

### 1.5 Simplifying Rational Expressions

McGraw-Hill Ryerson: MATHEMATICS 11, pp. 35-43

- To simplify a rational expression, factor both the numerator and the denominator and divide by any common factors.
- To find the restrictions on the variable(s) in a rational expression, set the denominator equal to zero. The restrictions are any values of the variable(s) that satisfy this equation.

1. Simplify each rational expression.

$\frac{5}{13a}$  a)  $\frac{15a}{39a^2} \quad a \neq 0$       b)  $\frac{35y^2z}{14yz^2}$   
 $x^2 - 18x + 4$  c)  $\frac{4x^4 - 72x^3 + 16x^2}{4x^2} \quad x \neq 0$       d)  $\frac{-7a^2b^3}{21a^5b}$   
 $\frac{3y}{4x}$  e)  $\frac{-54x^3y^5}{-72x^4y^4} \quad x \neq 0, y \neq 0$       f)  $\frac{51ab}{34a^3(a+3)}$

2. Express in simplest form.

$\frac{x}{5(x+3)}$  a)  $\frac{3x}{15(x+3)} \quad x \neq -3$       b)  $\frac{x(x+2)}{x^2}$   
 $\frac{x+3}{x+2}$  c)  $\frac{(x+3)(x-3)}{(x-3)(x+2)} \quad x \neq 3, x \neq -2$       d)  $\frac{4a}{3a+a^2}$

3. Simplify.

$\frac{4}{5}$  a)  $\frac{4x-12}{5x-15} \quad x \neq 3$       b)  $\frac{y+3y^2}{3y+1}$   
 $\frac{4x+1}{8x+1}$  c)  $\frac{8x+2}{16x+2} \quad x = -\frac{1}{8}$       d)  $\frac{2x^2+2y}{5x^2+5y}$

4. Simplify.

$-1$  a)  $\frac{5-2y}{2y-5} \quad y \neq \frac{5}{2}$       b)  $\frac{(x+3)(3-x)}{(x-3)(x-3)}$   
 $-1$  c)  $\frac{x-6}{6-x} \quad x = 6$       d)  $\frac{14b-21}{15-10b}$

5. Simplify.

$\frac{1}{x-4}$  a)  $\frac{x+5}{x^2+x-20} \quad x \neq -5, 4$       b)  $\frac{a-3}{a^2-7a+12}$   
 $\frac{3}{(x-2)}$  c)  $\frac{3x-15}{x^2-7x+10} \quad x \neq 5, 2$       d)  $\frac{x^2-2x-15}{x^2-x-12}$

6. For what values of x are the following rational expressions not defined?

a)  $\frac{5}{x} \quad x = 0$       b)  $\frac{5x}{x^3-x} \quad x \neq x^3$   
 c)  $\frac{x-7}{x+7} \quad x = -7$       d)  $\frac{x+3}{x^2+8x+7}$

7. Write expressions for the following.

- a) The time it will take to travel  $(4-4x)$  km if you are travelling at 100 km/h.  $\frac{1-x}{25}$   
 b) The cost of one widget if you are planning to produce  $500(x-2)$  widgets for  $\$250(x^2-6x+8)$ .  $\frac{2}{x-4}$   
 c) The width of a rectangle having length  $\left(\frac{5x-15}{4}\right)$  cm and area  $(x^2-5x+6)$  cm<sup>2</sup>.  $\frac{4(x-2)}{5}$

8. Cylinder A solid cylinder has a height equal to its radius.

- a) If the height is x, find the ratio of the volume to the surface area. Simplify, if possible.  $\frac{rh}{2(r+h)}$   
 \* b) If the expression you found in part a) equals 3 for a particular cylinder, what is the height of the cylinder?  $\frac{6r}{r-6}$   
 c) If the volume of that cylinder is 7.2 cm<sup>3</sup>, find the surface area. 2.4

9. Rectangular prism Find the ratio of the volume to the surface area of the rectangular prism shown. Simplify, if possible.

