A1.4 Algebraic Fractions: Addition and Subtraction

$$\frac{h}{6}+\frac{2h}{9}$$
$$=\frac{h}{6}\times\frac{3}{3}+\frac{2h}{9}\times\frac{2}{2}$$
$$=\frac{3h}{18}+\frac{4h}{18}$$
$$=\frac{7h}{18}$$

You are familiar with adding and subtracting fractions. Fractions involving pro-numerals and numbers can also be added and subtracted. This module discusses how this is done.

Play a short video on this topic.Get a transcript of the video.
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Review of Ordinary Fractions

The basic concept is that only fractions with a common denominator[1] may be added or subtracted. For example:[2]

$$\begin{aligned}\frac{7}{10}-\frac{3}{7} &= \frac{7}{10}\times\frac{7}{7}-\frac{3}{7}\times\frac{10}{10}, \text{ common denominator is 70,}\\ &= \frac{49}{70}-\frac{30}{70}\\ &= \frac{49-30}{70}\\ &= \frac{19}{70}.\end{aligned}$$

[1] The denominator is the number or pro-numeral on the bottom of the fraction. The number on top is called the numerator. For the fraction 2/5, the numerator is 2 and the denominator is 5.

[2] In this example the common denominator is $10\times 7=70$. So we want the denominator to be 70 for both fractions. This is done by multiplying by 7/7 and 10/10 respectively. Note that these are both equal to one and so you change nothing when you multiply a fraction by them.

Algebraic Fractions

Algebraic fractions are fractions that involve pro-numerals. For example:

$$\frac{a}{2}, \frac{2b}{3}, \frac{1}{2c}, \frac{e+1}{2}, \frac{3}{a-2}, \frac{a}{b}, \frac{a}{b+c}$$

are algebraic fractions.

Algebraic fractions can be added and subtracted in a similar way to ordinary fractions. The same concepts apply. To add or subtract two algebraic fractions, their denominators must be the same.

Example 1

$$\begin{aligned}\frac{h}{6}+\frac{2h}{9} &= \frac{h}{6}\times\frac{3}{3}+\frac{2h}{9}\times\frac{2}{2}, \text{ common denominator is } 18,\\ &= \frac{3h}{18}+\frac{4h}{18}\\ &= \frac{3h+4h}{18}\\ &= \frac{7h}{18}.\end{aligned}$$

Example 2

$$\begin{aligned}\frac{e+1}{2}+\frac{e}{5} &= \frac{e+1}{2}\times\frac{5}{5}+\frac{e}{5}\times\frac{2}{2}, \text{ common denominator is } 10,\\ &= \frac{5\,(e+1)}{10}+\frac{2e}{10}\\ &= \frac{5\,(e+1)+2e}{10}\\ &= \frac{5e+5+2e}{10}\\ &= \frac{7e+5}{10}.\end{aligned}$$

Example 3

$$\begin{aligned}\frac{5}{2a}-\frac{3}{4} &= \frac{5}{2a}\times\frac{2}{2}-\frac{3}{4}\times\frac{a}{a}, \text{ common denominator is } 4a,\\ &= \frac{10}{4a}-\frac{3a}{4a}\\ &= \frac{10-3a}{4a}.\end{aligned}$$

Exercise

Simplify the following:

1. $\frac{4}{5}+\frac{3}{4}$
2. $\frac{x}{3}-\frac{x}{5}$
3. $\frac{2p}{7}-\frac{p}{4}$
4. $\frac{2g}{3}+\frac{g+1}{4}$
5. $\frac{d+3}{2}+\frac{1-d}{4}$
6. $\frac{5}{9}-\frac{3}{b}$
7. $\frac{3x+2}{5}-\frac{x-3}{10}$
8. $\frac{3}{v}+\frac{2}{v+1}$

Answers

1. $\frac{31}{30}$ 2. $\frac{2x}{15}$ 3. $\frac{p}{28}$ 4. $\frac{11g+3}{12}$ 5. $\frac{d+7}{4}$ 6. $\frac{5b-27}{9b}$

7. $\frac{5x+7}{10}$ 8. $\frac{5v+3}{v\,(v+1)}$