Writing a Fraction in Lowest Terms

Guidelines for Taking a Fraction to Lowest Terms:

1.) If you have a Mixed Number \(\rightarrow\) focus ONLY on the proper fractional part to determine if the mixed number is in lowest terms.

2.) Look at the numerator and denominator of your fraction and think about:
   - Your knowledge of the Times Tables and the *Foundational Knowledge* handout
   - Divisibility Rules
     - 2: a number is divisible by 2 if it is even
     - 3: a number is divisible by 3 if the sum of the digits are divisible by 3
     - 5: a number is divisible by 5 if it ends in a 0 or 5
     - 10: a number is divisible by 10 if it ends in a 0

3.) Things to look for:
   - If the numerator and denominator are both even (divisible by 2), divide the numerator and denominator by 2.
   - If the numerator and denominator share a common divisor, divide by this number. Use your knowledge of:
     - the Times Tables, and
     - Divisibility Rules – look specifically to see if both the numerator and denominator are divisible by 2, 3, 5, or 10

4.) If you are unsure about whether or not you are done taking a fraction to lowest terms, now that the numerator and denominator are smaller, you can …
   - Locate the smaller of either the numerator or denominator
   - Think about its prime divisors
   - Consider whether or not these prime divisors divide evenly into the other number
     - If so, you have made another pass at moving your fraction to Lowest Terms
     - If not, then your fraction is in Lowest Terms \(\rightarrow\) STOP.

5.) Remember, a fraction is in Lowest Terms when you have removed all the divisors common to the numerator and denominator (other than 1), and the denominator is positive.
Step–By–Step \textit{PROPER} Fraction Addition & Subtraction Rules

\begin{center}
\textbf{Guidelines for \textit{PROPER} Fraction Addition/Subtraction:}
\end{center}

1.) Check to see if EACH fraction is in Lowest Terms. If not, simplify to Lowest Terms.
2.) Check to see if you already have a Least Common Denominator (LCD); if so proceed to Step 5.
3.) If you do NOT have a LCD, then you need to determine the LCD. Refer to the “\textit{Constructing a LCD: 3 Cases}” Handout.
4.) Once you have determined the LCD you need to create EQUIVALENT FRACTIONS containing this LCD.
   \begin{itemize}
   \item Change all the denominators to the LCD.
   \item Adjust the numerators by multiplying by the same number that was used to produce the change to the LCD.
   \item You should now have two or more fractions containing this LCD.
   \end{itemize}
5.) To carry out the addition/subtraction process:
   \begin{itemize}
   \item Recopy your (big and long) fraction division bar.
   \item Recopy the LCD.
   \item Recopy the two numerators and any addition (or subtraction) symbol(s) between them, and place that in your new numerator.
   \item Add/subtract across the numerator and format your preliminary answer.
   \end{itemize}
This is the “\textit{Big Recopy}” step.
6.) Check to see if your preliminary answer is in Lowest Terms.
   \begin{itemize}
   \item If already in Lowest Terms \(\rightarrow\) STOP.
   \item If not in Lowest Terms \(\rightarrow\) take it to Lowest Terms.
   \end{itemize}

\begin{center}
\textbf{Can I guarantee an answer in Lowest Terms with Add/Subtract?}
\end{center}

No! For fraction addition/subtraction, even using the LCD will not guarantee an answer that is always in Lowest Terms. The LCD guarantees the optimal computation which uses the smallest numbers possible, but you still need to check to see if your answer is in Lowest Terms. If your answer is not in Lowest Terms, then you need to continue working until you get it in Lowest Terms.

However, with fraction multiplication and division, if you follow the steps in this handout, then you will be guaranteed an answer in Lowest Terms.
Step–By–Step **MIXED NUMBER** Addition & Subtraction Rules  
*(Options for Addition & Subtraction of Mixed Numbers)*

**Guidelines for MIXED NUMBER Addition:**

**Method 1: Math 20 Approach to Mixed Number Addition**
1.) Add the Whole Number parts together.
2.) Add the Proper Fractional parts together (you may need to get an LCD).
   - Check to see if this fractional sum is in Lowest Terms. If not, rewrite it in Lowest Terms.
   - If the Proper Fractions add to an Improper Fraction, rewrite it as a Mixed Number.
     - Then, add the Whole Number parts again (this is called “Regrouping”).
3.) Format your answer as a Mixed Number in Lowest Terms.

**Method 2: Math 60 Approach to Mixed Number Addition**
1.) Rewrite each Mixed Number as an Improper Fraction.
2.) Carry out fraction addition (you may need to get an LCD).
3.) Format your answer:
   - Convert to a Mixed Number in Lowest Terms, **OR**
   - Write as an Improper Fraction in Lowest Terms.

**Guidelines for MIXED NUMBER Subtraction:**

**Method 1: Math 20 Approach to Mixed Number Subtraction**
1.) Look at the Proper Fractional parts, and get an LCD, if needed.
   - If possible to subtract, do so.
   - If impossible to subtract, because the first numerator is smaller than the second numerator, borrow “1” from the whole number and add “1” to the Proper Fraction.
     - Add “1” in the form of a fraction that looks like: \[
     \frac{\text{LCD}}{\text{LCD}}.
     \]
   - Now subtract the fractions.
2.) Next, subtract the resulting Whole Numbers.
3.) Format your answer as a Mixed Number in Lowest Terms.

**Method 2: Math 60 Approach to Mixed Number Subtraction**
1.) Rewrite each Mixed Number as an Improper Fraction.
2.) Carry out fraction subtraction (you may need to get an LCD).
3.) Format your answer:
   - Convert to a Mixed Number in Lowest Terms, **OR**
   - Write as an Improper Fraction in Lowest Terms.
Step–By–Step Fraction Multiplication & Division Rules

Guidelines for Fraction Multiplication:

1.) If you have a Mixed Number → rewrite it as an Improper Fraction.
2.) If you have a Whole Number → indicate the denominator of 1.
3.) Check to see if EACH fraction is in Lowest Terms. If not, simplify to Lowest Terms.
4.) BEFORE multiplying, check to see if you can cross–cancel, from ANY numerator to ANY denominator.
5.) Once steps 1 – 4 have been done, then …
   - Multiply across the numerator;
   - Multiply across the denominator;
   - Your answer will automatically be in Lowest Terms.
6.) If your answer is a …
   - Proper Fraction → STOP.
   - Improper Fraction → rewrite as a Mixed Number → STOP.
   - Note: I will also accept an Improper Fraction answer as long as it is in Lowest Terms.

Guidelines for Fraction Division:

1.) If you have a Mixed Number → rewrite it as an Improper Fraction.
2.) If you have a Whole Number → indicate the denominator of 1.
3.) KEEP the first fraction, CHANGE division to multiplication, and FLIP the second fraction.
4.) Now, carry out the standard fraction multiplication process. (See above.)

So When Can We CROSS CANCEL?

You can only CROSS CANCEL with MULTIPLY!

Remember …
- There is no cross cancel with Addition.
- There is no cross cancel with Subtraction.
- There is no cross cancel with Division.

So When Do We Need to Use a Least Common Denominator?

- We only USE a LCD for Addition and Subtraction of Fractions.
- We DO NOT USE a LCD for Multiplication and Division of Fractions.