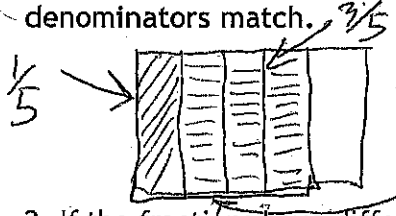
NOTES: How do you add, subtract, multiply and divide fractions?

Adding fractions

1. You can add fractions if the **denominators** (bottom number of the fraction) are the same. You simply add the **numerators** (top number of the fraction).

$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$

Discuss: WHY does this make sense?
Draw pictures or write sentences to explain why you can simply add the numerators when the denominators match.



Because the denominator tells you the size of the fraction. You can add up the numerators because you are combining like terms (fractions of the same size)

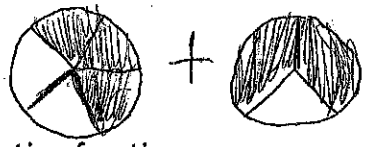
2. If the fractions have different denominators, determine the **lowest common denominator** (LCD) so that you can express each fraction in equivalent form. The lowest common denominator is the lowest number that the denominator of each individual fraction will divide into evenly. Multiply both numerator and denominator of each fraction by the same number.

3/5 + 2/3 The lowest common denominator of 5 and 3 is 15.

Multiply 3/5 by 3/3 and multiply 2/3 by 5/5. This will create two equivalent fractions with the same denominator.

$\frac{3}{5} + \frac{2}{3} = \frac{9}{15} + \frac{10}{15} = \frac{19}{15}$ (Note LCD is 15.)

Discuss: WHY can you not just add the numerators in this example? WHY are you allowed to multiply by 3/3 and 5/5? What can you do if you can't figure out the LCD?
Draw pictures or write sentences to explain why you need a common denominator when you add fractions with unlike denominators.



The slices are different sizes (denominators). You can't add things that are different. So you cut up the slices until they are the same size. Then you can add the slices.

Subtracting fractions

3. Subtracting fractions is very similar to adding in that all fractions in your calculation need to have the same denominator. You may need to determine the lowest common denominator (LCD) as you did with addition.

Subtract 1/3 from 3/4.

$\frac{3}{4} - \frac{1}{3} = \frac{9}{12} - \frac{4}{12} = \frac{5}{12}$ (Note LCD is 12.)

Subtracting IS Adding. So the logic is the same as above.

Explain: How did the 3/4 turn into 9/12? How did the 1/3 turn into 4/12? Use correct mathematical vocabulary to explain.

$\frac{3}{4} \xrightarrow{\cdot 3} \frac{9}{12}$, $\frac{1}{3} \xrightarrow{\cdot 4} \frac{4}{12}$

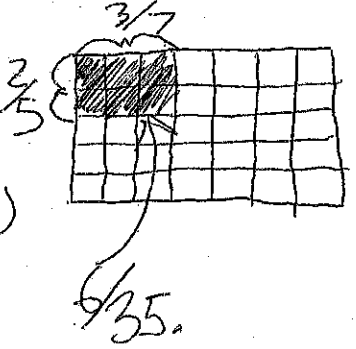
You multiply each fraction by the other denominator. Multiply BOTH Top & Bottom. (numerator & denominator)

3. Multiplication of fractions is carried out by multiplying all the numerators together and all the denominators together.

Multiply 2/5 by 3/7. $\frac{2}{5} \times \frac{3}{7} = \frac{2 \times 3}{5 \times 7} = \frac{6}{35}$

Discuss: Do you need a common denominator to multiply fractions? Why do both the denominator and the numerator change when you multiply fractions?

Do not need a common denominator. You are both changing the number of slices & the size of slices



Dividing fractions

4. To divide by a fraction, invert it and multiply. (numerator x denominator)

Divide $2\frac{3}{4}$ by $\frac{5}{8}$.

$2\frac{3}{4} \div 5/8 = \frac{11}{4} \div \frac{5}{8} = \frac{11}{4} \times \frac{8}{5} = \frac{88}{20} = \frac{22}{5} = 4\frac{2}{5}$

Explain: How did the 2 ¾ turn into 11/4? How did the 88/20 turn into 22/5?

2·4=8. 8+3=11. 88÷4=22, 20÷4=5

Complete the following problems. Use a calculator only to check.

1) $\frac{5 \cdot 7}{5 \cdot 8} - \frac{3 \cdot 8}{5 \cdot 8} = \frac{35-24}{40} = \frac{11}{40}$

2) $\frac{5}{7} \div \frac{7}{9} = \frac{5}{7} \cdot \frac{9}{7} = \frac{45}{49}$

3) $\frac{8 \cdot 2}{8 \cdot 3} - \frac{5 \cdot 3}{8 \cdot 3} = \frac{16-15}{24} = \frac{1}{24}$

4) $\frac{3 \cdot 7}{3 \cdot 10} + \frac{1 \cdot 10}{3 \cdot 10} = \frac{21+10}{30} = \frac{31}{30}$

5) $\frac{\cancel{4}}{8} \times \frac{3}{\cancel{4}} = \frac{3}{8}$

6) $\frac{2}{3} \div \frac{1}{2} = \frac{2}{3} \cdot \frac{2}{1} = \frac{4}{3}$

7) $\frac{1}{4} \times \frac{7}{10} = \frac{7}{40}$

8) $\frac{2}{9} \div \frac{1}{5} = \frac{2}{9} \cdot \frac{5}{1} = \frac{10}{9}$

9) $\frac{6 \cdot 4}{6 \cdot 10} - \frac{1 \cdot 10}{6 \cdot 10} = \frac{24-10}{60} = \frac{14}{60}$

10) $\frac{4 \cdot 2}{4 \cdot 3} + \frac{2 \cdot 3}{4 \cdot 3} = \frac{8+6}{12} = \frac{14}{12}$

11) $\frac{4}{\cancel{8}} \times \frac{\cancel{8}}{9} = \frac{4}{9}$

12) $\frac{4 \cdot 2}{4 \cdot 5} + \frac{1 \cdot 5}{4 \cdot 5} = \frac{8+5}{20} = \frac{13}{20}$