

## 11-7 Mixed Expressions and Complex Fractions

Write each mixed expression as a rational expression.

1.  $\frac{2}{n} + 4$

ANSWER:

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

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

ANSWER:

$$\frac{3r^2 + 1}{3r}$$

3.  $6 + \frac{5}{t+1}$

ANSWER:

$$\frac{6t + 11}{t + 1}$$

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

ANSWER:

$$\frac{-10x^2 + x + 7}{2x}$$

5. **ROWING** Rico rowed a canoe  $2\frac{1}{2}$  miles in  $\frac{1}{3}$  hour.

a. Write an expression to represent his speed in miles per hour.

b. Simplify the expression to find his average speed.

ANSWER:

a.  $\frac{2\frac{1}{2} \text{ mi}}{\frac{1}{3} \text{ h}}$

b.  $\frac{15}{2}$  or  $7\frac{1}{2}$  mi/h

Simplify each expression.

6.  $\frac{2\frac{1}{3}}{1\frac{2}{5}}$

ANSWER:

$$\frac{5}{3} \text{ or } 1\frac{2}{3}$$

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

ANSWER:

$$\frac{3}{25}$$

8.  $\frac{\frac{a^2}{b^3}}{\frac{a}{b^5}}$

ANSWER:

$$\frac{a^3}{b^8}$$

9.  $\frac{\frac{y^4}{x^2}}{\frac{xy^2}{2x^2}}$

ANSWER:

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

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

ANSWER:

$$2(x + 1)$$

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$$11. \frac{\frac{r+s}{x^2-y^2}}{\frac{(r+s)^2}{x-y}}$$

ANSWER:

$$\frac{1}{(x+y)(r+s)}$$

$$12. \frac{\frac{2+q}{q^2-4}}{\frac{q+4}{q^2-6q+8}}$$

ANSWER:

$$\frac{q-4}{q+4}$$

$$13. \frac{\frac{p+3}{p^2+p-6}}{\frac{p^2+4p+3}{p^2+6p+9}}$$

ANSWER:

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

**Write each mixed expression as a rational expression.**

$$14. 10 + \frac{6}{f}$$

ANSWER:

$$\frac{10f+6}{f}$$

$$15. p - \frac{7}{2p}$$

ANSWER:

$$\frac{2p^2-7}{2p}$$

$$16. 5a - \frac{2a}{b}$$

ANSWER:

$$\frac{5ab-2a}{b}$$

$$17. 3h + \frac{1+h}{h}$$

ANSWER:

$$\frac{3h^2+h+1}{h}$$

$$18. t + \frac{v+w}{v-w}$$

ANSWER:

$$\frac{tv-tw+v+w}{v-w}$$

$$19. n^2 + \frac{n-1}{n+4}$$

ANSWER:

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

$$20. (k+2) + \frac{k-1}{k-2}$$

ANSWER:

$$\frac{k^2+k-5}{k-2}$$

$$21. (d-6) + \frac{d+1}{d-7}$$

ANSWER:

$$\frac{d^2-12d+43}{d-7}$$

$$22. \frac{h-3}{h+5} - (h+2)$$

ANSWER:

$$\frac{-h^2-6h-13}{h+5}$$

## 11-7 Mixed Expressions and Complex Fractions

23. **READING** Ebony reads  $6\frac{3}{4}$  pages of a book in 9 minutes. What is her average reading rate in pages per minute?

ANSWER:

$$\frac{3}{4} \text{ page/min}$$

24. **HORSES** A thoroughbred can run  $\frac{1}{2}$  mile in about

$\frac{3}{4}$  minute. What is the horse's speed in miles per hour?

ANSWER:

40 mi/h

**Simplify each expression.**

25.  $\frac{2\frac{2}{9}}{3\frac{1}{3}}$

ANSWER:

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

26.  $\frac{5\frac{3}{5}}{2\frac{1}{7}}$

ANSWER:

$$2\frac{46}{75}$$

27.  $\frac{\frac{g^2}{h}}{\frac{g^5}{h^2}}$

ANSWER:

$$\frac{h}{g^3}$$

28.  $\frac{\frac{5n^4}{p^3}}{\frac{6n}{5p}}$

ANSWER:

$$\frac{25n^3}{6p^2}$$

29.  $\frac{\frac{2}{a}}{\frac{1}{a+6}}$

ANSWER:

$$\frac{2a+12}{a}$$

30.  $\frac{\frac{t+5}{9}}{\frac{t^2-t-30}{12}}$

ANSWER:

$$\frac{4}{3(t-6)}$$

31.  $\frac{\frac{j^2-16}{j^2+10j+16}}{\frac{15}{j+8}}$

ANSWER:

$$\frac{(j-4)(j+4)}{15(j+2)}$$

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

ANSWER:

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

## 11-7 Mixed Expressions and Complex Fractions

33. **CCSS MODELING** The Centralville High School Cooking Club has  $12\frac{1}{2}$  pounds of flour with which to make tortillas. There are  $3\frac{3}{4}$  cups of flour in a pound, and it takes about  $\frac{1}{3}$  cup of flour per tortilla. How many tortillas can they make?

**ANSWER:**

about 140

34. **SCOOTER** The speed  $v$  of an object spinning in a circle equals the circumference of the circle divided by the time  $T$  it takes the object to complete one revolution.
- Use the variables  $v$ ,  $r$  (the radius of the circle), and  $T$  to write a formula describing the speed of a spinning object.
  - A scooter has tires with a radius of  $3\frac{1}{2}$  inches.

The tires make one revolution every  $\frac{1}{10}$  second. Find the speed in miles per hour. Round to the nearest tenth.

**ANSWER:**

- $v = \frac{2\pi r}{T}$
- 12.5 mi/h

35. **SCIENCE** The *density* of an object equals  $\frac{m}{V}$ , where  $m$  is the mass of the object and  $V$  is the volume. The densities of four metals are shown in the table. Identify the metal of each ball described below. (*Hint*: The volume of a sphere is  $V = \frac{4}{3}\pi r^3$ .)

Metal	Density (kg/m <sup>3</sup> )
copper	8900
gold	19,300
iron	7800
lead	11,300

- A metal ball has a mass of 15.6 kilograms and a radius of 0.0748 meter.
- A metal ball has a mass of 285.3 kilograms and a radius of 0.1819 meter.

**ANSWER:**

- copper
- lead

36. **SIRENS** As an ambulance approaches, the siren sounds different than if it were sitting still. If the ambulance is moving toward you at  $v$  miles per hour and blowing the siren at a frequency of  $f$ , then you hear the siren as if it were blowing at a frequency  $h$ .

This can be described by the equation  $h = \frac{f}{1 - \frac{v}{s}}$ ,

where  $s$  is the speed of sound, approximately 760 miles per hour.

- Simplify the complex fraction in the formula.
- Suppose a siren blows at 45 cycles per minute and is moving toward you at 65 miles per hour. Find the frequency of the siren as you hear it.

**ANSWER:**

- $\frac{fs}{s - v}$
- 49.21 cycles/min

## 11-7 Mixed Expressions and Complex Fractions

Simplify each expression.

$$37. 15 - \frac{17x+5}{5x+10}$$

ANSWER:

$$\frac{58x+145}{5x+10}$$

$$38. \frac{\frac{b}{b+3} + 2}{b^2 - 2b - 8}$$

ANSWER:

$$\frac{3}{(b+3)(b-4)}$$

$$39. \frac{1 + \frac{2c^2 - 6c - 10}{c+7}}{2c+1}$$

ANSWER:

$$\frac{c-3}{c+7}$$

$$40. \frac{y - \frac{12}{y-4}}{y - \frac{18}{y-3}}$$

ANSWER:

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

$$41. \frac{\frac{x^2 - 4x - 32}{x+1}}{\frac{x^2 + 6x + 8}{x^2 - 1}}$$

ANSWER:

$$\frac{(x-8)(x-1)}{x+2}$$

$$42. \frac{\frac{r^2 - 9r}{r^2 + 7r + 10}}{\frac{r^2 + 5r}{r^2 + r - 2}}$$

ANSWER:

$$\frac{(r-9)(r-1)}{(r+5)^2}$$

43. **REASONING** Describe the first step to simplify the expression shown.

$$\frac{\left(\frac{y}{x} - \frac{x}{y}\right)}{\frac{x+y}{xy}}$$

ANSWER:

Find the lowest common denominator for the

fractions in the numerator and simplify to  $\frac{y^2 - x^2}{xy}$ .

44. **REASONING** Is  $\frac{n}{1 - \frac{5}{p}} + \frac{n}{\frac{5}{p} - 1}$  sometimes,

always, or never equal to 0? Explain.

ANSWER:

Always; the expression can be simplified to

$$\frac{\frac{n}{1 - \frac{5}{p}} - \frac{n}{1 - \frac{5}{p}}}{p}, p \neq 0.$$

45. **CCSS PERSEVERANCE** Simplify the rational expression shown.

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

ANSWER:

$$\frac{2t^3}{(t-1)(t^2-1)}$$

## 11-7 Mixed Expressions and Complex Fractions

46. **OPEN ENDED** Write a complex fraction that, when simplified, results in  $\frac{1}{x}$ .

**ANSWER:**

Sample answer:  $\frac{\frac{x}{a}}{\frac{x^2}{a}}$

47. **WRITING IN MATH** Explain how complex fractions can be used to solve a problem involving distance, rate, and time. Give an example.

**ANSWER:**

Sample answer: Time equals distance divided by rate or  $\frac{d}{r}$ . When the distance or the rate is given as a fraction or mixed number, the expression

$\frac{d}{r}$  becomes a complex fraction. Example: Someone

walks  $\frac{3}{4}$  mile in  $10\frac{1}{2}$  minutes; the time in miles per

minute is  $\frac{\frac{3}{4}}{10\frac{1}{2}}$ , which simplifies to  $\frac{1}{14}$  mi/min.

48. A number is between 44 squared and 45 squared. 5 squared is one of its factors, and it is a multiple of 13. Find the number.

- A 1950  
B 2000  
C 2025  
D 1975

**ANSWER:**

A

49. **SHORT RESPONSE** Bernard is reading a 445-page book. He has already read 157 pages. If he reads 24 pages a day, how long will it take him to finish the book?

**ANSWER:**

12 days

50. **GEOMETRY** Angela wanted a round rug to fit her room that is 16 feet wide. The rug should just meet the edges. What is the area of the rug rounded to the nearest tenth?

- F 100.5 ft  
G 804.2 ft<sup>2</sup>  
H 50.3 ft  
J 201.1 ft<sup>2</sup>

**ANSWER:**

J

51. Simplify  $7x + \frac{10}{2xy}$ .

- A  $\frac{7x+10}{2xy}$   
B  $\frac{7x^2y+5}{xy}$   
C  $\frac{17x}{2xy}$   
D  $\frac{7xy+5}{x^2y}$

**ANSWER:**

B

**Find each sum or difference.**

52.  $\frac{6}{7x} - \frac{5+x}{7x}$

**ANSWER:**

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

53.  $\frac{4}{d-1} + \frac{d}{1-d}$

**ANSWER:**

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

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

ANSWER:

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

55.  $\frac{2}{5m} - \frac{1}{15m^3}$

ANSWER:

$$\frac{6m^2-1}{15m^3}$$

56.  $\frac{10}{3g} - \frac{-3}{4h}$

ANSWER:

$$\frac{9g+40h}{12gh}$$

57.  $\frac{b}{b+3} + \frac{6}{b-2}$

ANSWER:

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

**Find each quotient. Use long division.**

58.  $(x^2 - 2x - 30) \div (x + 7)$

ANSWER:

$$x-9+\frac{33}{x+7}$$

59.  $(a^2 + 4a - 22) \div (a - 3)$

ANSWER:

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

60.  $(3q^2 + 20q + 11) \div (q + 6)$

ANSWER:

$$3q+2-\frac{1}{q+6}$$

61.  $(3y^3 + 8y^2 + y - 7) \div (y + 2)$

ANSWER:

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

62.  $(6t^3 - 9t^2 + 6) \div (2t - 3)$

ANSWER:

$$3t^2+\frac{6}{2t-3}$$

63.  $(9h^3 + 5h - 8) \div (3h - 2)$

ANSWER:

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

64. **GEOMETRY** A rectangle has a base of 8 meters and a height of 14 meters. What is the length of the diagonal?

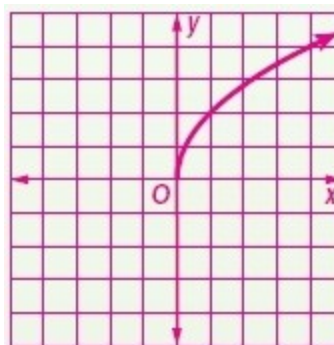
ANSWER:

$$2\sqrt{65} \text{ or about } 16.1 \text{ m}$$

**Graph each function. Determine the domain and range.**

65.  $y = 2\sqrt{x}$

ANSWER:

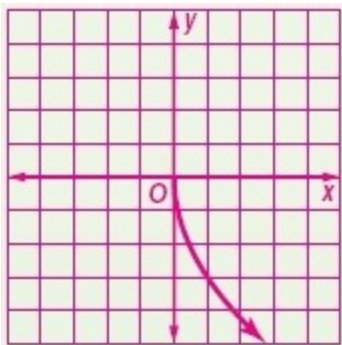


$$D = \{x|x \geq 0\}; R = \{y|y \geq 0\}$$

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66.  $y = -3\sqrt{x}$

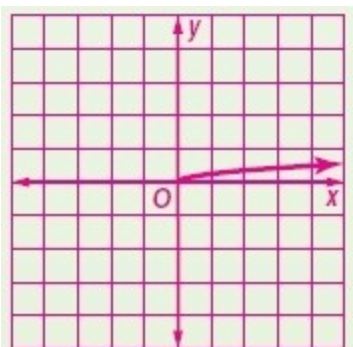
ANSWER:



$D = \{x|x \geq 0\}; R = \{y|y \leq 0\}$

67.  $y = \frac{1}{4}\sqrt{x}$

ANSWER:



$D = \{x|x \geq 0\}; R = \{y|y \geq 0\}$

**Factor each polynomial. If the polynomial cannot be factored, write *prime*.**

68.  $x^2 - 81$

ANSWER:

$(x - 9)(x + 9)$

69.  $a^2 - 121$

ANSWER:

$(a - 11)(a + 11)$

70.  $n^2 + 100$

ANSWER:

prime

71.  $-25 + 4y^2$

ANSWER:

$(2y - 5)(2y + 5)$

72.  $p^4 - 16$

ANSWER:

$(p - 2)(p + 2)(p^2 + 4)$

73.  $4t^4 - 4$

ANSWER:

$4(t - 1)(t + 1)(t^2 + 1)$

74. **PARKS** A youth group traveling in two vans visited Mammoth Cave in Kentucky. The number of people in each van and the total cost of the cave are shown. Find the adult price and the student price of the tour.

Van	Number of Adults	Number of Students	Total Cost
A	2	5	\$77
B	2	7	\$95

ANSWER:

adult: \$16; student: \$9

**Solve each equation.**

75.  $6x = 24$

ANSWER:

4

76.  $5y - 1 = 19$

ANSWER:

4

77.  $2t + 7 = 21$

ANSWER:

7

78.  $\frac{p}{3} = -4.2$

ANSWER:

-12.6



## **11-7 Mixed Expressions and Complex Fractions**

79.  $\frac{2m+1}{4} = -5.5$

ANSWER:

-11.5

80.  $\frac{3}{4}g = \frac{1}{2}$

ANSWER:

$\frac{2}{3}$