

RATIONAL EXPRESSIONS: ADDING AND SUBTRACTING RATIONAL EXPRESSIONS*

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Abstract

This module is from [Elementary Algebra](#) by Denny Burzynski and Wade Ellis, Jr. A detailed study of arithmetic operations with rational expressions is presented in this chapter, beginning with the definition of a rational expression and then proceeding immediately to a discussion of the domain. The process of reducing a rational expression and illustrations of multiplying, dividing, adding, and subtracting rational expressions are also included. Since the operations of addition and subtraction can cause the most difficulty, they are given particular attention. We have tried to make the written explanation of the examples clearer by using a "freeze frame" approach, which walks the student through the operation step by step. The five-step method of solving applied problems is included in this chapter to show the problem-solving approach to number problems, work problems, and geometry problems. The chapter also illustrates simplification of complex rational expressions, using the combine-divide method and the LCD-multiply-divide method. Objectives of this module: be familiar with the basic rule for adding and subtracting rational expressions, be able to add and subtract fractions with the same and with different denominators.

1 Overview

- Basic Rule
- Fractions with the Same Denominator
- Fractions with Different Denominators

2 Basic Rule

We are now in a position to study the process of adding and subtracting rational expressions. There is a most basic rule to which we must strictly adhere if we wish to conveniently add or subtract rational expressions.

To add or subtract rational expressions conveniently, they should have the same denominators.

Thus, to add or subtract two or more rational expressions conveniently, we must ensure that they all have the same denominator. The denominator that is most convenient is the LCD.

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3 Fractions With The Same Denominator

The Rule for Adding and Subtracting Rational Expressions

To add (or subtract) two or more rational expressions with the same denominators, add (or subtract) the numerators and place the result over the LCD. Reduce if necessary. Symbolically,

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

$$\frac{a}{c} - \frac{b}{c} = \frac{a-b}{c}$$

Note that we combine **only** the numerators.

4 Sample Set A

Add or subtract the following rational expressions.

Example 1

$$\begin{aligned} \frac{1}{6} + \frac{3}{6} & & \text{The denominators are the same. Add the numerators.} \\ \frac{1}{6} + \frac{3}{6} &= \frac{1+3}{6} = \frac{4}{6} & \text{Reduce.} \\ \frac{1}{6} + \frac{3}{6} &= \frac{2}{3} \end{aligned}$$

Example 2

$$\begin{aligned} \frac{5}{x} + \frac{8}{x} & & \text{The denominators are the same. Add the numerators.} \\ \frac{5}{x} + \frac{8}{x} &= \frac{5+8}{x} = \frac{13}{x} \end{aligned}$$

Example 3

$$\begin{aligned} \frac{2ab}{y^2w} - \frac{5b}{y^2w} & & \text{The denominators are the same. Subtract the numerators.} \\ \frac{2ab}{y^2w} - \frac{5b}{y^2w} &= \frac{2ab-5b}{y^2w} \end{aligned}$$

Example 4

$$\begin{aligned} \frac{3x^2+x+2}{x-7} + \frac{x^2-4x+1}{x-7} & & \text{The denominators are the same. Add the numerators.} \\ \frac{3x^2+x+2}{x-7} + \frac{x^2-4x+1}{x-7} &= \frac{3x^2+x+2+x^2-4x+1}{x-7} \\ &= \frac{4x^2-3x+3}{x-7} \end{aligned}$$

Example 5

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

$$\begin{aligned} \frac{5y+3}{2y-5} - \frac{2y+4}{2y-5} &= \frac{5y+3-(2y+4)}{2y-5} \\ &= \frac{5y+3-2y-4}{2y-5} \\ &= \frac{3y-1}{2y-5} \end{aligned}$$

Note :
$$\frac{5y+3}{2y-5} - \underbrace{\frac{2y+4}{2y-5}}_{\text{Observe this part}}$$

The term $-\frac{2y+4}{2y-5}$ could be written as

$$+\frac{-(2y+4)}{2y-5} = \frac{-2y-4}{2y-5}$$

A common mistake is to write

$$-\frac{2y+4}{2y-5} \text{ as } \frac{-2y+4}{2y-5}$$

This is **not** correct, as the negative sign is not being applied to the entire numerator.

Example 6

$$\frac{3x^2+4x+5}{(x+6)(x-2)} + \frac{2x^2+x+6}{x^2+4x-12} - \frac{x^2-4x-6}{x^2+4x-12}$$

Factor the denominators to determine if they're the same.

$$\frac{3x^2+4x+5}{(x+6)(x-2)} + \frac{2x^2+x+6}{(x+6)(x-2)} - \frac{x^2-4x-6}{(x+6)(x-2)}$$

The denominators are the same. Combine the numerators being careful to note the negative sign.

$$\frac{3x^2+4x+5+2x^2+x+6-(x^2-4x-6)}{(x+6)(x-2)}$$

$$\frac{3x^2+4x+5+2x^2+x+6-x^2+4x+6}{(x+6)(x-2)}$$

$$\frac{4x^2+9x+17}{(x+6)(x-2)}$$

5 Practice Set A

Add or Subtract the following rational expressions.

Exercise 1

$$\frac{4}{9} + \frac{2}{9}$$

(Solution on p. 13.)

Exercise 2

$$\frac{3}{b} + \frac{2}{b}$$

(Solution on p. 13.)

Exercise 3

$$\frac{5x}{2y^2} - \frac{3x}{2y^2}$$

*(Solution on p. 13.)***Exercise 4**

$$\frac{x+y}{x-y} + \frac{2x+3y}{x-y}$$

*(Solution on p. 13.)***Exercise 5**

$$\frac{4x^2-x+4}{3x+10} - \frac{x^2+2x+5}{3x+10}$$

*(Solution on p. 13.)***Exercise 6**

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

*(Solution on p. 13.)***Exercise 7**

$$\frac{4x+3}{x^2-x-6} - \frac{8x-4}{(x+2)(x-3)}$$

*(Solution on p. 13.)***Exercise 8**

$$\frac{5a^2+a-4}{2a(a-6)} + \frac{2a^2+3a+4}{2a^2-12a} + \frac{a^2+2}{2a^2-12a}$$

*(Solution on p. 13.)***Exercise 9**

$$\frac{8x^2+x-1}{x^2-6x+8} + \frac{2x^2+3x}{x^2-6x+8} - \frac{5x^2+3x-4}{(x-4)(x-2)}$$

*(Solution on p. 13.)***6 Fractions with Different Denominators****7 Sample Set B**

Add or Subtract the following rational expressions.

Example 7

$$\frac{4a}{3y} + \frac{2a}{9y^2}$$

The denominators are *not* the same. Find the LCD. By inspection, the LCD is $9y^2$.

$$\frac{4a}{9y^2} + \frac{2a}{9y^2}$$

The denominator of the first rational expression has been multiplied by $3y$,

so the numerator must be multiplied by $3y$.

$$4a \cdot 3y = 12ay$$

$$\frac{12ay}{9y^2} + \frac{2a}{9y^2}$$

The denominators are now the same. Add the numerators.

$$\frac{12ay+2a}{9y^2}$$

Example 8

$$\frac{3b}{b+2} + \frac{5b}{b-3}$$

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

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

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

$$\begin{aligned} \frac{3b(b-3)+5b(b+2)}{(b-3)(b+2)} &= \frac{3b^2-9b+5b^2+10b}{(b-3)(b+2)} \\ &= \frac{8b^2+b}{(b-3)(b+2)} \end{aligned}$$

Example 9

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

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

$$\frac{\quad}{4(x+1)(x-1)} + \frac{\quad}{4(x+1)(x-1)}$$

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

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

$$\begin{aligned} \frac{4(x+3)(x+1)+(x-1)(x-2)}{4(x+1)(x-1)} &= \frac{4(x^2+4x+3)+x^2-3x+2}{4(x+1)(x-1)} \\ &= \frac{5x^2+13x+14}{4(x+1)(x-1)} \end{aligned}$$

Example 10

The denominators are *not* the same. The LCD is $(b+2)(b-3)$.

The denominator of the first rational expression has been multiplied by $b-3$, so the numerator must be multiplied by $b-3$. $3b(b-3)$

The denominator of the second rational expression has been multiplied by $b+2$, so the numerator must be multiplied by $b+2$. $5b(b+2)$

The denominators are now the same. Add the numerators.

The denominators are *not* the same.

Find the LCD.

The LCD is $(x+1)(x-1)$

The denominator of the first rational expression has been multiplied by $4(x+1)$, so the numerator must be multiplied by $4(x+1)$. $4(x+3)(x+1)$

The denominator of the second rational expression has been multiplied by $(x-1)$, so the numerator must be multiplied by $(x-1)$. $(x-1)(x-2)$

The denominators are now the same.

Add the numerators.

$$\begin{aligned} & \frac{x+5}{x^2-7x+12} + \frac{3x-1}{x^2-2x-3} \\ & \frac{x+5}{(x-4)(x-3)} + \frac{3x-1}{(x-3)(x+1)} \\ & \frac{(x-4)(x-3)(x+1)}{(x-4)(x-3)(x+1)} + \frac{(x-4)(x-3)(x+1)}{(x-4)(x-3)(x+1)} \\ & \frac{(x+5)(x+1)}{(x-4)(x-3)(x+1)} + \frac{(3x-1)(x-4)}{(x-4)(x-3)(x+1)} \\ & \frac{(x+5)(x+1)+(3x-1)(x-4)}{(x-4)(x-3)(x+1)} \\ & \frac{x^2+6x+5+3x^2-13x+4}{(x-4)(x-3)(x+1)} \\ & \frac{4x^2-7x+9}{(x-4)(x-3)(x+1)} \end{aligned}$$

Example 11

$$\begin{aligned} & \frac{a+4}{a^2+5a+6} - \frac{a-4}{a^2-5a-24} \\ & \frac{a+4}{(a+3)(a+2)} - \frac{a-4}{(a+3)(a-8)} \\ & \frac{(a+3)(a+2)(a-8)}{(a+3)(a+2)(a-8)} - \frac{(a+3)(a+2)(a-8)}{(a+3)(a+2)(a-8)} \\ & \frac{(a+4)(a-8)}{(a+3)(a+2)(a-8)} - \frac{(a-4)(a+2)}{(a+3)(a+2)(a-8)} \\ & \frac{(a+4)(a-8)-(a-4)(a+2)}{(a+3)(a+2)(a-8)} \\ & \frac{a^2-4a-32-(a^2-2a-8)}{(a+3)(a+2)(a-8)} \\ & \frac{a^2-4a-32-a^2+2a+8}{(a+3)(a+2)(a-8)} \\ & \frac{-2a-24}{(a+3)(a+2)(a-8)} \\ & \frac{-2(a+12)}{(a+3)(a+2)(a-8)} \end{aligned}$$

Example 12

$$\frac{3x}{7-x} + \frac{5x}{x-7}.$$

$$\begin{aligned} \frac{3x}{7-x} &= \frac{3x}{-(x-7)} = \frac{-3x}{x-7} \\ \frac{3x}{7-x} + \frac{5x}{x-7} &= \frac{-3x}{x-7} + \frac{5x}{x-7} \\ &= \frac{-3x+5x}{x-7} \\ &= \frac{2x}{x-7} \end{aligned}$$

Determine the LCD.

The LCD is $(x-4)(x-3)(x+1)$.

The first numerator must be multiplied by $x+1$ and the second by $x-4$.

The denominators are now the same. Add the numerators.

Determine the LCD.

The LCD is $(a+3)(a+2)(a-8)$.

The first numerator must be multiplied by $a-8$ and the second by $a+2$.

The denominators are now the same. Subtract the numerators.

Factor -2 from the numerator.

The denominators are *nearly* the same. They differ only in sign.

Our technique is to factor -1 from one of them.

Factor -1 from the first term.

8 Practice Set B

Add or Subtract the following rational expressions.

Exercise 10

$$\frac{3x}{4a^2} + \frac{5x}{12a^3}$$

(Solution on p. 13.)

Exercise 11

$$\frac{5b}{b+1} + \frac{3b}{b-2}$$

*(Solution on p. 13.)***Exercise 12**

$$\frac{a-7}{a+2} + \frac{a-2}{a+3}$$

*(Solution on p. 13.)***Exercise 13**

$$\frac{4x+1}{x+3} - \frac{x+5}{x-3}$$

*(Solution on p. 13.)***Exercise 14**

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

*(Solution on p. 13.)***Exercise 15**

$$\frac{a-7}{a^2-3a+2} + \frac{a+2}{a^2-6a+8}$$

*(Solution on p. 13.)***Exercise 16**

$$\frac{6}{b^2+6b+9} - \frac{2}{b^2+4b+4}$$

*(Solution on p. 13.)***Exercise 17**

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

*(Solution on p. 13.)***Exercise 18**

$$\frac{5x}{4-x} + \frac{7x}{x-4}$$

*(Solution on p. 13.)***9 Sample Set C**

Combine the following rational expressions.

Example 13

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

Rewrite the expression.

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

The LCD is $x - 1$.

$$\begin{aligned} \frac{3(x-1)}{x-1} + \frac{7}{x-1} &= \frac{3x-3}{x-1} + \frac{7}{x-1} = \frac{3x-3+7}{x-1} \\ &= \frac{3x+4}{x-1} \end{aligned}$$

Example 14

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

Rewrite the expression.

$$\frac{3y+4}{1} - \frac{y^2-y+3}{y-6}$$

The LCD is $y - 6$.

$$\begin{aligned} \frac{(3y+4)(y-6)}{y-6} - \frac{y^2-y+3}{y-6} &= \frac{(3y+4)(y-6) - (y^2-y+3)}{y-6} \\ &= \frac{3y^2-14y-24-y^2+y-3}{y-6} \\ &= \frac{2y^2-13y-27}{y-6} \end{aligned}$$

10 Practice Set C**Exercise 19**

Simplify $8 + \frac{3}{x-6}$.

*(Solution on p. 13.)***Exercise 20**

Simplify $2a - 5 - \frac{a^2+2a-1}{a+3}$.

(Solution on p. 13.)

11 Exercises

For the following problems, add or subtract the rational expressions.

Exercise 21

$$\frac{3}{8} + \frac{1}{8}$$

(Solution on p. 13.)

Exercise 22

$$\frac{1}{9} + \frac{4}{9}$$

Exercise 23

$$\frac{7}{10} - \frac{2}{5}$$

(Solution on p. 13.)

Exercise 24

$$\frac{3}{4} - \frac{5}{12}$$

Exercise 25

$$\frac{3}{4x} + \frac{5}{4x}$$

(Solution on p. 13.)

Exercise 26

$$\frac{2}{7y} + \frac{3}{7y}$$

Exercise 27

$$\frac{6y}{5x} + \frac{8y}{5x}$$

(Solution on p. 14.)

Exercise 28

$$\frac{9a}{7b} + \frac{3a}{7b}$$

Exercise 29

$$\frac{15n}{2m} - \frac{6n}{2m}$$

(Solution on p. 14.)

Exercise 30

$$\frac{8p}{11q} - \frac{3p}{11q}$$

Exercise 31

$$\frac{y+4}{y-6} + \frac{y+8}{y-6}$$

(Solution on p. 14.)

Exercise 32

$$\frac{y-1}{y+4} + \frac{y+7}{y+4}$$

Exercise 33

$$\frac{a+6}{a-1} + \frac{3a+5}{a-1}$$

(Solution on p. 14.)

Exercise 34

$$\frac{5a+1}{a+7} + \frac{2a-6}{a+7}$$

Exercise 35

$$\frac{x+1}{5x} + \frac{x+3}{5x}$$

(Solution on p. 14.)

Exercise 36

$$\frac{a-6}{a+2} + \frac{a-2}{a+2}$$

Exercise 37

$$\frac{b+1}{b-3} + \frac{b+2}{b-3}$$

(Solution on p. 14.)

Exercise 38

$$\frac{a+2}{a-5} - \frac{a+3}{a-5}$$

Exercise 39

$$\frac{b+7}{b-6} - \frac{b-1}{b-6}$$

(Solution on p. 14.)

Exercise 40

$$\frac{2b+3}{b+1} - \frac{b-4}{b+1}$$

Exercise 41

$$\frac{3y+4}{y+8} - \frac{2y-5}{y+8}$$

(Solution on p. 14.)

Exercise 42

$$\frac{2a-7}{a-9} + \frac{3a+5}{a-9}$$

Exercise 43

$$\frac{8x-1}{x+2} - \frac{15x+7}{x+2}$$

*(Solution on p. 14.)***Exercise 44**

$$\frac{7}{2x^2} + \frac{1}{6x^3}$$

Exercise 45

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

*(Solution on p. 14.)***Exercise 46**

$$\frac{5}{6y^3} - \frac{2}{18y^5}$$

Exercise 47

$$\frac{2}{5a^2} - \frac{1}{10a^3}$$

*(Solution on p. 14.)***Exercise 48**

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

Exercise 49

$$\frac{4}{x-6} + \frac{1}{x-1}$$

*(Solution on p. 14.)***Exercise 50**

$$\frac{2a}{a+1} - \frac{3a}{a+4}$$

Exercise 51

$$\frac{6y}{y+4} + \frac{2y}{y+3}$$

*(Solution on p. 14.)***Exercise 52**

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

Exercise 53

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

*(Solution on p. 14.)***Exercise 54**

$$\frac{a+3}{a-3} - \frac{a+2}{a-2}$$

Exercise 55

$$\frac{y+1}{y-1} - \frac{y+4}{y-4}$$

*(Solution on p. 14.)***Exercise 56**

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

Exercise 57

$$\frac{y+2}{(y+1)(y+6)} + \frac{y-2}{y+6}$$

*(Solution on p. 14.)***Exercise 58**

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

Exercise 59

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

*(Solution on p. 14.)***Exercise 60**

$$\frac{2x}{x^2-3x+2} + \frac{3}{x-2}$$

Exercise 61

$$\frac{4a}{a^2-2a-3} + \frac{3}{a+1}$$

*(Solution on p. 14.)***Exercise 62**

$$\frac{3y}{y^2-7y+12} - \frac{y^2}{y-3}$$

Exercise 63

$$\frac{x-1}{x^2+6x+8} + \frac{x+3}{x^2+2x-8}$$

(Solution on p. 14.)

Exercise 64

$$\frac{a-4}{a^2+2a-3} + \frac{a+2}{a^2+3a-4}$$

Exercise 65

$$\frac{b-3}{b^2+9b+20} + \frac{b+4}{b^2+b-12}$$

*(Solution on p. 14.)***Exercise 66**

$$\frac{y-1}{y^2+4y-12} - \frac{y+3}{y^2+6y-16}$$

Exercise 67

$$\frac{x+3}{x^2+9x+14} - \frac{x-5}{x^2-4}$$

*(Solution on p. 14.)***Exercise 68**

$$\frac{x-1}{x^2-4x+3} + \frac{x+3}{x^2-5x+6} + \frac{2x}{x^2-3x+2}$$

Exercise 69

$$\frac{4x}{x^2+6x+8} + \frac{3}{x^2+x-6} + \frac{x-1}{x^2+x-12}$$

*(Solution on p. 14.)***Exercise 70**

$$\frac{y+2}{y^2-1} + \frac{y-3}{y^2-3y-4} - \frac{y+3}{y^2-5y+4}$$

Exercise 71

$$\frac{a-2}{a^2-9a+18} + \frac{a-2}{a^2-4a-12} - \frac{a-2}{a^2-a-6}$$

*(Solution on p. 14.)***Exercise 72**

$$\frac{y-2}{y^2+6y} + \frac{y+4}{y^2+5y-6}$$

Exercise 73

$$\frac{a+1}{a^3+3a^2} - \frac{a+6}{a^2-a}$$

*(Solution on p. 15.)***Exercise 74**

$$\frac{4}{3b^2-12b} - \frac{2}{6b^2-6b}$$

Exercise 75

$$\frac{3}{2x^5-4x^4} + \frac{-2}{8x^3+24x^2}$$

*(Solution on p. 15.)***Exercise 76**

$$\frac{x+2}{12x^3} + \frac{x+1}{4x^2+8x-12} - \frac{x+3}{16x^2-32x+16}$$

Exercise 77

$$\frac{2x}{x^2-9} - \frac{x+1}{4x^2-12x} - \frac{x-4}{8x^3}$$

*(Solution on p. 15.)***Exercise 78**

$$4 + \frac{3}{x+2}$$

Exercise 79

$$8 + \frac{2}{x+6}$$

*(Solution on p. 15.)***Exercise 80**

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

Exercise 81

$$3 + \frac{5}{x-6}$$

*(Solution on p. 15.)***Exercise 82**

$$-2 + \frac{4x}{x+5}$$

Exercise 83

$$-1 + \frac{3a}{a-1}$$

*(Solution on p. 15.)***Exercise 84**

$$6 - \frac{4y}{y+2}$$

Exercise 85

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

(Solution on p. 15.)

Exercise 86

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

Exercise 87

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

*(Solution on p. 15.)***Exercise 88**

$$b + 6 + \frac{2b+5}{b-2}$$

Exercise 89

$$\frac{3x-1}{x-4} - 8$$

*(Solution on p. 15.)***Exercise 90**

$$\frac{4y+5}{y+1} - 9$$

Exercise 91

$$\frac{2y^2+11y-1}{y+4} - 3y$$

*(Solution on p. 15.)***Exercise 92**

$$\frac{5y^2-2y+1}{y^2+y-6} - 2$$

Exercise 93

$$\frac{4a^3+2a^2+a-1}{a^2+11a+28} + 3a$$

*(Solution on p. 15.)***Exercise 94**

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

Exercise 95

$$\frac{5m}{6-m} + \frac{3m}{m-6}$$

*(Solution on p. 15.)***Exercise 96**

$$\frac{-a+7}{8-3a} + \frac{2a+1}{3a-8}$$

Exercise 97

$$\frac{-2y+4}{4-5y} - \frac{9}{5y-4}$$

*(Solution on p. 15.)***Exercise 98**

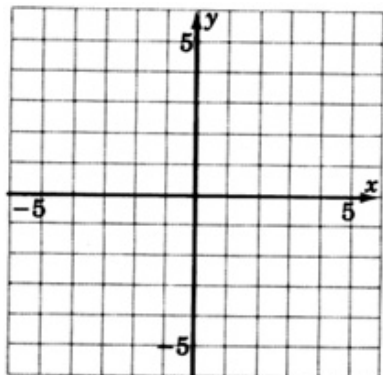
$$\frac{m-1}{1-m} - \frac{2}{m-1}$$

12 Exercises For Review**Exercise 99***(here¹)* Simplify $(x^3y^2z^5)^6(x^2yz)^2$.*(Solution on p. 15.)***Exercise 100***(here²)* Write $6a^{-3}b^4c^{-2}a^{-1}b^{-5}c^3$ so that only positive exponents appear.¹"Basic Properties of Real Numbers: The Power Rules for Exponents" <<http://cnx.org/content/m21897/latest/>>²"Basic Operations with Real Numbers: Negative Exponents" <<http://cnx.org/content/m21882/latest/>>

Exercise 101

(here³) Construct the graph of $y = -2x + 4$.

(Solution on p. 15.)

**Exercise 102**

(here⁴) Find the product: $\frac{x^2-3x-4}{x^2+6x+5} \cdot \frac{x^2+5x+6}{x^2-2x-8}$.

Exercise 103

(here⁵) Replace N with the proper quantity: $\frac{x+3}{x-5} = \frac{N}{x^2-7x+10}$.

(Solution on p. 15.)

³"Graphing Linear Equations and Inequalities: Graphing Equations in Slope-Intercept Form"
<<http://cnx.org/content/m22000/latest/>>

⁴"Rational Expressions: Multiplying and Dividing Rational Expressions" <<http://cnx.org/content/m21964/latest/>>

⁵"Rational Expressions: Building Rational Expressions and the LCD" <<http://cnx.org/content/m21941/latest/>>

Solutions to Exercises in this Module

Solution to Exercise (p. 3)

$$\frac{2}{3}$$

Solution to Exercise (p. 3)

$$\frac{5}{b}$$

Solution to Exercise (p. 4)

$$\frac{x}{y^2}$$

Solution to Exercise (p. 4)

$$\frac{3x+4y}{x-y}$$

Solution to Exercise (p. 4)

$$\frac{3x^2-3x-1}{3x+10}$$

Solution to Exercise (p. 4)

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

Solution to Exercise (p. 4)

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

Solution to Exercise (p. 4)

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

Solution to Exercise (p. 4)

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

Solution to Exercise (p. 6)

$$\frac{9ax+5x}{12a^3}$$

Solution to Exercise (p. 6)

$$\frac{8b^2-7b}{(b+1)(b-2)}$$

Solution to Exercise (p. 7)

$$\frac{2a^2-4a-25}{(a+2)(a+3)}$$

Solution to Exercise (p. 7)

$$\frac{3x^2-19x-18}{(x+3)(x-3)}$$

Solution to Exercise (p. 7)

$$\frac{5y^2+6y-12}{y(y+4)}$$

Solution to Exercise (p. 7)

$$\frac{2a^2-10a+26}{(a-2)(a-1)(a-4)}$$

Solution to Exercise (p. 7)

$$\frac{4b^2+12b+6}{(b+3)^2(b+2)^2}$$

Solution to Exercise (p. 7)

$$\frac{2x^2-5x+8}{3(x+4)(x-1)}$$

Solution to Exercise (p. 7)

$$\frac{2x}{x-4}$$

Solution to Exercise (p. 7)

$$\frac{8x-45}{x-6}$$

Solution to Exercise (p. 7)

$$\frac{a^2-a-14}{a+3}$$

Solution to Exercise (p. 8)

$$\frac{1}{2}$$

Solution to Exercise (p. 8)

$$\frac{3}{10}$$

Solution to Exercise (p. 8)

$$\frac{2}{x}$$

Solution to Exercise (p. 8)

$$\frac{14y}{5x}$$

Solution to Exercise (p. 8)

$$\frac{9n}{2m}$$

Solution to Exercise (p. 8)

$$\frac{2y+12}{y-6}$$

Solution to Exercise (p. 8)

$$\frac{4a+11}{a-1}$$

Solution to Exercise (p. 8)

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

Solution to Exercise (p. 8)

$$\frac{2b+3}{b-3}$$

Solution to Exercise (p. 8)

$$\frac{8}{b-6}$$

Solution to Exercise (p. 8)

$$\frac{y+9}{y+8}$$

Solution to Exercise (p. 9)

$$\frac{-7x-8}{x+2}$$

Solution to Exercise (p. 9)

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

Solution to Exercise (p. 9)

$$\frac{4a-1}{10a^3}$$

Solution to Exercise (p. 9)

$$\frac{5(x-2)}{(x-6)(x-1)}$$

Solution to Exercise (p. 9)

$$\frac{2y(4y+13)}{(y+4)(y+3)}$$

Solution to Exercise (p. 9)

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

Solution to Exercise (p. 9)

$$\frac{-6y}{(y-1)(y-4)}$$

Solution to Exercise (p. 9)

$$\frac{y^2}{(y+1)(y+6)}$$

Solution to Exercise (p. 9)

$$\frac{-2a^2-4a+9}{(a+4)(a-1)}$$

Solution to Exercise (p. 9)

$$\frac{7a-9}{(a+1)(a-3)}$$

Solution to Exercise (p. 9)

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

Solution to Exercise (p. 10)

$$\frac{2b^2+3b+29}{(b-3)(b+4)(b+5)}$$

Solution to Exercise (p. 10)

$$\frac{-x+29}{(x-2)(x+2)(x+7)}$$

Solution to Exercise (p. 10)

$$\frac{5x^4-3x^3-34x^2+34x-60}{(x-2)(x+2)(x-3)(x+3)(x+4)}$$

Solution to Exercise (p. 10)

Solution to Exercise (p. 10)

$$\frac{(a+5)(a-2)}{(a+2)(a-3)(a-6)}$$

Solution to Exercise (p. 10)

$$\frac{-a^3-8a^2-18a-1}{a^2(a+3)(a-1)}$$

Solution to Exercise (p. 10)

$$\frac{-x^3+2x^2+6x+18}{4x^4(x-2)(x+3)}$$

Solution to Exercise (p. 10)

$$\frac{14x^4-9x^3-2x^2+9x-36}{8x^3(x+3)(x-3)}$$

Solution to Exercise (p. 10)

$$\frac{8x+50}{x+6}$$

Solution to Exercise (p. 10)

$$\frac{3x-13}{x-6}$$

Solution to Exercise (p. 10)

$$\frac{2a+1}{a-1}$$

Solution to Exercise (p. 10)

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

Solution to Exercise (p. 11)

$$\frac{2x^2+x+2}{x-1}$$

Solution to Exercise (p. 11)

$$\frac{-5x+31}{x-4}$$

Solution to Exercise (p. 11)

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

Solution to Exercise (p. 11)

$$\frac{7a^3+35a^2+85a-1}{(a+7)(a+4)}$$

Solution to Exercise (p. 11)

$$\frac{-2m}{m-6}$$

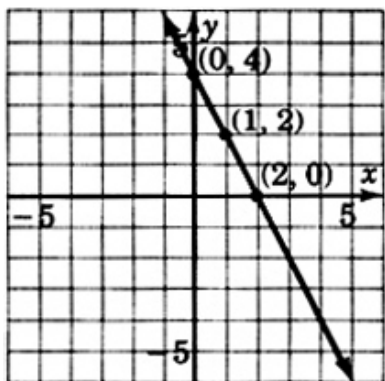
Solution to Exercise (p. 11)

$$\frac{2y-13}{5y-4}$$

Solution to Exercise (p. 11)

$$x^{22}y^{14}z^{32}$$

Solution to Exercise (p. 12)



Solution to Exercise (p. 12)

$$(x+3)(x-2)$$