

**Warm Up**

Create an expression that when simplified gives:  $x + 3$

and has restrictions:  $x \neq -1, 5$

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



# Adding and Subtracting Rational Expressions

## Lesson objectives

- I know how to add and subtract rational functions
- I know how to state the restrictions when adding and subtracting rational functions

1.1

Lesson objectives

Teachers' notes

Lesson notes

Nelson Page 128 #s 1, 2, 3, 6acf, 7ace & 10ad

## How to add or subtract rational expressions

1. Factor the numerator and denominator.
2. State restrictions.
3. Find a common denominator.
4. Write the sum/difference as a single rational expression.

### Example:

Determine the sum or difference.  $x \neq 0, y \neq 0$

$$\frac{2}{ab^2} + \frac{4}{a^2b} \quad a \neq 0, b \neq 0 \quad \frac{2}{xy} + \frac{3}{x^2y} - 2$$

$$= \frac{2(a)}{ab^2(a)} + \frac{4(b)}{a^2b(b)} = \frac{2(x)}{xy(x)} + \frac{3}{x^2y} - \frac{2(x^2y)}{(x^2y)}$$

$$= \frac{2a}{a^2b^2} + \frac{4b}{a^2b^2} = \frac{2x}{x^2y} + \frac{3}{x^2y} - \frac{2x^2y}{x^2y}$$

$$= \frac{2a + 4b}{a^2b^2} = \frac{2x + 3 - 2x^2y}{x^2y}$$

**Example:**Determine the sum or difference.  $x \neq -1, 4, 2$ 

$$\frac{x+1}{x-2} + \frac{x}{x+3} \quad x \neq 2, -3 \quad \frac{x-4}{x^2+2x+1} - \frac{x+1}{x^2-6x+8}$$

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

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

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

$$= \frac{(x-4)(x-4)(x-2)}{(x^2-8x+16)(x-2)}$$

$$= \frac{x^3-8x^2+16x-2x^2+16x-32}{(x+1)(x+1)(x+1)}$$

$$= \frac{x^3-10x^2+32x-32}{(x+1)(x+1)(x+1)} = \frac{-13x^2+29x-33}{(x-4)(x-2)(x+1)^2}$$

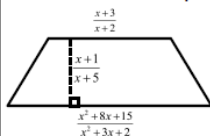
$$= \frac{(x^2+2x+1)(x+1)}{(x+1)(x+1)(x+1)}$$

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

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

**Example.**

Determine a simplified expression for the area.



$$A = \frac{1}{2}(a+b)h$$

$$x \neq -2, -5, -1$$

$$\frac{x+3}{x+2} + \frac{x^2+8x+15}{x^2+3x+2}$$

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

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

$$= \frac{x^2+4x+3}{(x+2)(x+1)} + \frac{x^2+8x+15}{(x+2)(x+1)}$$

$$= \frac{2x^2+12x+18}{(x+2)(x+1)} \times \frac{x+1}{x+5} \times \frac{1}{2}$$

$$= \frac{x^2+6x+9}{(x+2)(x+1)} \times \frac{x+1}{x+5}$$

$$= \frac{x^2+6x+9}{(x+2)(x+5)}$$