Simplify a Fraction

Example: Simplify the fraction $\frac{24}{30}$.

To *simplify* a fraction means to *reduce* both the numerator and the denominator by a common factor. We are making the fraction smaller, if it is possible.

Method 1 – Divide by a Common Factor

STEP 1: Find a number that divides into *both* 24 and 30. Ideally you want to find the biggest number for the maximum reduction. Although the 24 and 30 are in the multiplication facts table and you should know that 6 divides into them, pretend that you do not know for this example. If you cannot think of the biggest number, then use *divisibility rules* to help you. The 24 and 30 are even numbers so 2 divides into them. Thus, we divide the numerator and denominator by 2 to reduce the fraction.

$$\frac{24}{30} \begin{array}{l} \div 2 \\ \div 2 \end{array} \Rightarrow \frac{12}{15}$$

Divide by the common factor **2** to reduce.

STEP 2: Now we have $\frac{12}{15}$. Ask yourself, "Is this fraction fully reduced, or can it be further simplified?" Repeat the step above to find a number that divides into *both* 12 and 15. You can use your knowledge of the multiplication facts or divisibility rules to find that number. The number that divides into 12 and 15 is 3. We divide the numerator and denominator by 3 to reduce further.

$$\frac{24}{30} \begin{array}{l} \div 2 \\ \div 2 \end{array} \Rightarrow \frac{12}{15} \begin{array}{l} \div 3 \\ \div 3 \end{array} \Rightarrow \frac{4}{5}$$

Divide by the common factor **3** to reduce.

STEP 3: Now we have $\frac{4}{5}$. Ask yourself, "Is this fraction fully reduced, or can it be further simplified?" Repeat the step above to find a number that divides into *both* 4 and 5. The only number that divides into 4 and 5 is 1, thus we are done simplifying. If we divided by 1, we would get the same fraction back, $\frac{4}{5}$.

Tip: To reduce quickly, think of the biggest number that divides into both the numerator and denominator. Here, the biggest number that divides into $\frac{24}{30}$ is 6. Thus,

$$\frac{24}{30} \begin{array}{l} \div 6 \\ \div 6 \end{array} \Rightarrow \frac{4}{5}$$

Divide by the biggest common factor **6** to reduce.

Method 2 – Find Prime Factorization Then Cancel

STEP 1: Find prime factorization of both 24 and 30. Use the factor tree as needed.

$$\frac{24}{30} \Rightarrow \frac{2 \bullet 2 \bullet 2 \bullet 3}{2 \bullet 3 \bullet 5}$$

List the prime numbers of **24** and **30**.

STEP 2: Find any common factors between the numerator and denominator. If there are common factors, then you can "cancel" them. *Cancelling* means the factors become 1. Why? Because a fraction means division. And any number divided by itself is 1. Thus, we can cancel the 2 from both the numerator and denominator. We can also cancel the 3 from both the numerator and denominator. Slash out the 2 and 3 and put a " 1 " in their place.

$$\frac{2 \bullet 2 \bullet 2 \bullet 3}{2 \bullet 3 \bullet 5} \Rightarrow \frac{\overset{1}{\cancel{2}} \bullet 2 \bullet 2 \bullet \overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}} \bullet \underset{1}{\cancel{3}} \bullet 5}$$

Cancel common factors, **2** and **3**, from numerator and denominator.

STEP 3: Ensure there are no more common factors between numerator and denominator. Then multiply the remaining factors straight across in the numerator and in the denominator. Do not bother multiplying the cancelled factors " 1 " because 1 times anything results in that other number.

$$\frac{2 \bullet 2 \bullet 2 \bullet 3}{2 \bullet 3 \bullet 5} \Rightarrow \frac{\overset{1}{\cancel{2}} \bullet 2 \bullet 2 \bullet \overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}} \bullet \underset{1}{\cancel{3}} \bullet 5} \Rightarrow \frac{4}{5}$$

Multiply remaining factors across numerator and denominator.

Notes:

- Factors between numerator and denominator do not need to be directly over each other to cancel them. Since the factors are connected by the multiplication dot " • " they can be located anywhere along the numerator or the denominator. This is due to the *Commutative Property of Multiplication.*
- You cannot cancel the same factors that appear together in the numerator or the same factors that appear together in the denominator.
- You can only cancel "up and down" or "diagonally" *across* the fraction bar. You cannot cancel "side to side" on the same side of the fraction bar.