

# Adding and Subtracting

Just remember what these guys taught you!

Remember when multiplying was hard, and adding was easy?



We'll do a quick example to see how much you remember / know about adding fractions.

$$\frac{3}{x^3} + \frac{8}{x^3} - \frac{4}{x^3}$$

$$\frac{3 + 8 - 4}{x^3} = \frac{7}{x^3}$$

$$x \neq 0$$

Here's your algorithm. (The steps you need to take every time: I'll wait for you to write it down)

1. State the restrictions.
  - Always. Every question. Every time. You can not divide by zero. It is nonsensical.
2. Find a common denominator.
  - This is the step that makes adding difficult.
3. Write an equivalent fraction
  - Be able to write one denominator with all the numerator stuff above one line.
4. Add and subtract like terms in the numerator.
5. Make sure your final answer is simplified.

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

$$= \frac{x + 2}{3} \quad \checkmark$$

You try these two. Follow the algorithm:

$\frac{3x}{x+2} + \frac{6}{x+2}$ <p><math>x \neq -2</math></p> $= \frac{3x + 6}{x + 2}$ $= \frac{3(x + 2)}{x + 2}$ $= 3$	$\frac{x^2}{x-3} + \frac{x}{x-3} - \frac{12}{x-3}$ $\frac{x^2 + x - 12}{x - 3}$ $= \frac{(x-3)(x+4)}{(x-3)}$ <p><math>x \neq 3</math></p> <p><math>x + 4</math></p> <div style="border: 1px solid purple; border-radius: 50%; padding: 10px; display: inline-block; margin-top: 10px;"> <p><math>m \rightarrow -12</math>  <math>a \rightarrow 1</math>  <math>(-3, 4)</math></p> <math display="block">\frac{x^2 - 3x + 4x - 12}{x(x-3) + 4(x-3)}</math> <math display="block">(x-3)(x+4)</math> </div>
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Ok, all those were “best case scenario” you will not have questions that already have a common denominator. Getting one will be your job. Expect to do this every question.

$$\frac{5m}{6} - \frac{3m}{4} + \frac{m}{8}$$

There are 2 ways to get your common denominator. The *best* way is to see that  $6(4)=4(6)=8(3)=24$ .

However, if you can't see the **lowest** common denominator like that you can always multiply all the bottom terms together to get a common denominator.  $6(4)(8)=192$ ... big numbers usually do not make the question easier though...

$$\frac{2n-7}{8n} - \frac{3n-4}{6n}$$

$$n \neq 0$$

$$= \frac{3(2n-7) - 4(3n-4)}{24n}$$

$$= \frac{6n - 21 - 12n + 16}{24n}$$

$$= \frac{-6n - 5}{24n}$$

$$\frac{2y}{5x^2} + \frac{1}{10x} - \frac{6}{15x^3}$$

$$x \neq 0$$

$$\frac{12xy + 3x^2 - 12}{30x^3}$$

$$\frac{3(4xy + x^2 - 4)}{3(10x^3)}$$

Let's kick it up a notch!



$$x \neq -5, 3$$

$$\begin{aligned} & \frac{2x}{(x+5)} + \frac{3x}{(x-3)} \\ &= \frac{2x(x-3) + 3x(x+5)}{(x+5)(x-3)} \\ &= \frac{2x^2 - 6x + 3x^2 + 15x}{(x+5)(x-3)} \\ &= \frac{5x^2 + 9x}{(x+5)(x-3)} = \frac{x(5x+9)}{(x+5)(x-3)} \quad \checkmark \end{aligned}$$

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$$\frac{x}{2x-4} - \frac{3}{3x-6}$$

$$\frac{x}{2(x-2)} - \frac{3}{3(x-2)}$$

$$x \neq 2$$

$$\frac{x-2}{2(x-2)}$$

$$= \frac{1}{2} \quad \text{;)}$$

$x \neq -3, 2, 4$

$$\frac{4}{x^2+x-6} - \frac{5}{x^2-x-12} = \frac{4}{(x+3)(x-2)} - \frac{5}{(x-4)(x+3)}$$

$$= \frac{4(x-4) - 5(x-2)}{(x+3)(x-2)(x-4)}$$

$$= \frac{4x-16-5x+10}{(x+3)(x-2)(x-4)}$$

$$= \frac{-x-6}{(x+3)(x-2)(x-4)}$$



$(x+3)(x-2)$  ←

$x \neq -3, 2, -1$

$$\frac{x-1}{x^2+x-6} - \frac{x-2}{x^2+4x+3} \rightarrow \frac{(x+3)(x+1)}{(x+3)(x-2)(x+1)}$$

$$= \frac{(x-1)(x+1) - (x-2)(x-2)}{(x+3)(x-2)(x+1)}$$

$$= \frac{x^2-1 - (x-2)^2}{(x+3)(x-2)(x+1)}$$

$$= \frac{x^2-1 - x^2+4x+4}{(x+3)(x-2)(x+1)}$$

$$= \frac{-4x+3}{(x+3)(x-2)(x+1)}$$