Adding Unlike Fractions

Prerequisites: Multiply fractions; fraction bars; add and subtract like fractions;
GCF/LCM; equivalent forms of one; solve/simplify equations

Lesson:
Today we are going to apply what we have learned about fractions so far in order to add fractions with unlike denominators.

If I have $\frac{1}{5}+\frac{3}{5}$. What do I do to determine the sum?
(add the numerators and keep the denominators the same.)

Why?
[choral response: because in math, we add and subtract things that are LIKE – combining like terms]

Both fractions have the same number of total parts, so we just add the numerators to see how many piece we have all together.

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

Do we need to simplify $\frac{4}{5}$? [choral response: NO]
How do I know? [because the GCF of 4 and 5 is 1. The fraction is simplified]

OK, so what if I have $\frac{1}{4}+\frac{1}{3}$? Are my denominators the same? [no]
So can I add this fraction like I did before? [no]

Why? [because our denominators are not the same]

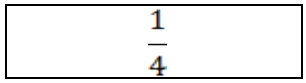
Today we are going to learn **three methods** to add fractions with unlike denominators.

On chart paper, chart each method side-by-side as you introduce each example and as you debrief each you try — see last page.

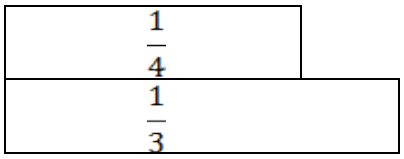
Method 1 — Fraction Tiles: $\frac{1}{4}+\frac{1}{3}$

We are going use our fraction tiles.

Find your $\frac{1}{4}$ fraction tile.

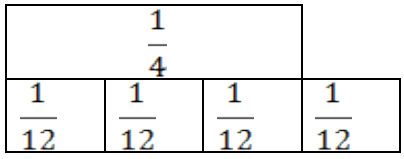


Now we add the $\frac{1}{3}$ fraction tile.

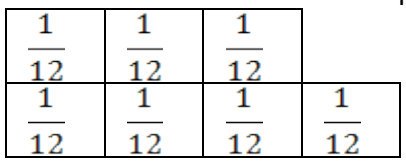


Can we replace the $\frac{1}{3}$ with tiles that will match up with the $\frac{1}{4}$? [yes, the $\frac{1}{12}$ fraction tile]

How many of the $\frac{1}{12}$ fractions tiles do we need? [4]



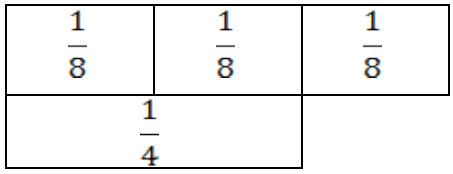
Now we need to change the $\frac{1}{4}$ to 12ths. How many do we need? Tell your partner. [3]

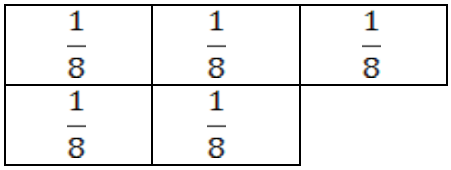


Now do we have the same denominators? [yes] Can we add our numerators? [yes]

$$\frac{1}{4}+\frac{1}{3}$$
$$=\frac{3}{12}+\frac{4}{12}$$
$$=\frac{3+4}{12}$$
$$=\frac{7}{12}$$

You try: $\frac{3}{8}+\frac{1}{4}$





$$\frac{3}{8}+\frac{1}{4}$$
$$=\frac{3}{8}+\frac{2}{8}$$
$$=\frac{3+2}{8}$$
$$=\frac{5}{8}$$

$$\therefore \frac{3}{8}+\frac{1}{4}=\frac{5}{8}$$

Method 2: **Common Denominators**

Let's do it another way. We will use the first problem: $x=\frac{1}{4}+\frac{1}{3}$.
We can find a **common denominator.**

What is the LCM of 4 and 3? [12]

What do we multiply 4 by to get 12? [3]
What do we multiply 3 by to get 12? [4]

So what would we multiply $\frac{1}{4}$ by to get a denominator of 12? **Remember we can only multiply by one so we don't change what we started with. This is called the multiplicative identity.** $\left[\frac{3}{3}=1\right]$

So what would we multiply $\frac{1}{3}$ by to get a denominator of 12? **Remember we can only multiply by one so we don't change what we started with. This is called the multiplicative identity.** $\left[\frac{4}{4}=1\right]$

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

$$x = \left(\frac{1}{4} \bullet \frac{3}{3}\right) + \left(\frac{1}{3} \bullet \frac{4}{4}\right)$$

$$x = \frac{3}{12} + \frac{4}{12}$$

$$x = \frac{3+4}{12}$$

$$x = \frac{7}{12}$$

When we are finding a common denominator we need to multiple by an equivalent form of one.

Do we always need rename both fractions? [no]

Do we in this case? [yes]

You try: $x = \frac{3}{8} + \frac{1}{4}$

$$x = \frac{3}{8} + \frac{1}{4}$$

$$x = \frac{3}{8} + \left(\frac{1}{4} \bullet \frac{2}{2}\right)$$

$$x = \frac{3}{8} + \frac{2}{8}$$

$$x = \frac{3+2}{8}$$

$$x = \frac{5}{8}$$

Method 3: Clearing the Denominators

This method is similar to the method we just used. We will use a common multiple to clear or get rid of the denominators. This method is often how it is done in algebra. We will use the first problem again

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

This time we will multiply the entire problem (both sides of the equation) by our least common multiple: 12.

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

$$12(x) = 12\left(\frac{1}{4}\right) + 12\left(\frac{1}{3}\right)$$

$$\frac{12}{1}(x) = \frac{12}{1}\left(\frac{1}{4}\right) + \frac{12}{1}\left(\frac{1}{3}\right)$$

$$12x = \frac{12 \bullet 1}{1 \bullet 4} + \frac{12 \bullet 1}{1 \bullet 3}$$

$$12x = \frac{12}{4} + \frac{12}{3}$$

$$12x = 3 + 4$$

$$12x = 7$$

$$\frac{12x}{12} = \frac{7}{12}$$

$$x = \frac{7}{12}$$

To clear the denominators we must multiple both sides of the equation by 12, which is the LCM (3, 4). Why would we multiply both sides of the equation? [What we do to one side we do to the other to keep balance.]

When we simplify we get $12x = 3 + 4$ or $12x = 7$.

What are we solving for? [x] How do we solve for x? [We need to do the inverse of multiplication to isolate x. So we need to divide by 12].

You try: **Solve for *x*:** $x = \frac{3}{8} + \frac{1}{4}$

$$x = \frac{3}{8} + \frac{1}{4}$$

$$8(x) = 8\left(\frac{3}{8}\right) + 8\left(\frac{1}{4}\right)$$

$$\frac{8}{1}(x) = \frac{8}{1}\left(\frac{3}{8}\right) + \frac{8}{1}\left(\frac{1}{4}\right)$$

$$8x = \frac{8 \bullet 3}{1 \bullet 8} + \frac{8 \bullet 1}{1 \bullet 4}$$

$$8x = \frac{3}{1} + \frac{8}{4}$$

$$8x = 3 + 2$$

$$8x = 5$$

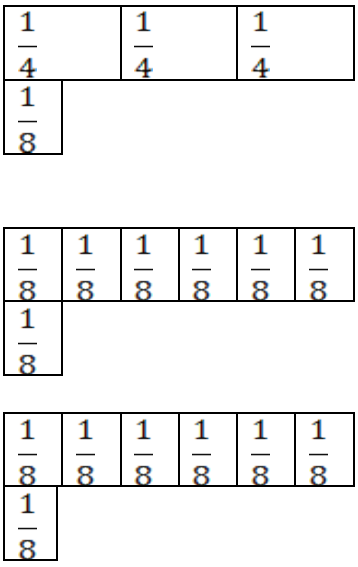
$$\frac{8x}{8} = \frac{5}{8}$$

$$x = \frac{5}{8}$$

You Try: **Solve for *x*:** $x = \frac{3}{4} + \frac{1}{8}$ **using all three methods side-by-side.**

Fraction Tiles:

$x = \frac{3}{4} + \frac{1}{8}$



$\therefore \frac{3}{4} + \frac{1}{8} = \frac{7}{8}$

Common Denominators:

$$x = \frac{3}{4} + \frac{1}{8}$$

$$x = \left(\frac{3}{4} \bullet \frac{2}{2}\right) + \frac{1}{8}$$

$$x = \frac{6}{8} + \frac{1}{8}$$

$$x = \frac{6+1}{8}$$

$$x = \frac{7}{8}$$

Clearing Denominators:

$$x = \frac{3}{4} + \frac{1}{8}$$

$$8(x) = 8\left(\frac{3}{4}\right) + 8\left(\frac{1}{8}\right)$$

$$\frac{8}{1}(x) = \frac{8}{1}\left(\frac{3}{4}\right) + \frac{8}{1}\left(\frac{1}{8}\right)$$

$$8x = \frac{8 \bullet 3}{1 \bullet 4} + \frac{8 \bullet 1}{1 \bullet 8}$$

$$8x = \frac{24}{4} + \frac{8}{8}$$

$$8x = 6 + 1$$

$$8x = 7$$

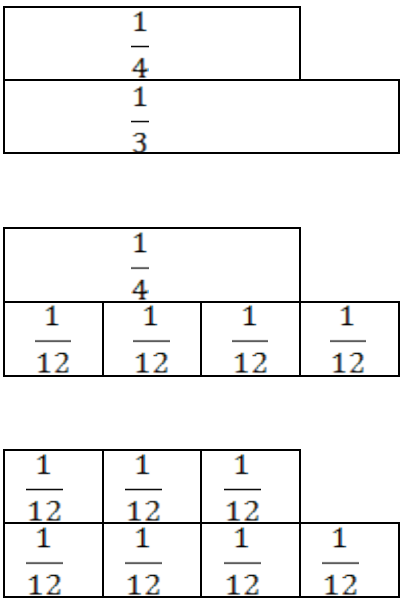
$$\frac{8x}{8} = \frac{7}{8}$$

$$x = \frac{7}{8}$$

Side-by-side Class Chart of Example & You Try:

Example: $x = \frac{1}{4} + \frac{1}{3}$

Fraction Tiles:



$\therefore \frac{1}{4} + \frac{1}{3} = \frac{7}{12}$

Common Denominators:

$$x = \frac{1}{4} + \frac{1}{3}$$
$$x = \left(\frac{1}{4} \bullet \frac{3}{3}\right) + \left(\frac{1}{3} \bullet \frac{4}{4}\right)$$
$$x = \frac{3}{12} + \frac{4}{12}$$
$$x = \frac{3+4}{12}$$
$$x = \frac{7}{12}$$

Clearing Denominators:

$$x = \frac{1}{4} + \frac{1}{3}$$
$$12(x) = 12\left(\frac{1}{4}\right) + 12\left(\frac{1}{3}\right)$$
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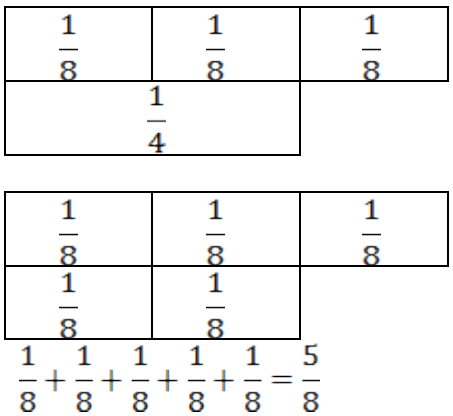
$$12x = \frac{12 \bullet 1}{1 \bullet 4} + \frac{12 \bullet 1}{1 \bullet 3}$$
$$12x = \frac{12}{4} + \frac{12}{3}$$
$$12x = 3 + 4$$
$$12x = 7$$
$$\frac{12x}{12} = \frac{7}{12}$$
$$x = \frac{7}{12}$$

You Try: $x = \frac{3}{8} + \frac{1}{4}$

Fraction Tiles:

$\frac{3}{8} + \frac{1}{4}$



$\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{5}{8}$

$\therefore \frac{3}{8} + \frac{1}{4} = \frac{5}{8}$

Common Denominators:

$$x = \frac{3}{8} + \frac{1}{4}$$
$$x = \frac{3}{8} + \left(\frac{1}{4} \bullet \frac{2}{2}\right)$$
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Clearing Denominators:

$$x = \frac{3}{8} + \frac{1}{4}$$
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$$x = \frac{5}{8}$$