

Simplify the expression.

1. $\frac{3}{7} + \frac{2}{3}$

2. $\frac{7}{10} + \frac{8}{5}$

3. $\frac{3}{28} - \frac{1}{4}$

4. $\frac{\frac{3}{2}}{\frac{3}{5}}$

5. $\frac{\frac{5}{8} - \frac{3}{4}}{2}$

6. $\frac{\frac{5}{2} - \frac{7}{3}}{-\frac{2}{3} + 4}$

Warm Up

Given $f(x) = 2x - x^2$ and $g(x) = 4 - 3x$, determine the value of the expression.

1. $(f+g)(x)$

2. $f(x) \cdot g(x)$

3. $\left(\frac{g}{f}\right)(x)$

4. $f(g(x))$

5. $(f-g)(2)$

6. $g(f(3))$

Cumulative Warm Up

Essential Question

How can you determine the domain of the sum or difference of two rational expressions?

* we can use technology to graph the related function

Essential Question

* When adding and/or subtracting fractions we need common denominators

* If you multiply the bottom, you must multiply the top by the same value

Composition of functions

What you will learn:

• Add or subtract rational expressions

• re-write rational expressions

• Simplify complex fractions

Work with a partner. Find the sum or difference of the two rational expressions. Then match the sum or difference with its domain. Explain your reasoning.

Sum or Difference
a. $\frac{1}{x-1} + \frac{3}{x-1} = C$

Domain
A. all real numbers except -2

b. $\frac{1}{x-1} + \frac{1}{x} = F$

B. all real numbers except -1 and 1

c. $\frac{1}{x-2} + \frac{1}{2-x} = G$

C. all real numbers except 1

Exploration 1a-c

d. $\frac{1}{x-1} + \frac{-1}{x+1} = B$

D. all real numbers except 0

e. $\frac{x}{x+2} + \frac{x+1}{2+x} = A$

E. all real numbers except -2 and 1

f. $\frac{x}{x-2} - \frac{x+1}{x} = H$

F. all real numbers except 0 and 1

g. $\frac{x}{x+2} - \frac{x}{x-1} = E$

G. all real numbers except 2

Exploration 1 d-g

h. $\frac{x+2}{x} - \frac{x+1}{x} = D$

H. all real numbers except 0 and 2

Exploration 1 h

* always write in standard form

* see what each denominator has and what the other needs

* get common denominators

* add or subtract the numerators

Work with a partner. Write a sum or difference of rational expressions that has the given domain. Justify your answer.


a. all real numbers except -1

b. all real numbers except -1 and 3

c. all real numbers except -1, 0, and 3

Exploration 2

* Skip *

 **Core Concept**
Adding or Subtracting with Like Denominators
 Let a , b , and c be expressions with $c \neq 0$.

| | |
|---|---|
| Addition | Subtraction |
| $\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$ | $\frac{a}{c} - \frac{b}{c} = \frac{a-b}{c}$ |

Core Concept

* Together write a step by step process for finding common denominators with regular fractions

a. $\frac{7}{4x} + \frac{3}{4x} = \frac{7+3}{4x} = \frac{10}{4x} = \frac{5}{2x}$ Add numerators and simplify.

b. $\frac{2x}{x+6} - \frac{5}{x+6} = \frac{2x-5}{x+6}$ Subtract numerators.

Example 1

When denominators are common → just add or subtract the numerators and keep the common denominator

Find the sum or difference.

$$1. \frac{8}{12x} - \frac{5}{12x} \quad 2. \frac{2}{3x^2} + \frac{1}{3x^2} \quad 3. \frac{4x}{x-2} - \frac{x}{x-2} \quad 4. \frac{2x^2}{x^2+1} + \frac{2}{x^2+1}$$

Monitoring Progress 1-4

Core Concept

Adding or Subtracting with Unlike Denominators

Let a , b , c , and d be expressions with $c \neq 0$ and $d \neq 0$.

Addition

$$\frac{a}{c} + \frac{b}{d} = \frac{ad}{cd} + \frac{bc}{cd} = \frac{ad + bc}{cd}$$

Subtraction

$$\frac{a}{c} - \frac{b}{d} = \frac{ad}{cd} - \frac{bc}{cd} = \frac{ad - bc}{cd}$$

Core Concept

Find the least common multiple of $4x^2 - 16$ and $6x^2 - 24x + 24$.

$$4x^2 - 16$$

$$4(x^2 - 4)$$

$$4(x-2)(x+2)$$

$$12(x+2)(x-2)(x-2)$$

Example 2

Student practice

ask yourself: what does each denominator need in order to be written with common denominators?

- find GCF first
- factor both polynomials
- what does each need

Find the sum $\frac{7}{9x^2} + \frac{x}{3x^2+3x}$.

$$\frac{7}{9x^2} + \frac{x}{3x(x+1)}$$

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

Example 3

Find the difference $\frac{x+2}{2x-2} - \frac{-2x-1}{x^2-4x+3}$.

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

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

Example 4

5. Find the least common multiple of $5x^3$ and $10x^2 - 15x$.

Find the sum or difference.

6. $\frac{3}{4x} - \frac{1}{7}$

7. $\frac{1}{3x^2} + \frac{x}{9x^2-12}$

8. $\frac{x}{x^2-x-12} + \frac{5}{12x-48}$

Monitoring Progress 6-8

$$\frac{7(x+1)}{9x^2(x+1)} + \frac{x(3x)}{3x \cdot 3x(x+1)}$$

$$\frac{7x+7+3x^2}{9x^2(x+1)}$$

$$\frac{3x^2+7x+7}{9x^2(x+1)}$$

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

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

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

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

Student practice (Answers)

5.) $5x^3(2x-3)$

6.) $\frac{21-4x}{28x}$

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

8.) $\frac{17x+15}{12(x-4)(x+3)}$

Rewrite the function $g(x) = \frac{3x+5}{x+1}$ in the form $g(x) = \frac{a}{x-h} + k$.

Graph the function.

Describe the graph of g as a transformation of the graph of $f(x) = \frac{a}{x}$.

Example 5

Skip

9. Rewrite $g(x) = \frac{2x-4}{x-3}$ in the form $g(x) = \frac{a}{x-h} + k$.

Graph the function.

Describe the graph of g as a transformation of the graph of $f(x) = \frac{a}{x}$.

Monitoring Progress 9

Skip

Core Concept
Simplifying Complex Fractions

Method 1 If necessary, simplify the numerator and denominator by writing each as a single fraction. Then divide by multiplying the numerator by the reciprocal of the denominator.

Method 2 Multiply the numerator and the denominator by the LCD of every fraction in the numerator and denominator. Then simplify.

Core Concept

Complex fraction: a fraction that contains a fraction in its numerator or denominator.

Simplify $\frac{5}{\frac{1}{x+4} + \frac{2}{x}}$

$x+4$ (x)
 x $(x+4)$

$$\frac{5}{x+4} = \frac{5}{x+4} \cdot \frac{x(x+4)}{x(x+4)}$$

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

$$\frac{5}{x+4} = \frac{5}{\frac{x+2x+8}{x(x+4)}}$$

Example 6

• before we add denominator get a common denominator

$$\frac{5}{x+4} \cdot \frac{3x+8}{3x+8} = \frac{5}{x+4} \cdot \frac{x(x+4)}{3x+8}$$

$$\frac{5x}{3x+8}$$

Student practice (Answers)

10.) $\frac{-5x}{3(2x-7)}$

11.) $\frac{2(1-2x)}{2+3x}$

12.) $\frac{3(x-3)}{3x+7}$

Simplify the complex fraction.

10. $\frac{\frac{x}{6} - \frac{x}{3}}{\frac{x}{5} - \frac{7}{10}}$ 11. $\frac{\frac{2}{x} - 4}{\frac{2}{x} + 3}$ 12. $\frac{\frac{3}{x+5}}{\frac{2}{x-3} + \frac{1}{x+5}}$

Monitoring Progress 10-12

• Writing Prompt: To add or subtract rational expressions ...

Closure

