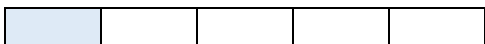




CYPRESS COLLEGE

Adding and Subtracting Fractions

Visually: Add the fractions by shading the result



Mathematically: Write a fraction for each and add

$$\begin{array}{r}
 \frac{2}{5} \\
 + \\
 \frac{1}{5} \\
 = \underline{\hspace{1cm}} \\
 \frac{3}{5}
 \end{array}$$

If the denominators are the same:

1. Add or Subtract the Numerator
2. Keep the Same Denominator
3. Simplify or Reduce (if possible)

Answer: $\frac{3}{5}$

Example: Add the fractions $\frac{4}{9} + \frac{2}{9}$.

Solution: Since the denominators are the same, we add the numerators and keep the denominator the same,

$$\frac{4}{9} + \frac{2}{9} = \frac{4+2}{9} = \frac{6}{9}$$

Simplify the answer by reducing $\frac{6}{9}$. Divide $\frac{6}{9}$ by $\frac{3}{3}$:

$$\begin{aligned}
 \frac{6}{9} \div \frac{3}{3} &= \frac{6 \div 3}{9 \div 3} \\
 &= \frac{2}{3}
 \end{aligned}$$

Answer: $\frac{2}{3}$

Example: Subtract the fractions $\frac{9}{10} - \frac{3}{10}$.

Solution: Since the denominators are the same, we subtract the numerators and keep the denominator the same,

$$\frac{9}{10} - \frac{3}{10} = \frac{6}{10}$$

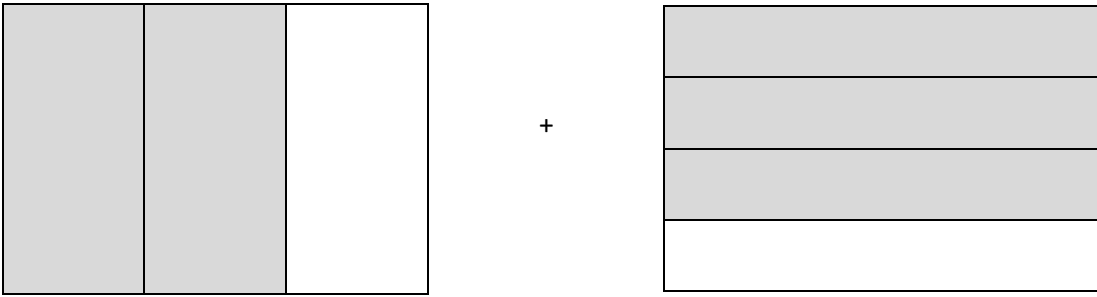
Simplify the answer by reducing $\frac{6}{10}$. Divide $\frac{6}{10}$ by $\frac{2}{2}$ to get $\frac{3}{5}$.

Answer: $\frac{3}{5}$

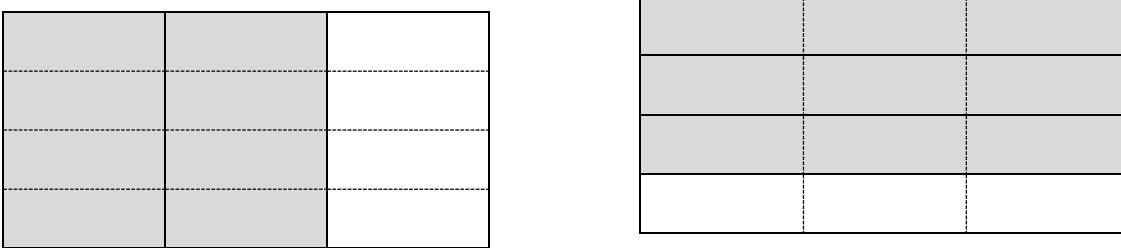
How do we add/subtract fractions if the denominators are different?

$$\frac{2}{3} + \frac{3}{4}$$

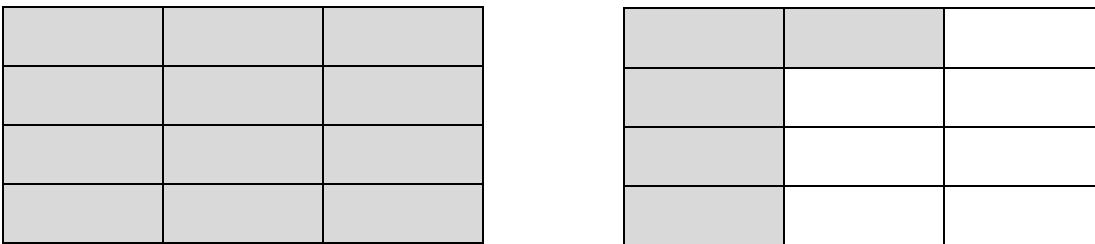
Visually: We can represent the fractions as below:



The shaded pieces have different sizes so we cannot put them together. To put them together, we have to make them the same size. We do this by drawing the lines of one rectangle into the other one.



Now all the pieces have the same so we can add all the shaded pieces together to get,



Mathematically: The figure that represents $\frac{2}{3}$ can be drawn to represent $\frac{8}{12}$. The one that represents $\frac{3}{4}$ can be drawn to represent $\frac{9}{12}$. Thus,

$$\begin{aligned} \frac{2}{3} + \frac{3}{4} \\ = \frac{8}{12} + \frac{9}{12} \end{aligned}$$

Now the two fractions have the same denominator so we can add the numerators and keep the denominator the same,

$$\begin{aligned} \frac{8}{12} + \frac{9}{12} \\ = \frac{17}{12} \end{aligned}$$

Answer: $\frac{17}{12}$ or $1\frac{5}{12}$

We call 12 the least common denominator (LCD). Therefore, the LCD of 3 and 4 is 12. To find the LCD, we use the same method as finding the least common multiple (LCM) of the denominators.

Finding The Least Common Denominator (LCD)

Step 1: List the multiples of the larger denominator.

Step 2: Find the first multiple that the other smaller denominator goes into evenly.

Example: Find the LCD of $\frac{1}{4}$ and $\frac{5}{6}$.

Solution: First, we list the multiples of 6 because 6 is the larger denominator: 6, 12, 18, 24,...

Then we ask ourselves, which one is the FIRST multiple that 4 goes into evenly? Since 12 is the first multiple that is 4 divides evenly into, then 12 is the LCD.

To add/subtraction fractions with different denominators:

1. Find the LCD
2. Multiply by the Missing Numbers (to get LIKE fractions)
3. Add or Subtract the Numerator
4. Keep the Denominator
5. Reduce (if possible)

Example: Add. $\frac{2}{5} + \frac{1}{6}$

Solution: Since the denominators are different, we need to find the LCD first. The least common multiple of 5 and 6 is 30 so the LCD is 30.

Next, we need to rewrite the fractions so that they are like fractions,

$$\begin{aligned}\frac{2 \cdot 6}{5 \cdot 6} + \frac{1 \cdot 5}{6 \cdot 5} \\ = \frac{12}{30} + \frac{5}{30}\end{aligned}$$

Now the denominators are the same so we can add the numerators and keep the denominator the same to get,

$$\frac{12 + 5}{30} = \frac{17}{30}$$

Answer: $\frac{17}{30}$

Example: Subtract. $\frac{3}{5} - \frac{1}{10}$

Solution:

$$\begin{aligned}\frac{3 \cdot 2}{5 \cdot 2} - \frac{1}{10} \\ = \frac{6}{10} - \frac{1}{10} \\ = \frac{5}{10} = \frac{1}{2}\end{aligned}$$

Answer: $\frac{1}{2}$

Exercise 1: Add or subtract. Simplify all answers.

a) $\frac{1}{5} + \frac{3}{5}$

b) $\frac{7}{9} - \frac{4}{9}$

c) $\frac{7}{8} - \frac{5}{8}$

d) $\frac{5}{16} + \frac{1}{2}$

e) $\frac{1}{5} + \frac{1}{4}$

f) $\frac{5}{8} + \frac{5}{12}$

g) $\frac{7}{10} + \frac{5}{12}$

h) $\frac{11}{15} - \frac{7}{12}$

i) $\frac{13}{18} - \frac{17}{24}$