Sect 3.1 - Adding and Subtracting Like Fractions

Objective a: Addition and Subtraction of Like Fractions

Two or more fractions are called **like fractions** if they have the same denominator. To see how addition of like fractions works, let's consider the following application:

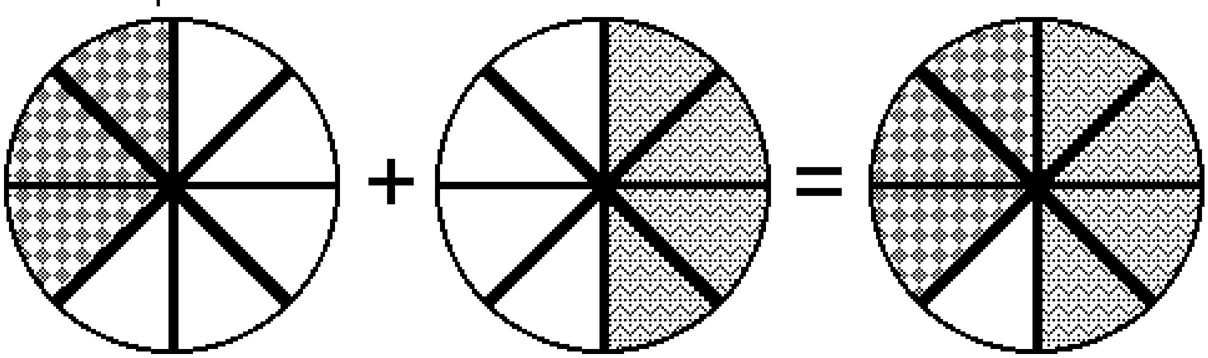
Solve:

Ex. 1 After the Super Bowl game, the Rodriguez's had two partially eaten pizzas left. In one box, there was three out of eight slices remaining while in the other box, there was four out of eight slices remaining. If they combine the contents of the two boxes, how much pizza will they have?

Solution:

Let's analyze this situation:

To combine the two pizzas into one box, we will move the three slices in the first box to the second box with the four slices. This will give us seven out of eight slices in one box. We can represent this as a picture:



$$\frac{3}{8} + \frac{4}{8} = \frac{3+4}{8} = \frac{7}{8}$$

So, they will have $\frac{7}{8}$ of a pizza combined.

This example shows us that if we add two fractions with the same denominator, we add only the numerators. The denominator remains the same. The denominator refers to the size of each slice and by combining the two pizzas together, the size of each slice did not change. Hence, that is why the denominator does not change. This is very different from multiplying and dividing fractions.

To see how subtraction of like fractions works, let's consider the following application:

Solve :

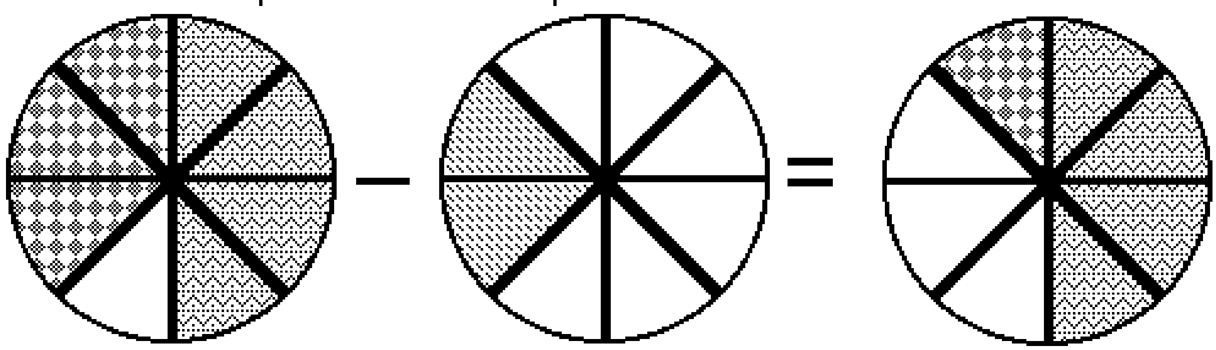
Ex. 2 Building on example one, the Rodriguez's son eats two slices of pizza for breakfast the next day. How much pizza do the Rodriguez's now have left?

Solution:

Let's analyze this situation:

The Rodriguezs had seven out of eight slices left. Their son eats two slices, which leaves five out of eight slices.

We can represent this as a picture:



$$\frac{7}{8} - \frac{2}{8} = \frac{7-2}{8} = \frac{5}{8}$$

This example shows us that if we subtract two fractions with the same denominator, we subtract only the numerators. The denominator remains the same since the sizes of the slices do not change. Again, this is very different from multiplying and dividing fractions.

Simplify:

Ex. 3 $\frac{2}{9} + \frac{5}{9}$

Solution:

To add $\frac{2}{9}$ and $\frac{5}{9}$, add only the numerators, keep the denominator the same: $\frac{2}{9} + \frac{5}{9} = \frac{2+5}{9} = \frac{7}{9}$.

Ex. 4 $\frac{15}{7} - \frac{8}{7}$

Solution:

To subtract $\frac{8}{7}$ from $\frac{15}{7}$, subtract only the numerators, keep the denominator the same: $\frac{15}{7} - \frac{8}{7} = \frac{15-8}{7} = \frac{7}{7} = 1$.

Remember to always reduce to your answers to lowest terms.

Ex. 5 $\frac{23}{8} + \frac{21}{8} - \frac{19}{8}$

Solution:

$\frac{23}{8} + \frac{21}{8} - \frac{19}{8} = \frac{23+21-19}{8} = \frac{44-19}{8} = \frac{25}{8}$.

Now, let's write the answer as a mixed number:

$$\begin{array}{r|l} & \underline{\;\;3\;\;} \\ 8 & 25 \\ & \underline{-24} \\ & \;\;\;1 \end{array}$$

So, the answer is $3\frac{1}{8}$.

Ex. 6 $\frac{7}{15} - \frac{4}{15} + \frac{2}{15}$

Solution:

$\frac{7}{15} - \frac{4}{15} + \frac{2}{15} = \frac{7-4+2}{15} = \frac{3+2}{15} = \frac{5}{15} = \frac{5\bullet1}{5\bullet3} = \frac{1}{3}$.

Objective b: Order of Operations.

Recall the Order of Operations:

<u>Order of Operations</u>

1) Parentheses - Do operations inside of Parentheses ( ), [ ], { }, | |
2) Exponents including square roots.
3) Multiplication or Division as they appear from left to right.
4) Addition or Subtraction as they appear from left to right.

<u>Simplify:</u>

Ex. 7 $\left(\frac{2}{9} + \frac{5}{9}\right)^2 \div \frac{21}{4}$

Solution:

$\left(\frac{2}{9} + \frac{5}{9}\right)^2 \div \frac{21}{4}$ (Add inside ())

$= \left(\frac{7}{9}\right)^2 \div \frac{21}{4}$ (Exponents)

$= \left(\frac{7}{9}\right)\left(\frac{7}{9}\right) \div \frac{21}{4}$

$= \frac{49}{81} \div \frac{21}{4}$ (Invert and multiply)

$= \frac{49}{81} \bullet \frac{4}{21}$ (Reduce)

$= \frac{7 \bullet 7}{81} \bullet \frac{4}{7 \bullet 3} = \frac{28}{243}$

Ex. 8 $5\frac{1}{4} \bullet \frac{1}{6} - \frac{1}{8}$

Solution:

$5\frac{1}{4} \bullet \frac{1}{6} - \frac{1}{8}$ (Change $5\frac{1}{4}$ to an improper fraction)

$= \frac{21}{4} \bullet \frac{1}{6} - \frac{1}{8}$ (Reduce)

$= \frac{3 \bullet 7}{4} \bullet \frac{1}{3 \bullet 2} - \frac{1}{8}$

$= \frac{7}{4} \bullet \frac{1}{2} - \frac{1}{8}$

$= \frac{7}{8} - \frac{1}{8}$ (Subtract)

$= \frac{6}{8}$ (Reduce)

$= \frac{3}{4}$

Objective c: Applications.

Solve the following:

Ex. 9 A recipe for pancakes calls for $3\frac{1}{4}$ cups of flour. Craig only has $2\frac{3}{4}$ cups of flour. How much flour must he borrow from a neighbor to make the pancakes?

Solution:

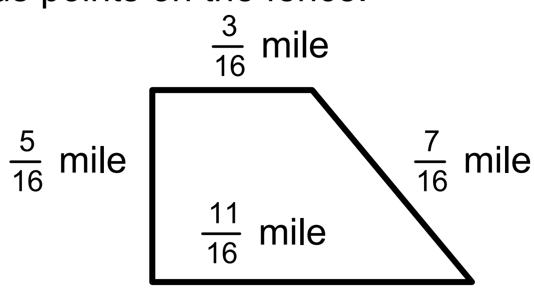
We have not discussed how to subtract mixed numbers, but we can first change the mixed numbers into improper fractions and then work the problem:

$3\frac{1}{4} = \frac{3 \bullet 4 + 1}{4} = \frac{13}{4}$ and $2\frac{3}{4} = \frac{2 \bullet 4 + 3}{4} = \frac{11}{4}$.

Thus, $3\frac{1}{4} - 2\frac{3}{4} = \frac{13}{4} - \frac{11}{4} = \frac{2}{4} = \frac{2 \bullet 1}{2 \bullet 2} = \frac{1}{2}$.

So, Craig will need to borrow $\frac{1}{2}$ cup of flour.

Ex. 10 How much fencing is needed to enclose the following property below? Assume that $\frac{1}{16}$ mile will be removed to locate gates at various points on the fence.



Solution:

The amount of fencing need will be equal to the perimeter of the property minus the $\frac{1}{16}$ mile that will be used for the gates. The perimeter is the sum of the lengths of the sides of the figure.

$\frac{5}{16} + \frac{3}{16} + \frac{7}{16} + \frac{11}{16} - \frac{1}{16} = \frac{5+3+7+11-1}{16} = \frac{25}{16} = 1\frac{9}{16}$

So, $1\frac{9}{16}$ miles of fencing will be need.