

Operations with Algebraic Fractions

Adding or Subtracting

$$\begin{aligned} \frac{3x}{4} + \frac{1}{2x} &= \frac{6x^2}{8x} + \frac{4}{8x} \\ &= \frac{6x^2 + 4}{8x} \\ &= \frac{3x^2 + 2}{4x} \end{aligned} \quad \left| \quad \begin{aligned} \frac{3}{x-1} - \frac{2}{2x+3} &= \frac{3(2x+3) - 2(x-1)}{(x-1)(2x+3)} \\ &= \frac{6x+9-2x+2}{(x-1)(2x+3)} \\ &= \frac{4x+11}{(x-1)(2x+3)} \end{aligned}$$

Multiplying or Dividing

$$\begin{aligned} \frac{a}{2b} \times \frac{3}{2a} &= \frac{3a}{4ab} \\ &= \frac{3}{4b} \end{aligned} \quad \left| \quad \begin{aligned} \frac{x+1}{3} \div \frac{2x+3}{6} &= \frac{x+1}{3} \times \frac{6}{2x+3} \\ &= \frac{6(x+1)}{3(2x+3)} \\ &= \frac{2(x+1)}{2x+3} \end{aligned}$$

1. Simplify fully,

(a) $\frac{x}{2} + \frac{y}{3}$

(b) $\frac{3x}{y} + \frac{2}{x}$

(c) $\frac{4}{3x} - \frac{3}{x^2}$

(d) $\frac{5}{a} + \frac{2}{b}$

(e) $\frac{1}{2a} - \frac{3}{2b}$

(f) $\frac{3}{5x} + \frac{2}{x^2}$

(g) $\frac{5}{2x^2} - \frac{2}{xy}$

(h) $\frac{3}{2ab} + \frac{4a}{3b}$

2. Simplify fully,

(a) $\frac{5}{2x+3} + \frac{1}{x+1}$

(b) $\frac{3}{a+4} + \frac{2}{a+2}$

(c) $\frac{3}{2x-1} + \frac{5}{x+2}$

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

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

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

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

(h) $\frac{4x+5}{3} + \frac{2x-1}{2}$

(i) $\frac{5a-2}{4} - \frac{2a-1}{2}$

(j) $\frac{2}{a+b} - \frac{3}{2a-b}$

3. Simplify,

(a) $\frac{2}{3x} \times \frac{4x}{3}$

(b) $\frac{1}{2x} \times \frac{3xy}{2}$

(c) $\frac{2a^2}{3} \times \frac{4b}{5a}$

(d) $\frac{3y}{10} \times \frac{2x}{3y}$

(e) $\frac{3a}{2b} \times \frac{4b}{7a}$

(f) $\frac{5x}{7} \times \frac{14}{5x^2}$

(g) $\frac{4e}{f} \times \frac{3f^2}{12e}$

(h) $\frac{6}{7a} \times \frac{a^3}{5}$

4. Simplify (remember to flip the second fraction).

$$(a) \frac{3}{2a} \div \frac{1}{4a} \quad (b) \frac{5x}{2} \div \frac{3x}{2} \quad (c) \frac{4xy}{5} \div \frac{12}{7} \quad (d) \frac{1}{2ab} \div \frac{2a}{5b}$$

$$(e) \frac{3}{2a} \div \frac{1}{4a} \quad (f) \frac{5rs}{2} \div \frac{10r}{3s} \quad (g) \frac{x^3}{5y} \div \frac{x}{y^2} \quad (h) \frac{32x^5}{5y^3} \div \frac{16xy}{15}$$

5. Try this mix of multiply and divide.

$$(a) \frac{3}{n+1} \times \frac{5}{n+3} \quad (b) \frac{1}{x+1} \div \frac{3}{x} \quad (c) \frac{x}{x-1} \div \frac{2x}{x+3}$$

$$(d) \frac{1}{2n+1} \div \frac{5}{(2n+1)^2} \quad (e) \frac{3}{n+1} \times \frac{(n+1)^2}{n+3} \quad (f) \frac{4}{x+2} \times \frac{x^2-4}{x+3}$$

Past paper questions

6. Express

$$\frac{3}{(x+1)} - \frac{1}{(x-2)}, \quad x \neq -1, \quad x \neq -2$$

as a single fraction in its simplest form.

7. Write $\frac{3}{m} + \frac{4}{(m+1)}$ as a single fraction in its simplest form.

8. Express as a fraction in its simplest form

$$\frac{1}{x^2} + \frac{1}{x}, \quad x \neq 0$$

9. Express

$$\frac{3}{x-2} + \frac{5}{x+1}, \quad x \neq 2, \quad x \neq -1$$

as a single fraction in its simplest form.

10. Express $\frac{5t}{s} \div \frac{t}{2s^2}$ in its simplest form.

11. Express

$$\frac{n}{n^2-4} \div \frac{3}{n-2}, \quad n \neq -2, n \neq 2$$

as a single fraction in its simplest form.