key

You must get all parts of a problem correct to get the point, so be careful and check your work!

- You saw a wood board into 2 pieces. Find the length of the second piece if the length of the second piece is one foot less than twice the length of the first piece, and the length of the first piece is:
  - 3 feet
  - $x$  feet

Solution: Once again, "twice" comes before "one foot less". Kind of the order of operations of English grammar. Since I said "one foot", it's a good thing that I used feet in the problems, otherwise I would have to convert to get common units of measure.

Length of first piece (input, $x$ )	Length of second piece (output, $y$ )
3 feet	$2(3) - 1 = 5$ feet
$x$ feet	$2(x) - 1$ feet

- You saw another board into 3 pieces. The length of the second piece is 3 feet more than one-half of the length of the first piece, and the length of the third piece is twice the length of the second piece. Find the lengths of the second and third pieces if the length of the first piece is:
  - 4 feet
  - 2 inches
  - 8 meters (I'll use 8 feet in the solution)
  - 3 feet
  - $x$  feet (I added this one to show you how it would be)

Solution: Oops! Sorry about this one. If I have units in the paragraph, I must use the same units in the problems or you would have to convert. Inches are reasonable to convert to feet (or feet to inches) as we have been doing that. I did not, however, expect you all to convert between meters and feet. I will do these with the 8 meters changed to 8 feet, keeping the others as is. The 2 inches converts to  $2 \text{ inches} \cdot \frac{1 \text{ foot}}{12 \text{ inches}} = \frac{1}{6}$  foot.

First piece (input, $x$ )	Second piece (output, $y_1$ )	Third piece (output, $y_2$ )
4 feet	$\frac{1}{2}(4) + 3 = 5$ feet	$2(5) = 10$ feet
2 inches = $\frac{1}{6}$ foot	$\frac{1}{2}\left(\frac{1}{6}\right) + 3 = 3 + \frac{1}{12} = 3\frac{1}{12}$ feet	$2\left(3 + \frac{1}{12}\right) = 6 + \frac{1}{6} = 6\frac{1}{6}$ feet
8 feet	$\frac{1}{2}(8) + 3 = 7$ feet	$2(7) = 14$ feet
3 feet	$\frac{1}{2}(3) + 3 = 4.5$ feet	$2(4.5) = 9$ feet
$x$ feet	$\frac{1}{2}(x) + 3$ feet	$2\left(\frac{1}{2}x + 3\right) = x + 6$ feet

3. At a basketball game, tickets for non-students are \$8 per ticket and tickets for students are \$5 per ticket. If twice as many students went to the game as non-students, how much money was spent on tickets if the number of non-students was:
- (a) 10 people
  - (b) 5 people
  - (c) 22 people
  - (d) 17 people
  - (e)  $x$  people (please simplify)

Solution: This is similar to the hot dog problems, and falls under the overall category called "value problems". Just keep track of "how many" and "how much" for each category. Sometimes an Excel-like table can help to organize what you have and what you've calculated.

# of Non-S (input, $x$ )	Non-S \$ per tic (constant)	# of S (middle step)	S \$ per tic (constant)	Total \$ (output, $y$ )
10	\$8 per tic	20	\$5 per tic	$8(10) + 5(20) = \$180$
5	\$8 per tic	10	\$5 per tic	$8(5) + 5(10) = \$90$
22	\$8 per tic	44	\$5 per tic	$8(22) + 5(44) = \$396$
17	\$8 per tic	34	\$5 per tic	$8(17) + 5(34) = \$306$
$x$	\$8 per tic	$2x$	\$5 per tic	$8(x) + 5(2x) = \$18x$

4. You spend all of your entertainment money for the semester on iTunes downloads and movies. Your total entertainment budget for the semester is \$180. How much money will you have left for iTunes downloads if the amount spent on movies is:
- (a) \$100
  - (b) \$150
  - (c) \$122.50
  - (d)  $\$x$

Total budget (constant)	Volume of solution (input, $x$ )	Volume of pure anti-freeze (output, $y$ )
\$180	\$100	\$80
\$180	\$150	\$30
\$180	\$122.50	\$57.50
\$180	$\$x$	$180 - x$ dollars

5. The price per gallon for regular gas might increase by 17% in 2005. If it does, what will be the price per gallon at the end of the year if the price per gallon at the beginning of the year was: (Please round your answers to the nearest whole cent. For example, if your answer comes to \$3.387 per gallon, write \$3.39 per gallon.)
- (a) \$2.25 per gallon
  - (b) \$2.03 per gallon
  - (c) \$2.14 per gallon
  - (d) \$ $x$  per gallon (please simplify)

Solution: Increasing or decreasing by a percentage is very common in the world and is hopefully becoming a familiar friend in this class. First, figure out the increase by multiplying the original price per gallon by 0.17, then add to the original price per gallon. As usual, with the variable, the like terms combine so that your answer has only one term. I need to start taking points off if you round incorrectly, so watch that!!

Percentage (constant)	Original \$ per gal (input, $x$ )	Increase (middle step)	New price per gallon (output, $y$ )
17%	\$2.25 per gal	$0.17(2.25) = 0.3825$ \$ per gal	\$2.63 per gal
17%	\$2.03 per gal	$0.17(2.03) = 0.3451$ \$ per gal	\$2.38 per gal
17%	\$2.14 per gal	$0.17(2.14) = 0.3638$ \$ per gal	\$2.50 per gal
17%	\$ $x$ per gal	$0.17(x)$ \$ per gal	$x + 0.17x = 1.17x$ \$ per gal