

Math Connections Worksheets

MAT1033C Intermediate Algebra

Chapter 6

Rational Expressions

Name:
Instructor:

Date:
Section:

Chapter 6 Rational Expressions
Section 6.1 Rational Functions and Multiplying and Dividing Rational Expressions

Learning Objectives

1. Find the domain of a rational expression.
2. Simplify rational expressions.
3. Multiply rational expressions.
4. Divide rational expressions.
5. Use rational functions in applications.

Vocabulary

Use the choices to complete each statement.

Domain	Rational	Simplified
1	-1	0

1. The expression $\frac{x-y}{y-x}$ will simplify down to _____.
2. Like a fraction, if the denominator of a rational expression is _____ then the expression is undefined.
3. The _____ of the function $f(x) = \frac{6}{x+4}$ is $\{x \mid x \text{ is a real number, } x \neq -4\}$.
4. A _____ expression is an expression that can be written as a quotient of two polynomials, but the denominator cannot be 0.
5. The expression $\frac{a+b}{b+a}$ will simplify down to _____.

Objective 1

Find the domain of each rational expression.

6. $f(x) = \frac{3x+1}{x-5}$ 6. _____


7. $g(x) = \frac{4x}{x^2+3x+2}$ 7. _____

Name:
Instructor:

Date:
Section:

8. $h(x) = \frac{5x}{3x+2}$

8. _____

 9. $C(x) = \frac{x+3}{x^2-4}$


9. _____

Objective 2

Simplify each rational expression.

10. $\frac{6y-18}{8y-24}$

10. _____

 11. $\frac{x^2+6x-40}{x+10}$

11. _____

12. $\frac{-a+b}{b-a}$

12. _____

13. $\frac{x^2-9}{x^2+x-6}$

13. _____

Name:
Instructor:

Date:
Section:

Objective 3

Multiply and simplify.

14. $\frac{x+2}{x-6} \cdot \frac{x-6}{x+4}$

14. _____

15. $\frac{x^2+5x-6}{x-3} \cdot \frac{x^2+x-12}{x^2-1}$

15. _____

16. $\frac{a^3-8}{a^2-4} \cdot \frac{a+2}{a^2+2a+4}$

16. _____

17. $\frac{5x^2+5}{x^2+4x+4} \cdot \frac{x^2+3x+2}{x^2-1}$

17. _____

Name:
Instructor:

Date:
Section:

Objective 4

Divide and simplify.

18. $\frac{4}{5x} \div \frac{4x^2 - 12}{10x^2 + 15x}$

18. _____

19. $\frac{3x - x^2}{x^3 - 27} \div \frac{x}{x^2 + 3x + 9}$

19. _____

20. $\frac{x^2 + 4x + 3}{2x^2 + 5x + 2} \div \frac{x^2 + 5x + 6}{2x^2 + 3x + 1}$

20. _____

Objective 5

21. The total revenue from the sale of a popular book is approximated by the rational expression

$R(x) = \frac{1000x^2}{3x - 2}$, where x is the number of years since publication and $R(x)$ is the total revenue in millions of dollars.

a. Find the total revenue at the end of the first year.

21a. _____

b. Find the total revenue at the end of the second year.

21b. _____

c. Find the revenue during the second year only.

21c. _____

d. Find the domain of function R .

21d. _____

Name:
Instructor:

Date:
Section:

Concept Extension

22. Find the area of a triangle with height of $\frac{x}{x+3}$ and base of $\frac{x^2 + 6x + 9}{2x}$.

22. _____

Name:
Instructor:

Date:
Section:

Section 6.2 Adding and Subtracting Rational Expressions

Learning Objectives

1. Add or subtract rational expressions with common denominators.
2. Identify the least common denominator of two or more rational expressions.
3. Add or subtract rational expressions with unlike denominators.

Objective 1


Add or subtract as indicated.

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

1. _____

2. $\frac{x-5}{x+1} + \frac{x-3}{x+1}$

2. _____

 3. $\frac{x-5}{2x} - \frac{x+5}{2x}$

3. _____

4. $\frac{3x-4}{x^2+3x+4} - \frac{5x+3}{x^2+3x+4}$

4. _____

Name:
Instructor:

Date:
Section:

Objective 2

Find the LCD of the rational expressions in each list.

5. $\frac{7}{3x}, \frac{16}{9x^2}, \frac{5}{12x}$

5. _____

6. $\frac{x+1}{x-2}, \frac{x-1}{x^2-4}, \frac{x+3}{x+2}$

6. _____

7. $\frac{3x+1}{x}, \frac{x-2}{x+2}, \frac{x}{x-1}$

7. _____

8. $\frac{3x}{x+1}, \frac{2x+1}{x^2+3x+2}, \frac{x-4}{x^2+4x+4}$

8. _____



9. $\frac{2a}{a^2-b^2}, \frac{1}{a^2-2ab+b^2}$

9. _____

Name:
Instructor:

Date:
Section:

Objective 3

Add or subtract as indicated.

10. $\frac{12}{5x} + \frac{6}{25x^2}$

10. _____

11. $\frac{x-3}{x+2} - \frac{x-4}{x-2}$

11. _____



12. $\frac{y+1}{y^2-6y+8} - \frac{3}{y^2-16}$

12. _____

13. $\frac{y+1}{y^2+6y+8} - \frac{y-1}{y^2+7y+12}$

13. _____

14. $\frac{x+2}{2x^2+7x+3} + \frac{x+4}{2x^2-5x-3}$

14. _____

Name:
Instructor:

Date:
Section:

Concept Extension

15. Explain in your own words, how fractions are similar to rational expressions.

15. _____

16. Find the perimeter of a rectangle whose length is $\frac{x+2}{x^2-25}$ and width is $\frac{x-8}{x^2+10x+25}$.

16. _____

Name:
Instructor:

Date:
Section:

Section 6.3 Simplifying Complex Fractions

Learning Objective

1. Simplify complex fractions by simplifying the numerator and denominator and then dividing.
2. Simplify complex fractions by multiplying by a common denominator.
3. Simplify expressions with negative exponents.

Objective 1

Simplify each complex fraction.

1.
$$\frac{\frac{2}{5x}}{\frac{4}{15x}}$$

1. _____

2.
$$\frac{\frac{3}{x+2}}{\frac{5}{x-2}}$$

2. _____



3.
$$\frac{\frac{4x^2 - y^2}{xy}}{\frac{2}{y} - \frac{1}{x}}$$

3. _____

Name:
Instructor:

Date:
Section:

$$4. \frac{\frac{4}{x} - \frac{3}{x^2}}{\frac{6}{x^3} + \frac{4}{x^2}}$$

4. _____

Objective 2

Simplify each complex fraction.

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

5. _____

$$6. \frac{\frac{x+2}{x} - \frac{2}{x-1}}{\frac{x+1}{x} + \frac{x+1}{x-1}}$$

6. _____

$$7. \frac{\frac{2}{xy} - 4}{\frac{5}{x} + \frac{3}{y}}$$

7. _____

Name:
Instructor:

Date:
Section:

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

8. _____

Objective 3

Simplify.



9. $\frac{2a^{-1} + 3b^{-2}}{a^{-1} - b^{-1}}$

9. _____

10. $\frac{4 + y^{-1}}{3y^{-1} - 2y^{-2}}$

10. _____

11. $\frac{5 - (3x)^{-2}}{3 + x^{-3}}$

11. _____

Name:
Instructor:

Date:
Section:

Concept Extension

Simplify.

12. $\frac{(x-1)^{-2} + 3x^{-1}}{5x^{-2} + (x-1)^{-2}}$

12. _____

Name:
Instructor:

Date:
Section:

Section 6.4 Dividing Polynomials: Long Division and Synthetic Division

Learning Objectives

1. Divide a polynomial by a monomial.
2. Divide by a polynomial
3. Use synthetic division to divide a polynomial by a binomial.
4. Use the remainder theorem to evaluate polynomials.

Objective 1

Divide.

1. $12x^4 + 24x^3 - 36x^2$ by $6x^2$. 1. _____

2. $\frac{16x^2y^4 + 24xy^3 - 8x^2y^2}{8x^3y^3}$ 2. _____

3. $15x^6 - 25x^4 + 30x^2$ by $15x^2$ 3. _____

Objective 2

Divide.

4. $(x^2 + 16x + 15) \div (x + 15)$ 4. _____

Name:
Instructor:

Date:
Section:

5. $(6x^2 - 13x - 5) \div (2x - 5)$

5. _____

6. $(3x^5 - x^3 + 4x^2 - 12x - 8) \div (x^2 - 2)$

6. _____

7. $(2x^3 + x^2 - 35x + 40) \div (x + 5)$

7. _____

Objective 3

Use synthetic division to divide.

8. $(x^2 + 7x + 6) \div (x + 6)$

8. _____



9. $\frac{x^3 - 7x^2 - 13x + 5}{x - 2}$

9. _____

Name:
Instructor:

Date:
Section:

10. $\frac{x^3 + 27}{x + 3}$

10. _____

11. $\left(2x^4 + \frac{1}{2}x^3 + x^2 + x\right) \div (x - 2)$

11. _____

Objective 3

For the given polynomial $P(x)$ and the given c , use the remainder theorem to find $P(c)$.

12. $P(x) = 4x^4 + x^2 - 2; -1$

12. _____

13. $P(x) = 4x^4 + 2x^3 - 6x + 7; -2$

13. _____

14. $P(x) = 5x^4 - 4x^3 - 7x^2 - 5x + 1; 4$

14. _____

Name:
Instructor:

Date:
Section:

Concept Extension

Divide.

15. $(5x^4 + x^3 - x^2 + x - 1) \div (2x + 1)$

15. _____

Name:
Instructor:

Date:
Section:

Section 6.5 Solving Equations Containing Rational Expressions

Learning Objectives

1. Solve equations containing rational expressions.

Objective 1

Solve each equation.



1. $\frac{2}{x} + \frac{1}{2} = \frac{5}{x}$

1. _____

2. $\frac{x^2 - 5x}{7x} = \frac{6}{7x}$


2. _____

3. $\frac{6}{x+2} = \frac{4}{x-2}$

3. _____

Name:
Instructor:


Date:
Section:

 4. $\frac{2x+1}{4-x} = \frac{9}{4-x}$

4. _____

5. $\frac{2}{x-3} + \frac{3}{x+4} = \frac{4}{x^2+x-12}$

5. _____

 6. $\frac{x^2-20}{x^2-7x+12} = \frac{3}{x-3} + \frac{5}{x-4}$

6. _____

7. $\frac{5}{2x-5} - \frac{4}{3x-1} = \frac{2}{6x^2-17x+5}$

7. _____

Name:
Instructor:

Date:
Section:

8. $\frac{14}{2x^2 - 10x} + 1 = \frac{3}{x - 5}$

8. _____

Concept Extension

Solve each equation.

9. $x^{-2} - 14x^{-1} + 24 = 0$

9. _____

10. $\left(\frac{2}{x+1}\right)^2 + 3\left(\frac{2}{x+1}\right) - 28 = 0$

10. _____

Name:
Instructor:

Date:
Section:

Section 6.6 Rational Equations and Problem Solving

Learning Objectives

1. Solve an equation containing rational expressions for a specified variable.
2. Solve problems by writing equations containing rational expressions.

Objective 1

Solve each equation for the specified variable.

1. $\frac{1}{p} + \frac{1}{f} = \frac{1}{c}$ for f .

1. _____

2. $F = \frac{-GMm}{r^2}$ for G .

2. _____

3. $A = \frac{h(a+b)}{2}$ for a .

3. _____



4. $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ for R .

4. _____

Name:
Instructor:

Date:
Section:

Objective 2

Solve.

5. The sum of a number and 7 times its reciprocal is 8. Find the number.

5. _____

6. If a number is added to the denominator of $\frac{11}{3}$ and subtracted from the numerator, the resulting fraction is equivalent to $\frac{3}{4}$.

6. _____



7. Three postal workers can sort a stack of mail in 20 minutes, 30 minutes, and 60 minutes, respectively. Find how long it takes them to sort the mail if all three work together.

7. _____

Name:
Instructor:

Date:
Section:

8. Sue can grade tests in 2 hours, if she gets help from her husband, it will take them 45 minutes. how long would it take her husband to grade the tests for her?

8. _____



9. The speed of Lazy River's current is 5 mph. If a boat travels 20 miles downstream in the same time that it takes to travel 10 miles upstream, find the speed of the boat in still water.

9. _____

10. Two cars going in opposite directions leave at the same time. One car travels 10 mph faster than the other. In 5 hours they are 660 miles apart. Find the speed of each car.

10. _____

Name:
Instructor:

Date:
Section:

Chapter 6 Vocabulary

Vocabulary Word	Definition	Example
Rational Expression	The quotient of two polynomials.	$\frac{x+3}{x-7}$
Rational Function	A function that can be described by using a rational expression.	$f(x) = \frac{2x+7}{x-9}$
Synthetic Division	A short cut method to divide a polynomial by a binomial of the form $x - c$	
Extraneous Solution	A solution that will cause the denominator to be equal to 0.	$\frac{x}{x-2} = \frac{2}{x-2}$ 2 is an extraneous solution.
y varies directly as x.	$y = kx$	$y = 4x$
y varies inversely as x.	$y = \frac{k}{x}$	$y = \frac{24}{x}$
y varies jointly as x and z.	$y = kxz$	$y = 3xz$

Answers

Chapter 6 Section 6.1

1. -1
2. 0
3. Domain
4. Rational
5. 1
6. $\{x \mid x \text{ is a real number, } x \neq 5\}$
7. $\{x \mid x \text{ is a real number, } x \neq -1, x \neq -2\}$
8. $\{x \mid x \text{ is a real number, } x \neq -\frac{2}{3}\}$
9. $\{x \mid x \text{ is a real number, } x \neq -2, x \neq 2\}$
10. $\frac{3}{4}$
11. $x-4$
12. 1
13. $\frac{x-3}{x-2}$
14. $\frac{x+2}{x+4}$
15. $\frac{(x+6)(x+4)}{x+1}$
16. 1
17. $\frac{5(x^2+1)}{(x+2)(x-1)}$
18. $\frac{2x+3}{x^2-3}$
19. -1
20. $\frac{(x+1)^2}{(x+2)^2}$
- 21a. \$100 million
- 21b. \$1000 million (or \$1 billion)
- 21c. \$900 million
- 21d. $\{x \mid x \text{ is a real number } > \frac{2}{3}\}$
22. $\frac{x+3}{4}$

Section 6.2

1. $\frac{-11}{3x}$
2. $\frac{2x-8}{x+1}$
3. $-\frac{5}{x}$
4. $\frac{-2x-7}{x^2+3x+4}$
5. $36x^2$
6. x^2-4
7. $x(x+2)(x-1)$
8. $(x+2)(x+2)(x+1)$
9. $(a+b)(a-b)^2$
10. $\frac{6(10x+1)}{25x^2}$
11. $\frac{-3x+14}{(x+2)(x-2)}$
12. $\frac{y^2+2y+10}{(y+4)(y-4)(y-2)}$
13. $\frac{3y+5}{(y+2)(y+4)(y+3)}$
14. $\frac{2(x^2+3x+3)}{(x+3)(2x+1)(x-3)}$
15. Answers may vary.
16. $\frac{4(x^2-3x+25)}{(x+5)^2(x-5)}$

Section 6.3

- $\frac{3}{2}$
- $\frac{3(x-2)}{5(x+2)}$
- $2x+y$
- $\frac{x(4x-3)}{2(3+2x)}$
- $\frac{3y-4}{2y+2}$
- $\frac{x-2}{2x-1}$
- $\frac{2-4xy}{5y+3x}$
- $\frac{-5y^2}{x+y}$
- $\frac{2b^2+3a}{b(b-a)}$
- $\frac{y(4y+1)}{3y-2}$
- $\frac{x(45x^2-1)}{9(3x^3+1)}$
- $\frac{x(3x^2-5x+3)}{6x^2-10x+5}$

Section 6.4

- $2x^2+4x-6$
- $\frac{2y}{x} + \frac{3}{x^2} - \frac{1}{xy}$
- $x^4 - \frac{5x^2}{3} + 2$
- $x+1$
- $3x+1$
- $3x^3+5x+4 - \frac{2x}{x^2-2}$
- $2x^2-9x+10 - \frac{10}{x+5}$
- $x+1$
- $x^2-5x-23 - \frac{41}{x-2}$
- x^2-3x+9
- $2x^3 + \frac{9}{2}x^2 + 10x + 21 + \frac{42}{x-2}$

- 3
- 67
- 893
- $\frac{5}{2}x^3 - \frac{3}{4}x^2 - \frac{1}{8}x + \frac{9}{16} - \frac{25}{16(2x+1)}$

Section 6.5

- 6
- 6 and -1
- 10
- \emptyset
- 1
- 1 and 7
- $-\frac{13}{7}$
- 1 and 7
- $\frac{1}{2}$ and $\frac{1}{12}$
- $-\frac{9}{7}$ and $-\frac{1}{2}$

Section 6.6

- $f = \frac{-pc}{c-p}$
- $G = \frac{-Fr^2}{Mm}$
- $a = \frac{2A-bh}{h}$
- $R = \frac{R_1R_2}{R_1+R_2}$
- 1 or 7
- 5
- 10 minutes
- 72 minutes
- 15 mph
- 61 mph and 71 mph