Automotive Worksheet Fractions

In the automotive industry in this country, the fractions you are most likely to see are known as *proper* fractions. Proper fractions have the *numerator* (the top number) smaller than the *denominator* (the bottom number). Examples of proper fractions are $\frac{1}{2}$, $\frac{3}{4}$, $\frac{7}{16}$. *Improper* fractions are fractions in which the numerator (the top number) is bigger than the denominator (the bottom number). Examples of improper fractions are $\frac{3}{2}$, $\frac{8}{7}$, $\frac{5}{2}$. Most people don't use improper fractions. Instead, they use what's known as a mixed number. Examples of mixed numbers are $2\frac{1}{2}$, $3\frac{7}{8}$, $1\frac{1}{16}$.

There are three skills you need before you can work with fractions.

The first is learning to reduce a fraction. Unless told otherwise, fractions should always be reduced to the lowest terms. This means divide the numerator and the denominator by a number that is common to both. This process is repeated until the fraction can't be reduced any further. For example, consider the fraction $\frac{9}{12}$. To reduce it, find a number that is common to both; that is, a number that can go into 9 and 12 evenly. For this example, that number is 3. (9 is 3x3x3 and 12 is 3x3x3x3 right?)

$$\frac{9}{12} \rightarrow \div 3 = \frac{3}{4}$$

To reduce $\frac{12}{24}$ find a single number that goes evenly into both the numerator and the denominator. There are a few numbers that will work: 2, 3, 4, 6, and 12. Say you choose 3 as the common factor. Then,

$$\frac{12}{24} \rightarrow \div 3 = \frac{4}{8}$$

But notice that $\frac{4}{8}$ can be reduced as well:

$$\frac{4}{8} \rightarrow \div 4 = \frac{1}{2}$$

If you picked the *greatest common factor*, 12, instead of 3, you could have arrived at the fully reduced fraction in one step. So divide top and bottom by 12:

$$\frac{12}{24} \rightarrow \div 12 = \frac{1}{2}$$

The next skill you need to learn is how to change an improper fraction into a mixed number. To do this divide the bottom number into the top number. Then write the remainder as a fraction over the original denominator. Then reduce the fraction if needed. For example to change $\frac{5}{4}$ into a mixed number, you need to divide 4 into 5 and write the remainder (1 in this example) as the numerator and the original denominator (4 in this case) as the new denominator:

$4\overline{)5}$ 1

$\frac{4}{1}$ the remainder

So the mixed number that is the same as $\frac{5}{4}$ is $1\ \frac{1}{4}$

the old denominator

The third skill is learning how to change from a mixed number to an improper fraction. This will be necessary when multiplying or dividing fractions as we will see later in this document. To do this first multiply the denominator of the proper fraction by the whole number. Then add the result to the numerator. Then place the number you get over the original denominator. For example, to change $2\frac{3}{4}$ into an improper fraction, multiply the denominator (the 4) by the whole number (the 2) then add the result to the numerator (the 3), and put the answer over the original denominator (4).

$2\frac{3}{4}$

Multiply these two numbers together: 2 x 4 = 8.
Add that to the numerator; 8 + 3 = 11. Then place that number over the original denominator to get the final answer: $\frac{11}{4}$

To multiply fractions simply multiple the numerators together, multiple the denominators together, then write the product of the numerators over the product of the denominators. Then reduce the fraction to the lowest terms. You can save a little time if you reduce the fractions you were given before you multiply them as well. You can also divide out a common factor from the numerator of one fraction and the denominator of the other. This will result in an answer that is already reduced by that factor.

Example: Multiply $\frac{3}{8}\times\frac{1}{4}$ $\frac{3}{8}\times\frac{1}{4}=\frac{3}{32}$

Example: $\frac{9}{16}\times\frac{4}{8}=\frac{36}{128}=\frac{9}{32}$. You could also have noticed that $\frac{4}{8}=\frac{1}{2}$. Then $\frac{9}{16}\times\frac{1}{2}=\frac{9}{32}$. You could have also chosen to divide out a 4 out of the 16 and the 4 in the original fractions. That would leave you with $\frac{9}{4}\times\frac{1}{8}=\frac{9}{32}$. Which method you use is up to you.

When you want to multiply a fraction by a whole or mixed number, do the following: First change all the mixed numbers into improper fractions using the method described earlier. Convert a whole number into a

fraction by putting the number over 1. Then multiply the fractions together as before and reduce your answer. For example:

$1\frac{3}{4}\times\frac{3}{8}=\frac{7}{4}\times\frac{3}{8}=\frac{21}{32}.$

Example: $4\times\frac{3}{16}=\frac{4}{1}\times\frac{3}{16}=\frac{12}{16}=\frac{3}{4}.$

Homework Problems

In the following problems you will use what you've learned about multiplying fractions. Be sure to express your answers as reduced fractions or mixed numbers unless instructed otherwise.

1. If you ask your co-worker to hand you the $\frac{24}{96}$ inch wrench, which wrench should he bring you?

2. If one piston from an engine weighs $\frac{3}{4}$ pound, what do 8 pistons weigh? Write your answer as a mixed number with the fraction reduced to lowest terms.

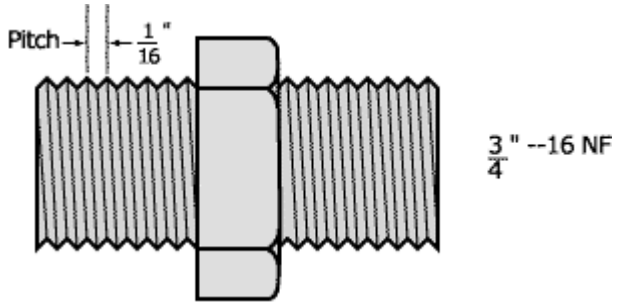
3. A certain car requires $20\frac{3}{16}$ inches of air conditioning hose. How many inches of hose are needed for 5 cars of the same type?

4. The cooling system of a Chevy 6 cylinder 250 cubic inch displacement engine has a capacity of $3\frac{1}{2}$ gallons. If a solution of $\frac{3}{8}$ ethylene glycol (the rest is water) is used to protect the engine against freezing temperatures, how many quarts of ethylene glycol are used? Remember that there are 4 quarts in 1 gallon.

5. A car has an average speed of $50\frac{1}{2}$ miles per hour on a trip that lasts $6\frac{3}{4}$ hours. How far does the car travel in this time? Hint: speed x time = distance traveled.

6. A car averages $20\frac{1}{4}$ miles per gallon of gas. How far can the car travel on $14\frac{7}{8}$ gallons of gas?

7. How far will the nut advance when it is turned 12 times on a $\frac{3}{4}$ inch--16 NF (National Fine Thread) bolt? The nut advances $\frac{1}{16}$" per revolution on a 16 NF. The pitch refers to the distance traveled by the nut in one turn (again $\frac{1}{16}$" in this exercise). On a 28 NF it would advance $\frac{1}{28}$" per revolution of the nut. See the figure. Note that the $\frac{3}{4}$" refers to the width of the bolt.



8. How far would a nut advance with 15 turns of a $\frac{1}{2}$ inch--12 NC (National Coarse Thread) bolt?

9. A mechanic cuts 13 pieces of vacuum tubing from a roll. Each piece is $14\frac{7}{16}$ inches long. What is the total length used?

10. A autopainter works $3\frac{3}{4}$ hours re-painting your car and normally charges $35 per hour to work. But because you are her friend, she only charges you $\frac{1}{2}$ her normal rate. How much do you owe her?