

## Checkpoint 1: Assess Your Understanding, pages 545–548

### 7.1

1. **Multiple Choice** Which expression simplifies to  $\frac{x-3}{x+4}$ ?

A.  $\frac{x^2-9}{x^2+7x+12}$ ,  $x \neq -4, -3$     B.  $\frac{x^2-9}{x^2-7x+12}$ ,  $x \neq 3, 4$

C.  $\frac{x^2+9}{x^2+7x+12}$ ,  $x \neq -4, -3$     D.  $\frac{x^2+9}{x^2-7x+12}$ ,  $x \neq 3, 4$

2. Write two equivalent forms of each rational expression.

a)  $\frac{3x^2}{5x}$

The expression has  $x = 0$  as a non-permissible value.

$$\begin{aligned}\frac{3x^2}{5x} &= \frac{3x^2}{5x} \cdot \frac{2x}{2x} \\ &= \frac{6x^3}{10x^2}\end{aligned}$$

$$\begin{aligned}\frac{3x^2}{5x} &= \frac{3x^{\cancel{2}}}{5\cancel{x}} \\ &= \frac{3x}{5}\end{aligned}$$

The equivalent expressions are:

$$\frac{6x^3}{10x^2}, x \neq 0 \text{ and } \frac{3x}{5}, x \neq 0$$

b)  $\frac{-2(x-6)}{x(x+7)(x-6)}$

The expression has  $x = -7, 0, 6$  as non-permissible values.

$$\frac{-2(x-6)}{x(x+7)(x-6)}$$

$$= \frac{-2(x-6)}{x(x+7)(x-6)} \cdot \frac{x+7}{x+7}$$

$$= \frac{-2(x-6)(x+7)}{x(x+7)^2(x-6)}$$

$$\frac{-2(x-6)}{x(x+7)(x-6)}$$

$$= \frac{-2(\cancel{x-6})}{x(x+7)(\cancel{x-6})}$$

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

The equivalent expressions are:

$$\frac{-2(x-6)(x+7)}{x(x+7)^2(x-6)}, x \neq -7, 0, 6 \text{ and}$$

$$\frac{-2}{x(x+7)}, x \neq -7, 0, 6$$

3. Write each rational expression in simplest form.

a)  $\frac{25x^3}{10x^2}$

The non-permissible value is:  
 $x = 0$

$$\begin{aligned}\frac{25x^3}{10x^2} &= \frac{5 \cdot 25x^{\cancel{3}}}{2 \cdot 10x^{\cancel{2}}} \\ &= \frac{5x}{2}, x \neq 0\end{aligned}$$

b)  $\frac{x^2 + 7x - 18}{x^2 - 81}$

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

The non-permissible values are:

$$x = -9 \text{ and } x = 9$$

$$= \frac{\cancel{(x+9)}(x-2)}{\cancel{(x+9)}(x-9)}$$

$$= \frac{x-2}{x-9}, x \neq -9, 9$$

c)  $\frac{98 - 2x^2}{4x^2 - 24x - 28} = \frac{2(49 - x^2)}{4(x^2 - 6x - 7)}$

$$= \frac{2(7-x)(7+x)}{4(x-7)(x+1)}$$

The non-permissible values are:  $x = -1$  and  $x = 7$

$$= \frac{-2(\cancel{x-7})(7+x)}{2 \cdot 4(\cancel{x-7})(x+1)}$$

$$= -\frac{7+x}{2(x+1)}, x \neq -1, 7$$

4. Here is a student's solution for simplifying a rational expression. Identify the error in the solution. Write a correct solution.

$$\begin{aligned}\frac{4x - 8}{x^2 + 2x - 8} &= \frac{4(\cancel{x-2})}{(x+4)(\cancel{x-2})} \\ &= \frac{4}{x+4}, x \neq -2, 4\end{aligned}$$

The student has made an error in the signs of the non-permissible values. Each factor in the denominator should be set equal to 0 to get  $x = 2$  and  $x = -4$  as non-permissible values.

Correct solution:

$$\begin{aligned}\frac{4x - 8}{x^2 + 2x - 8} &= \frac{4(\cancel{x-2})}{(x+4)(\cancel{x-2})} \\ &= \frac{4}{x+4}, x \neq -4, 2\end{aligned}$$

## 7.2

5. **Multiple Choice** Which values of  $x$  are non-permissible for

$$\frac{x^2 + 3x}{x - 2} \div \frac{x + 3}{x + 5}?$$

- A.  $-5, 2$       **B.**  $-5, -3, 2$       C.  $-5, -3, 0, 2$       D.  $-3, 0, 2$

6. Simplify each expression.

a)  $\frac{14(a-9)}{15a^2} \cdot \frac{5a}{7(a-9)}$

Non-permissible values:

$$a = 0 \text{ and } a = 9$$

$$\begin{aligned}&= \frac{\cancel{14}(\cancel{a-9})}{\cancel{3} \cdot \cancel{15} a^2} \cdot \frac{\cancel{5} a}{\cancel{7}(\cancel{a-9})} \\ &= \frac{2}{3a}, a \neq 0, 9\end{aligned}$$

b)  $\frac{2n^2 - 128}{3n - 5} \cdot \frac{6n - 10}{n - 8}$

Non-permissible values:

$$n = \frac{5}{3} \text{ and } n = 8$$

$$\begin{aligned}&= \frac{2(n^2 - 64)}{3n - 5} \cdot \frac{2(3n - 5)}{n - 8} \\ &= \frac{2(\cancel{n-8})(n+8)}{\cancel{3n-5}} \cdot \frac{2(\cancel{3n-5})}{\cancel{n-8}} \\ &= 4(n+8), n \neq \frac{5}{3}, 8\end{aligned}$$

$$\text{c) } \frac{18e^2}{4(e+2)} \div \frac{12e}{7(e+2)}$$

**Non-permissible values:**

$e = -2$  and  $e = 0$

$$= \frac{\cancel{3} \cancel{18} e^2}{4 \cancel{(e+2)}} \cdot \frac{\cancel{7} \cancel{(e+2)}}{\cancel{2} \cancel{12} e}$$

$$= \frac{21e}{8}, e \neq -2, 0$$

$$\text{d) } \frac{5x^2 - 11x + 2}{x^2 - 3x - 28} \div \frac{2x^2 + 10x - 28}{x^2 + 11x + 28}$$

$$= \frac{(5x-1)(x-2)}{(x-7)(x+4)} \div \frac{2(x^2+5x-14)}{(x+7)(x+4)}$$

$$= \frac{(5x-1)(x-2)}{(x-7)(x+4)} \div \frac{2(x+7)(x-2)}{(x+7)(x+4)}$$

**Non-permissible values:**

$x = -7, x = -4, x = 2,$  and  $x = 7$

$$= \frac{(5x-1)\cancel{(x-2)}}{(x-7)\cancel{(x+4)}} \cdot \frac{\cancel{(x+7)}\cancel{(x+4)}}{2\cancel{(x+7)}\cancel{(x-2)}}$$

$$= \frac{5x-1}{2(x-7)}, x \neq -7, -4, 2, 7$$

7. Simplify each expression.

$$\text{a) } \frac{2a^2b}{9ab^3} \div \frac{4bc^2}{3ab^2} \cdot \frac{12a^2c^2}{bc}$$

**Non-permissible values:**  $a = 0, b = 0, c = 0$

$$= \frac{\cancel{2} a^2 b}{\cancel{3} \cancel{9} a \cancel{b}^2 c^2} \cdot \frac{\cancel{3} \cancel{a} b^2}{\cancel{4} b^2 c^2} \cdot \frac{\cancel{3} \cancel{12} a^2 c^2}{bc}$$

$$= \frac{2a^4}{b^2c}, a \neq 0, b \neq 0, c \neq 0$$

$$\text{b) } \frac{3x-27}{x^2-1} \cdot \frac{x^2-7x-8}{x^2-81} \div \frac{5x}{2x-2}$$

$$= \frac{3(x-9)}{(x-1)(x+1)} \cdot \frac{(x-8)(x+1)}{(x-9)(x+9)} \div \frac{5x}{2(x-1)}$$

**Non-permissible values:**  $x = -9, -1, 0, 1, 9$

$$= \frac{\cancel{3}\cancel{(x-9)}}{\cancel{(x-1)}\cancel{(x+1)}} \cdot \frac{(x-8)\cancel{(x+1)}}{\cancel{(x-9)}(x+9)} \cdot \frac{2\cancel{(x-1)}}{5x}$$

$$= \frac{6(x-8)}{5x(x+9)}, x \neq -9, -1, 0, 1, 9$$