

1. **Vocabulary** How can you tell if an algebraic expression is a *rational expression*?

**SEE EXAMPLE 1** Simplify. Identify any  $x$ -values for which the expression is undefined.

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

3.  $\frac{6x^2 + 13x - 5}{6x^2 - 23x + 7}$

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

**SEE EXAMPLE 2**

5.  $\frac{-x-4}{x^2-x-20}$

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

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

**SEE EXAMPLE 3** Multiply. Assume that all expressions are defined.

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

9.  $\frac{x-2}{x-3} \cdot \frac{2x-6}{x+5}$

10.  $\frac{x^2-16}{x^2-4x+4} \cdot \frac{x-2}{x^2+6x+8}$

**SEE EXAMPLE 4** Divide. Assume that all expressions are defined.

11.  $\frac{x^5y^4}{3xy} \div \frac{1}{x^3y}$

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

13.  $\frac{x^2-25}{2x^2+5x-12} \div \frac{x^2-3x-10}{x^2+9x+20}$

14.  $\frac{x^2+2x+1}{x^2-3x-18} \div \frac{x^2-1}{x^2-7x+6}$

**SEE EXAMPLE 5** Solve. Check your solution.

15.  $\frac{16x^2-9}{4x+3} = -6$

16.  $\frac{2x^2+7x-15}{2x-3} = 10$

17.  $\frac{x^2-4}{x-2} = 1$

### PRACTICE AND PROBLEM SOLVING

Simplify. Identify any  $x$ -values for which the expression is undefined.

18.  $\frac{4x-8}{x^2-2x}$

19.  $\frac{8x-4}{2x^2+9x-5}$

20.  $\frac{x^2-36}{x^2-12x+36}$

21.  $\frac{3x+18}{24-2x-x^2}$

22.  $\frac{-2x^2-9x}{4x^2-81}$

23.  $\frac{4x+20}{-5-x}$

**Independent Practice**

For Exercises	See Example
18–20	1
21–23	2
24–27	3
28–31	4
32–34	5

**Extra Practice**

See Extra Practice for more Skills Practice and Applications Practice exercises.

**Multiply.** Assume that all expressions are defined.

24.  $\frac{x^2y}{4xy} \cdot \frac{x}{6} \cdot \frac{3y^5}{x^4}$

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

26.  $\frac{x^2-2x-8}{9x^2-16} \cdot \frac{3x^2+10x+8}{x^2-16}$

27.  $\frac{4x^2-20x+25}{x^2-4x} \cdot \frac{3x-12}{2x-5}$

**Divide.** Assume that all expressions are defined.

28.  $\frac{4x^2+15x+9}{8x^2+10x+3} \div \frac{x^2+4x}{2x+1}$

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

30.  $\frac{x+2}{x-4} \div \frac{1}{3x-12}$

31.  $\frac{x^2-2x-3}{x^2-x-2} \div \frac{x^2+2x-15}{x^2+x-6}$

**Solve.** Check your solution.

32.  $\frac{3x^2+10x+8}{-x-2} = -2$

33.  $\frac{x^2-9}{x-3} = 5$

34.  $\frac{x^2+3x-28}{(x+7)(x-4)} = -11$

**35. Archery** An archery target consists of an inner circle and four concentric rings. The width of each ring is equal to the radius  $r$  of the inner circle. Write a rational expression in terms of  $r$  that represents the probability that an arrow hitting the target at random will land in the inner circle. Then simplify the expression.



**Multiply or divide.** Assume that all expressions are defined.

36.  $\frac{2x}{3} \cdot \frac{x^3}{6x-8}$

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

38.  $\frac{1}{25x^2-49} \div \frac{x}{10x-14}$

39.  $2xy \cdot \frac{2x^2}{y} \cdot \frac{y^2}{2x}$

40.  $\frac{14x^4}{xy} \cdot \frac{x^3}{6y^3} \div \frac{5x^2}{12y^5}$

41.  $(y+4) \div \frac{4x+4+xy+y}{3}$



**Archery**



Archery was practiced in ancient times on every inhabited continent except Australia. The painting in the photo above dates from about 1400 B.C.E. and shows archers from ancient