Multiplying Fractions

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Lecture Notes

Notes

- To multiply fractions, the rule states to multiply straight across.
  - Multiply numerators.
  - Multiply denominators.
  - Then reduce, if possible.
- However, it is better to **reduce first**, **then multiply**.
  - Reducing first means that you will work with smaller numbers.
  - Multiplying second means that you will work with smaller numbers.
  - And working with smaller numbers means that:
    - Your chance of making mistakes decrease.
    - Multiplying is easier.
  - I call this technique "reducing up front."

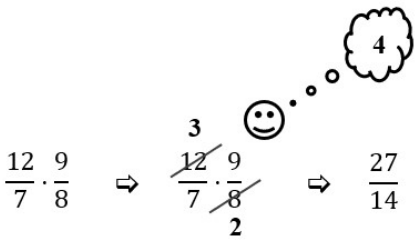
Cross Reducing

- When multiplying two fractions, it is possible to reduce *diagonally*, called **cross reducing**.
  - Case 1: numerator of left fraction reduces with denominator of right fraction.
  - Case 2: numerator of right fraction reduces with denominator of left fraction.
- *Caution:* Do not cross multiply. That concept is used for proportions, and we do not cover proportions in this course.

"Reducing Up Front" (Reducing Before Multiplying)

- **Step 1: Left Fraction.** See if the numerator reduces with denominator.
- **Step 2: Right Fraction.** See if the numerator reduces with denominator.
- **Step 3: Left Numerator and Right Denominator.** See if the numerator of left fraction reduces with denominator of right fraction.
- **Step 4: Right Numerator and Left Denominator.** See if the numerator of right fraction reduces with denominator of left fraction.
- **Step 5: Multiply Across.** Multiply any reduced numerators. Multiply any reduced denominators.
- If you reduced the fractions "up front" to their lowest terms, the product after multiplying is guaranteed to be fully reduced.
- *Notes:*
  - Use reducing techniques you know: slash old numbers and replace them with new ones.
  - You can only reduce **up-down and diagonally**. You cannot reduce going across.
  - If there is a '1' in the numerator or denominator, the '1' *cannot* further reduce.
  - If the answer is an improper fraction, do not change it to a mixed number.

"Reduce Up Front" Example:



$$\frac{12}{7}\cdot\frac{9}{8} \Rightarrow \frac{\cancel{12}^{3}}{7}\cdot\frac{9}{\cancel{8}_{2}} \Rightarrow \frac{27}{14}$$

- *Note:* After reducing (slashing old numbers and replacing them with new ones), it is a good idea to then slash out the "thought bubble" too. The reason is to avoid accidentally multiplying across with the "thought bubble" instead of multiplying only the two numerators.

Multiply. $\frac{3}{4}\cdot\frac{3}{5}$	The answer is $\frac{9}{20}$.

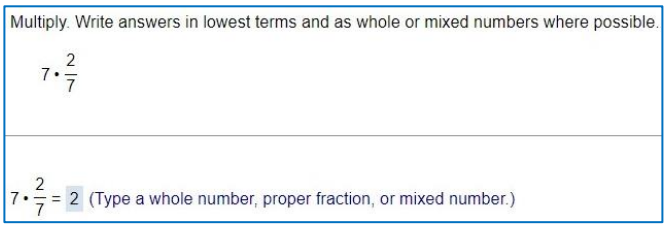
- It is not possible to "reduce up front."
- We can then multiply across.
- The product is guaranteed to be fully reduced.

Multiply. Write answers in lowest terms.

$\frac{1}{4}\cdot\frac{4}{5}$

$\frac{1}{4}\cdot\frac{4}{5} = \frac{1}{5}$ (Simplify your answer.)

- If the product has a '1' in the numerator, it must stay there as part of the answer.
- Ex: $\frac{\mathbf{1}}{\mathbf{5}}$ is a very different number from $\frac{\mathbf{5}}{\mathbf{1}} = \mathbf{5}$



- *Caution:*
  - This is *not a mixed number*, a common mistake.
  - If it was, there would be no multiplication dot '•' between the whole number and fraction.
  - It would then look like this: $7\frac{2}{7}$
  - However, it *does have* a multiplication dot '•' between the whole number and fraction so therefore this is a multplication problem.
- When multiplying a whole number and a fraction, write a '**1**' under the whole number to make it into a fraction.
  - Putting a '1' under any number does not change its value.
- "Reduce up front." The two 7s reduce (cancel) diagonally into '1'. Each 7 becomes a '1'.
- Now mutliply across.
- Do not leave your answer with a '**1**' in the denominator because the answer is not fully reduced. A fraction means division so divide the numerator (2) by the denominator (1) to get a result of **2**.
- Ex: $7 \cdot \frac{2}{7} = \frac{7}{\mathbf{1}} \cdot \frac{2}{7} = \frac{2}{\mathbf{1}} = \mathbf{2}$

- When multiplying fractions, you can set them up in either of the following two ways:
  - Keep the fractions separated by a multiplication dot '•' between them.
  - Combine the numerators and denominators of the two fractions so that they become one fraction.
    - The two numerators will be separated by a multiplication dot '•' between them.
    - The two denominators will be separated by a multiplication dot '•' between them.
    - Ex: $\frac{6 \cdot 2}{11 \cdot 3}$
- It is not necessary to combine the two separate fractions into one fraction.
  - You can keep the fractions separate with a multiplication dot '•' between them.
  - However, you should be aware of the format where fractions are combined in case you see that setup in future problems.

Multiply.

$\frac{4}{9} \cdot \frac{3}{5}$

$\frac{4}{9} \cdot \frac{3}{5} = \frac{4}{15}$ (Simplify your answer.)

- The **3** and **9** reduce diagonally into **1** and **3** respectively, because '3' divides into both numbers.
- Then multiply across.

Multiply and simplify.

$\frac{12}{7} \cdot \frac{9}{8}$

The product is $\frac{27}{14}$.

(Type an integer or a simplified fraction.)

- The **12** and **8** reduce diagonally into **3** and **2** respectively, because '4' divides into both numbers.
- Then multiply across.

Find the product and write it in lowest terms.

$\frac{6}{11} \cdot \frac{5}{4}$

$\frac{6}{11} \cdot \frac{5}{4} = \frac{15}{22}$

(Simplify your answer. Type an integer or a fraction.)

- The **6** and **4** reduce diagonally into **3** and **2** respectively, because '2' divides into both numbers.
- Then multiply across.

Find the product and write it in lowest terms.

$\frac{10}{39} \cdot \frac{3}{8}$

$\frac{10}{39} \cdot \frac{3}{8} = \frac{5}{52}$

- The **10** and **8** reduce diagonally into **5** and **4** respectively, because '2' divides into both numbers.
- The **3** and **39** reduce diagonally into **1** and **13** respectively, because '3' divides into both numbers.
- Then multiply across.

Multiply. Write the product in lowest terms.

$\left(\frac{9}{5}\right)\left(\frac{7}{6}\right)$

The product is $\frac{21}{10}$.

(Type an integer or a simplified fraction.)

- Although parentheses are used to indicate multiplication, follow the same procedure as above.