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Arithmetic & algebra · Lesson 5/7 · ●●○ Intermediate

Operations with fractions

How do you add two fractions with different denominators? And how do you divide them? We see the rules with bars split into equal parts: same denominator with the LCM, numerator times numerator, and division as multiplication by the reciprocal.

In this video we solve 3 exercises step by step, with cross-simplifying.

The method

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$$

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

Worked examples

Exercise 1

Work out: 2/3 + 1/4

Data: $\frac{2}{3} + \frac{1}{4}$

1. **Different denominators: the LCM of 3 and 4 is 12**

$$\mathrm{LCM}(3,4) = 12$$

Result: $\mathrm{LCM} = 12$

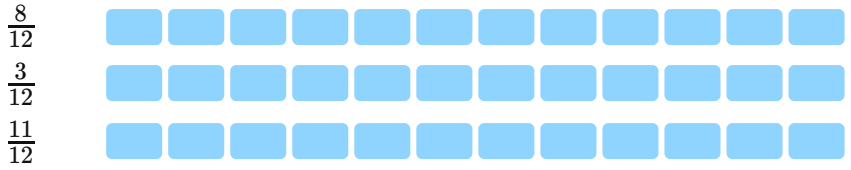
2. **Turn the fractions into twelfths**

$$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

$$\frac{1}{4} = \frac{1 \times 3}{4 \times 3} = \frac{3}{12}$$

Result: $2/3 = 8/12 \quad 1/4 = 3/12$

3. **Now add the numerators**



$$\frac{8}{12} + \frac{3}{12} = \frac{8+3}{12} = \frac{11}{12}$$

💡 The denominator stays 12: never add the denominators!

Result: $2/3 + 1/4 = 11/12$

✓ Check

$$\frac{11}{12} - \frac{1}{4} = \frac{11}{12} - \frac{3}{12} = \frac{8}{12} = \frac{2}{3} \checkmark$$

Exercise 2

Work it out and write it in lowest terms: 5/6 − 1/2

Data: $\frac{5}{6} - \frac{1}{2}$

1. **The LCM of 6 and 2 is 6: change only 1/2**

$$\frac{1}{2} = \frac{1 \times 3}{2 \times 3} = \frac{3}{6}$$

Result: $1/2 = 3/6$

2. **Subtract the numerators**

$$\frac{5}{6} - \frac{3}{6} = \frac{5-3}{6} = \frac{2}{6}$$

Result: $5/6 - 3/6 = 2/6$

3. **Simplify to lowest terms, dividing by 2**

$$\frac{2}{6} = \frac{2 \div 2}{6 \div 2} = \frac{1}{3}$$

💡 Always write the answer in lowest terms

Result: $5/6 - 1/2 = 1/3$

✓ **Check**

$$\frac{1}{3} + \frac{1}{2} = \frac{2}{6} + \frac{3}{6} = \frac{5}{6} \checkmark$$

Exercise 3

Work out: 3/4 ÷ 9/8

Data: $\frac{3}{4} \div \frac{9}{8}$

1. **Division: multiply by the reciprocal of the second**

$$\frac{3}{4} \div \frac{9}{8} = \frac{3}{4} \times \frac{8}{9}$$

💡 Flip only the second fraction!

Result: $3/4 \div 9/8 = 3/4 \times 8/9$

2. **Cross-simplify: 3 with 9 and 4 with 8**

$$\frac{3}{4} \times \frac{8}{9} = \frac{3 \div 3}{4 \div 4} \times \frac{8 \div 4}{9 \div 3}$$

$$= \frac{1}{1} \times \frac{2}{3}$$

3. **Multiply the numerators and the denominators**

$$\frac{1 \times 2}{1 \times 3} = \frac{2}{3}$$

Result: $3/4 \div 9/8 = 2/3$

✔ Check

$$\frac{2}{3} \times \frac{9}{8} = \frac{18}{24} = \frac{3}{4} \checkmark$$

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