

**LESSON** **Practice C**  
**10-3** **Simplifying Rational Expressions**

Find any excluded values for each rational expression.

1.  $\frac{5}{4x-7}$

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

3.  $\frac{x-5}{x^2-25}$

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Simplify each rational expression, if possible. Identify any excluded values.

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

5.  $\frac{4x^2-20x}{2x-10}$

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

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Simplify each rational expression, if possible.

7.  $\frac{x^2+4x-5}{x^2+8x+15}$

8.  $\frac{3x-12}{6x^2-18x-24}$

9.  $\frac{2x^2-32}{x^2+8x+16}$

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10.  $\frac{10x^2-360}{5x^2+30x}$

11.  $\frac{x^2+2x-8}{x^3-2x^2-24x}$

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

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13.  $\frac{5-x}{2x^3-16x^2+30x}$

14.  $\frac{x^2-25}{10+3x-x^2}$

15.  $\frac{27-3x^2}{6x^2-36x+54}$

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16. Flavored crushed ice is served in a paper container in the shape of a right circular cone.

- a. Find the surface-area-to-volume ratio of a right circular cone. (*Hint*: For a right circular cone,

$$S = \pi r^2 + \pi r s \text{ (where } s = \sqrt{r^2 + h^2} \text{) and } V = \frac{1}{3}\pi r^2 h.$$

- b. Container A has a radius of 2 in. and a height of 3 in. Container B has a radius of 3 in. and a height of 4 in. Which container uses the least amount of paper to hold the greatest amount of crushed ice? Explain.

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**LESSON 10-3 Practice A**  
**Simplifying Rational Expressions**

Find any excluded values for each rational expression.

1.  $\frac{2}{x-5}$       2.  $\frac{4}{x^2+3x}$       3.  $\frac{x+3}{x^2+6x+8}$   
 \_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_  
 5      0; -3      -4, -2

Simplify each rational expression, if possible.

4.  $\frac{x+4}{x^2-16}$       5.  $\frac{3x-18}{x^2-36}$       6.  $\frac{x^2-1}{x^2+8x+7}$   
 $\frac{\frac{x+4}{(x+4)(x-4)}}{\frac{1}{x-4}}$        $\frac{\frac{3(x-6)}{(x+6)(x-6)}}{\frac{3}{x+6}}$        $\frac{\frac{(x+1)(x-1)}{(x+1)(x+7)}}{\frac{x-1}{x+7}}$

7.  $\frac{x+5}{x^2+7x+10}$       8.  $\frac{x^2+4x-5}{x^2-4x+3}$       9.  $\frac{x^2-2x}{x^2+2x-8}$   
 $\frac{1}{x+2}$        $\frac{x+5}{x-3}$        $\frac{x}{x+4}$

10.  $\frac{3-x}{2x-6}$       11.  $\frac{x-4}{16-x^2}$       12.  $\frac{8-x}{x^2-6x-16}$   
 $\frac{-1(x-3)}{2(x-3)}$        $-\frac{1}{x+4}$        $-\frac{1}{x+2}$

13. An animal's surface-area-to-volume ratio indicates the amount of heat loss the animal may experience. Because a smaller animal has a higher ratio of surface-area-to-volume, the smaller animal has a higher rate of heat loss.

a. Find the surface-area-to-volume ratio of a cube.  $\frac{6}{s^2}$   
 (Hint: For a cube,  $S = 6s$  and  $V = s^3$ )

b. Two animals are both close to a cube in shape. The height of the first animal is 4 cm. The height of the second animal is 6 cm. Which animal would experience the greater amount of heat loss? Explain.  
 ratio for first animal:  $\frac{3}{8}$ ; ratio for second animal:  $\frac{1}{6}$ ; the first animal would experience greater heat loss because its surface-area-to-volume ratio is greater.

**LESSON 10-3 Practice B**  
**Simplifying Rational Expressions**

Find any excluded values for each rational expression.

1.  $\frac{6}{3+x}$       2.  $\frac{5}{x^2-4x}$       3.  $\frac{x+6}{x^2+3x-4}$   
 \_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_  
 -3      0; 4      -4, 1

Simplify each rational expression, if possible. Identify any excluded values.

4.  $\frac{7}{x-3}$       5.  $\frac{5x^2+10x}{5x}$       6.  $\frac{2x}{4x^2+6x}$   
 $\frac{7}{x-3}; 3$        $x+2; 0$        $\frac{1}{2x+3}; 0, -\frac{3}{2}$

Simplify each rational expression, if possible.

7.  $\frac{x+3}{x^2-2x-15}$       8.  $\frac{3x+6}{x^2+3x+2}$       9.  $\frac{x-6}{x^2-7x+6}$   
 $\frac{1}{x-5}$        $\frac{3}{x+1}$        $\frac{1}{x-1}$

10.  $\frac{x^2-49}{x^2+8x+7}$       11.  $\frac{x^2+4x-5}{x^2-4x+3}$       12.  $\frac{x^2-2x}{x^2+2x-8}$   
 $\frac{x-7}{x+1}$        $\frac{x+5}{x-3}$        $\frac{x}{x+4}$

13.  $\frac{x^2-x-12}{4-x}$       14.  $\frac{5-5x}{x^2-1}$       15.  $\frac{3-x}{x^2-6x+9}$   
 $-(x+3)$        $-\frac{5}{x+1}$        $-\frac{1}{x-3}$

16. When packaging food, a company wants a package that uses the least amount of material to hold the greatest volume of product. Some containers with mixed nuts are in the shape of a right circular cylinder.

a. Find the surface-area-to-volume ratio of a right circular cylinder. (Hint: For a right circular cylinder,  $S = 2\pi rh + 2\pi r^2$  and  $V = \pi r^2 h$ .)  $\frac{2(r+h)}{rh}$

b. Container A has a radius of 2 in. and a height of 5 in. Container B has a radius of 4 in. and a height of 8 in. Which container should the company choose? Explain.  
 ratio for A:  $\frac{7}{5}$ ; ratio for B:  $\frac{3}{4}$ ; The company wants the smallest surface-area-to-volume ratio, so it should choose container B.

**LESSON 10-3 Practice C**  
**Simplifying Rational Expressions**

Find any excluded values for each rational expression.

1.  $\frac{5}{4x-7}$       2.  $\frac{4x}{x^2-4x}$       3.  $\frac{x-5}{x^2-25}$   
 \_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_  
 $\frac{7}{4}$       0; 4      -5, 5

Simplify each rational expression, if possible. Identify any excluded values.

4.  $\frac{x-1}{x^2-4}$       5.  $\frac{4x^2-20x}{2x^3+5x^2+3x}$       6.  $\frac{x+1}{2x^3+5x^2+3x}$   
 $\frac{x-1}{x^2-4}; 2, -2$        $2x; 5$        $\frac{1}{x(2x+3)}; 0, -\frac{3}{2}, -1$

Simplify each rational expression, if possible.

7.  $\frac{x^2+4x-5}{x^2+8x+15}$       8.  $\frac{3x-12}{6x^2-18x-24}$       9.  $\frac{2x^2-32}{x^2+8x+16}$   
 $\frac{x-1}{x+3}$        $\frac{1}{2(x+1)}$        $\frac{2(x-4)}{x+4}$

10.  $\frac{10x^2-360}{5x^2+30x}$       11.  $\frac{x^2+2x-8}{x^3-2x^2-24x}$       12.  $\frac{x^2-1}{2x^2-3x-5}$   
 $\frac{2(x-6)}{x}$        $\frac{x-2}{x(x-6)}$        $\frac{x-1}{2x-5}$

13.  $\frac{5-x}{2x^3-16x^2+30x}$       14.  $\frac{x^2-25}{10+3x-x^2}$       15.  $\frac{27-3x^2}{6x^2-36x+54}$   
 $-\frac{1}{2x(x-3)}$        $-\frac{x+5}{x+2}$        $-\frac{x+3}{2(x-3)}$

16. Flavored crushed ice is served in a paper container in the shape of a right circular cone.

a. Find the surface-area-to-volume ratio of a right circular cone. (Hint: For a right circular cone,  $S = \pi r^2 + \pi rs$  (where  $s = \sqrt{r^2 + h^2}$ ) and  $V = \frac{1}{3}\pi r^2 h$ .)  $\frac{3(r+s)}{rh}$

b. Container A has a radius of 2 in. and a height of 3 in. Container B has a radius of 3 in. and a height of 4 in. Which container uses the least amount of paper to hold the greatest amount of crushed ice? Explain.  
 ratio for A:  $\approx 2.8$ ; ratio for B: 2; The container with the smallest ratio will hold the most ice using the least amount of paper and that is container B.

**LESSON 10-3 Review for Mastery**  
**Simplifying Rational Expressions**

A rational expression is an algebraic expression whose numerator and denominator are polynomials.

Exclude any values from a rational expression that make the denominator equal zero.

Find any excluded value of  $\frac{6x}{x^2-5x}$ . Simplify  $\frac{x+4}{2x^2+8x}$ , if possible. Identify any excluded values.

$\frac{6x}{x^2-5x}$        $\frac{x+4}{2x^2+8x}$   
 $x^2-5x=0$       Set denominator = 0.  
 $x(x-5)=0$       Factor.  
 $x=0$  or  $x-5=0$       Zero Product  
 $x=0$        $x=5$       Property

The excluded values are 0 and 5.

Find excluded values here.

$\frac{x+4}{2x(x+4)}$       Divide out common factors.  
 $\frac{1}{2x}$       Simplify.  
 Remember to find the excluded value from the original equation (not the simplified one).  
**The excluded values are 0 and -4.**

Identify any excluded values.

1.  $\frac{3}{4x}$       2.  $\frac{5x}{3x^2+15x}$       3.  $\frac{6}{x^2-5x-14}$   
 \_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_  
 0      0; -5      -2, 7

Simplify each rational expression, if possible. Identify any excluded values.

4.  $\frac{4x}{20x^2}$       5.  $\frac{x+3}{x-4}$       6.  $\frac{27x}{3x^2}$   
 $\frac{1}{5x^2}; x \neq 0$        $\frac{x+3}{x-4}; x \neq 4$        $\frac{9}{x}; x \neq 0$

7.  $\frac{6}{3x+9}$       8.  $\frac{x+4}{2x^2+8x}$       9.  $\frac{5x^2-20x}{x-4}$   
 $\frac{2}{x+3}; x \neq -3$        $\frac{1}{2x}; x \neq 0, x \neq -4$        $5x; x \neq 4$