Wednesday, January 21, 2026 9:03 AM

Lesson 3: Simplifying Algebraic Expressions II

Fractional Expression

- **Basic operations**

Ex 1: Simplify

(a) $\frac{1}{3} - \frac{2}{9} = \frac{1}{3} \cdot \frac{3}{3} - \frac{2}{9} = \frac{3}{9} - \frac{2}{9} = \frac{1}{9}$

(b) $\frac{2}{7} \cdot \frac{3}{5} = \frac{2 \cdot 3}{7 \cdot 5} = \frac{6}{35}$

(c) $\frac{1}{6} \cdot \frac{4}{7} = \frac{1}{\cancel{6}_{3}} \cdot \frac{\cancel{4}^{2}}{7} = \frac{1 \cdot 2}{3 \cdot 7} = \frac{2}{21}$

(d) $\frac{2}{7} \div \frac{3}{5} = \frac{2}{7} \cdot \frac{5}{3} = \frac{2 \cdot 5}{7 \cdot 3} = \frac{10}{21}$

- **Cancellation:** As long as $a \neq 0$ or $c \neq 0$

$$\frac{ab}{ac} = \frac{b}{c}$$

Ex 2: Can you cancel in the following?

(a) $\frac{3(4+2)}{3(5+7)} = \frac{\cancel{3}(4+2)}{\cancel{3}(5+7)}$ Yes!

$= \frac{6}{12} = \frac{1}{2}$

(b) $\frac{3+4}{3+5}$ Not in its form. Let's check if it simplifies.

$= \frac{7}{8}$ It doesn't so we are done.

© $\frac{2x(x+2)}{5x(x-7)} = \frac{2 \cdot x \cdot (x+2)}{5 \cdot x \cdot (x-7)} = \frac{2x+4}{5x-35}$ Yes!

(d) $\frac{2(x+2)}{5(x+2)} = \frac{2(x+2)}{5(x+2)} = \frac{2}{5}$ Yes!

Factoring and cancelling:

Ex 3: Simplifying the rational expressions

(a) $\frac{m-7}{m^2-49} = \frac{m-7}{(m-7)(m+7)}$ (by difference of squares formula)

$= \frac{1}{m+7}$

(b) $\frac{3x^2-5x-2}{x^2-4} \cdot \frac{2x-2}{x-3}$

① $3x^2-5x-2 = 3x^2+x-6x-2$ $\quad 3 \cdot (-2) = -6$

$= x(3x+1)-2(3x+1)$ $\quad -6 = -5$

$= (x-2)(3x+1)$ $\quad 2-3 = -1$

② $x^2-4 = (x-2)(x+2)$

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

Expand

	x	-1
$3x$	$3x^2$	$-3x$
1	x	-1

	x	-3
x	x^2	$-3x$
2	$2x$	-6

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

$$-\frac{2(3x-2x-1)}{x^2-x-6} = \frac{6x-1x-2}{x^2-x-6}$$

(c) $\frac{4y^2-81}{2y^2-23y+63} \div \frac{y^2-y-6}{y^2-5y-14}$

① ② ③ ④

Let's factor each one of these

① $4y^2-81 = (2y)^2-(9)^2 = (2y-9)(2y+9)$

② $2y^2-23y+63$

$= 2y^2-9y-14y+63$

$= y(2y-9)-7(2y-9)$

$= (y-7)(2y-9)$

$63 \cdot 2 = 2 \cdot 7 \cdot 9 = 2 \cdot 3^2 \cdot 7$

$-2-63$

$-3-14 \cdot 3$

$-6-21$

$-7-18$

$-9-14 = -23$

③ $y^2-y-6 = (y-3)(y+2)$

④ $y^2-5y-14 = (y-7)(y+2)$

Let's put it all together

$$= \frac{(2y-9)(2y+9)}{(y-7)(2y-9)} \div \frac{(y-3)(y+2)}{(y-7)(y+2)} = \frac{2y+9}{y-7} \div \frac{y-3}{y-7}$$

$$= \frac{2y+9}{y-7} \cdot \frac{y-7}{y-3} = \frac{2y+9}{y-3}$$

Combining fractions and simplifying

Ex 4: Simplifying the expression

(a) $\frac{\frac{9}{x}+\frac{x}{4}}{\frac{2}{x}-5} = \frac{\frac{9}{x}+\frac{x}{4}}{\frac{2}{x}-\frac{5}{1}}$

GCF of denominators: $GCF(x, 4, 1) = 4x$

$$= \frac{\left(\frac{9}{x}+\frac{x}{4}\right)(4x)}{\quad} = \frac{\frac{9 \cdot 4x}{x}+\frac{x \cdot 4x}{4}}{2 \cdot 4x \quad 5 \cdot 4x} = \frac{36+x^2}{\quad}$$

$$= \frac{\left(\frac{9}{x} + \frac{x}{4}\right)(4x)}{\left(\frac{2}{x} - \frac{5}{1}\right)(4x)} = \frac{\frac{4x}{x} + \frac{x^2}{4}}{\frac{2 \cdot 4x}{x} - \frac{5 \cdot 4x}{1}} = \frac{36 + x^2}{8 - 20x}$$

(b) $\dfrac{\frac{1}{x+3} - 2}{\frac{6}{x+3} + 7} = \dfrac{\frac{1}{x+3} - \frac{2}{1}}{\frac{6}{x+3} + \frac{7}{1}}$

GCF (of denominators) $(x+3, 1) = x+3$

$$= \frac{\left(\frac{1}{x+3} - \frac{2}{1}\right)(x+3)}{\left(\frac{6}{x+3} + \frac{7}{1}\right)(x+3)} = \frac{\frac{(x+3)}{x+3} - \frac{2(x+3)}{1}}{\frac{6(x+3)}{x+3} + \frac{7(x+3)}{1}} = \frac{1 - 2(x+3)}{6 + 7(x+3)}$$

$$= \frac{1 - 2x - 6}{6 + 7x + 21} = \frac{-2x - 5}{7x + 27}$$