

MATH SKILL INFORMATION PAGE

Pre-Algebra

For use with Section 7-3

Fractions in Multi-Step Equations

Chapter 7, Section 3, Part 1

*NOTE: Part 2, about DECIMALS, is not part of this handout.
Review the textbook, page 347, for part 2.*

A. WHEN THE FRACTION IS THE COEFFICIENT OF THE VARIABLE.

There are two ways to do fraction problems. The first method is to multiply every term by the denominator, and then divide every term by the numerator. The easy way is, if possible, to get rid of the fraction. You can most often do that by multiplying everything by the denominator (or by the LCD, if you have more than one fraction). You can also do it by multiplying by the reciprocal, which does two steps at one time (this is a good place for doing that). By the way, the hard way

NOTE: Always start by removing the constant away from the side of the equation that has the variable.

Example 1: $(\frac{3}{4})x + 5 = 17$

This can also be written as $\frac{3}{4}x + 5 = 17$ or $\frac{3x}{4} + 5 = 17$ or $(3x)/4 + 5 = 17$.

Step One: Make the +5 into zero. $\frac{3}{4}x + 5 - 5 = 17 - 5$. Simplified: $\frac{3}{4}x = 12$.

Step Two: Multiply both sides by the denominator: $4 \cdot \frac{3}{4}x = 4 \cdot 12$. Simplified: $3x = 48$

Step Three: Divide both sides by the numerator: $\frac{3x}{3} = \frac{48}{3}$. Simplified: $x = 16$ ← *Correct Answer*

Example 2: $(\frac{3}{4})x + 5 = 17$. *This time we'll use the reciprocal, with the same problem.*

Step One: Make the +5 into zero. $\frac{3}{4}x + 5 - 5 = 17 - 5$, so $\frac{3}{4}x = 12$.

Step Two: Multiply both sides by reciprocal: $\frac{4}{3} \cdot \frac{3}{4}x = \frac{4}{3} \cdot 12$. Simplify: $x = 16$ ← *Correct Answer*

FRACTION REVIEW (because many students make mistakes at this point)

Part of step two: Multiply fraction and whole number:

$$\frac{4}{3} \cdot 12 = \frac{4}{3} \cdot \frac{12}{1} = \frac{4 \cdot 12}{3 \cdot 1} = \frac{4 \cdot 12}{3} = \frac{48}{3} = 16$$

Cross reducing can simplify the multiplication/dividing: $\frac{4 \cdot 12}{3} = \frac{4 \cdot \cancel{12}^4}{\cancel{3}_1} = \frac{4 \cdot 4}{1} = 16$

B. WHEN THE FRACTION IS OUTSIDE PARENTHESES.

These fractions can be handled in two different ways. As I show in example 3, you can distribute the fraction to the parentheses, which is a great way of doing it (but don't forget that it has to multiply to ALL terms that are already inside the parentheses, not just the first term). Example 4 will show that you can use the reciprocal first, and then you don't have to distribute to the parentheses.

Example 3: $\frac{3}{4}(x - 8) = 10$

WARNING (common error): Don't forget to distribute to BOTH terms that are inside the parentheses.

Step One: Distribute the $\frac{3}{4}$. $\frac{3}{4}x - \frac{3}{4} \cdot 8 = 10$. Simplified: $\frac{3}{4}x - 6 = 10$

Now it is exactly like examples 1 and 2 on the first page of this handout.

Step Two: $\frac{3}{4}x - 6 + 6 = 10 + 6$. Simplified: $\frac{3}{4}x = 16$;

Step Three: $\frac{4}{3} \cdot \frac{3}{4}x = \frac{4}{3} \cdot 16$. Simplified: $x = \frac{4 \cdot 16}{3}$; $x = \frac{64}{3}$

NOTE: No reducing could be done in this problem. The answer should be left as a improper fraction.

Example 4: $\frac{3}{4}(x - 8) = 10$

Step One: Multiply both sides by the reciprocal: $\frac{4}{3} \cdot \frac{3}{4}(x - 8) = \frac{4}{3} \cdot 10$.

Simplified: $x - 8 = \frac{40}{3}$

Step Two: $x - 8 + 8 = \frac{40}{3} + 8$.

Step Three: 8 is $\frac{24}{3}$, so the equation is $x = \frac{40}{3} + \frac{24}{3} = \frac{40+24}{3} = \frac{64}{3}$ ← *Correct Answer*

C. TWO OR MORE FRACTIONS IN AN EQUATION.

You can do these the hard way (add or subtract the fractions, maybe multiplying by reciprocal as well). Or, you can get rid of all the fractions by multiplying every term (even the terms without fractions) by the LCD. That's the method shown in this example, and it will probably be the best way for you to do it for many years.

Example 5: $\frac{1}{4}x - \frac{5}{6} = 17$

Step 1: Figure out the LCD. It's NOT just multiplying the two denominators to make 24. Rather, it's 12 (the LOWEST multiple shared by both 4 and 6).

Step 2: Multiply every term by the LCD: $12 \cdot \frac{1}{4}x - 12 \cdot \frac{5}{6} = 12 \cdot 17$.

Simplified: $3x - 10 = 120$.

Step 3: Add 10 to both sides: $3x - 10 + 10 = 120 + 10$. Simplified: $3x = 130$.

Step 4: Divide both sides by 3: $(3x)/3 = 130/3$. Simplified: $x = 130/3$ or $\frac{130}{3}$. ← *Correct Answer*