

### 3.1 Simplify Rational Expressions

## PRACTICE

The following rational expressions are in lowest terms. State the excluded value(s) for each.

1.  $\frac{4x-9}{5x+2} \neq 0$   
 $\frac{-2}{5} = \frac{-2}{5}$   
 $x = -\frac{2}{5}$

2.  $\frac{45n+1}{15n^2-45n} \neq 0$   
 $15n(n-3) \neq 0$   
 $n \neq 0 \quad n \neq 3$

3.  $\frac{y^2+5y}{y^2-7} \neq 0$   
 $\frac{+7}{+7}$   
 $\sqrt{y^2} = \sqrt{7}$   
 $y = \pm\sqrt{7}$

4.  $\frac{(p+3)(2p-1)}{4(p-7)(p+2)(3p-5)} \neq 0$   
 $p-7 \neq 0 \quad p+2 \neq 0 \quad 3p-5 \neq 0$   
 $p \neq 7 \quad p \neq -2 \quad p \neq \frac{5}{3}$

5.  $\frac{4ab}{5a-3b} \neq 0$  - or -  
 $\frac{+3b}{+3b} \quad b \neq \frac{5a}{3}$   
 $\frac{5a}{5} \neq \frac{3b}{5}$   
 $a \neq \frac{3b}{5}$

6.  $\frac{c^2-3c-10}{c^2+2} \neq 0$   
 $\frac{-1}{-1} \quad \frac{-2}{-2}$   
 $\sqrt{c^2+2} \neq 0$   
 NON REAL SOLUTION  
 No excluded values!

Reduce the rational expression to lowest terms. State the excluded value for each rational expression.

7.  $\frac{4a(a+4)}{a^3-2a^2-24a} = \frac{4}{a-6}$   
 $a(a^2-2a-24)$   
 $a(a-6)(a+4)$

8.  $\frac{2r(r+7)}{r^2+r-42} = \frac{2r}{r-6}$   
 $(r+7)(r-6)$

9.  $\frac{(x+3)(x-3)}{x^2-9} = \frac{x+3}{x+6}$   
 $x^2+3x-18$   
 $(x+6)(x-3)$

$\frac{4a(a+4)}{a^3-2a^2-24a} \neq 0$   
 $a(a-6)(a+4) \neq 0$   
 $a \neq 0 \quad a \neq 6 \quad a \neq -4$

$\frac{2r^2+14r}{r^2+r-42} \neq 0$   
 $(r+7)(r-6) \neq 0$   
 $r \neq -7 \quad r \neq 6$

$\frac{x^2-9}{x^2+3x-18} \neq 0$   
 $(x+6)(x-3) \neq 0$   
 $x \neq -6 \quad x \neq 3$

10.  $\frac{4x(2x+3)}{8x^2+12x} = \frac{2x+3}{(x+2)(x-3)}$

11.  $\frac{(p-6)(p+4)}{p^2-2p-24} = \frac{p-6}{p-4}$   
 $p^2-16$   
 $(p+4)(p-4)$

12.  $\frac{(2n-5)(2n-1)}{10n^3-5n^2-14n+7} = \frac{2n-5}{5n^2-7}$   
 $5n^2(2n-1) - 7(2n-1)$   
 $(5n^2-7)(2n-1)$

$\frac{8x^2+12x}{4x(x+2)(x-3)} \neq 0$   
 $x \neq 0 \quad x \neq -2 \quad x \neq 3$

$\frac{p^2-2p-24}{p^2-16} \neq 0$   
 $(p+4)(p-4) \neq 0$   
 $p \neq -4 \quad p \neq 4$

$\frac{(2n-5)(2n-1)}{10n^3-5n^2-14n+7} \neq 0$   
 $(5n^2-7)(2n-1) \neq 0$   
 $5n^2-7 \neq 0 \quad 2n-1 \neq 0$   
 $5n^2 \neq 7 \quad 2n \neq 1$   
 $n^2 \neq \frac{7}{5} \quad n \neq \frac{1}{2}$   
 $n \neq \pm\sqrt{\frac{7}{5}}$

Reduce the rational expression to lowest terms. State the excluded value for each rational expression.

$$13. \frac{\cancel{(w^2+4)}(w^2-4)}{\cancel{w^2+4}} = \boxed{w^2-4}$$

$$\frac{w^4-16}{w^2+4} \neq 0$$

$w^2 \neq -4$   
 $w \neq \pm 2i$   
 Non Real Solution  
 No excluded values!

$$14. \frac{3(2d-7)}{\cancel{3}d} = \boxed{\frac{2d-7}{d}}$$

$$\frac{6d-21}{3d \neq 0}$$

$d \neq 0$

$$15. \frac{\cancel{t}(\cancel{t+7})(t-5)}{\cancel{t}(\cancel{t^2+7t-35})} = \boxed{t(t-5)}$$

$$\frac{t^3+2t^2-35t}{t+7 \neq 0}$$

$t \neq -7$

$$16. \frac{\cancel{(h-2)}(3h+1)}{\cancel{2(h-2)}(2h-4)} = \boxed{\frac{3h+1}{2}}$$

$$\frac{3h^2-5h-2}{2h-4} \neq 0$$

$2(h-2) \neq 0$   
 $h \neq 2$

$$17. \frac{x+2y}{2x+4y} = \boxed{\frac{1}{2}}$$

$\frac{x+2y}{2x+4y} \neq 0$  - OR -  
 $2x+4y \neq 0$   
 $2x \neq -4y$   
 $x \neq -2y$  or  $y = -\frac{1}{2}x$

$$18. \frac{4a^2b}{312ab} = \frac{a}{3}$$

$$\frac{4a^2b}{12ab} \neq 0$$

$a \neq 0$   $b \neq 0$

### FREE RESPONSE

19. Determine whether or not the rational expressions  $\frac{x+4}{(x+2)(x-3)}$  and  $\frac{x^2+5x+4}{(x+1)(x+2)(x-3)}$  are equivalent for  $x \neq -1$ ,  $x \neq -2$ , and  $x \neq 3$ . Explain how you know.

$$\frac{\cancel{(x+4)}\cancel{(x+1)}}{\cancel{(x+1)}(x+2)(x-3)} = \frac{x+4}{(x+2)(x-3)}$$

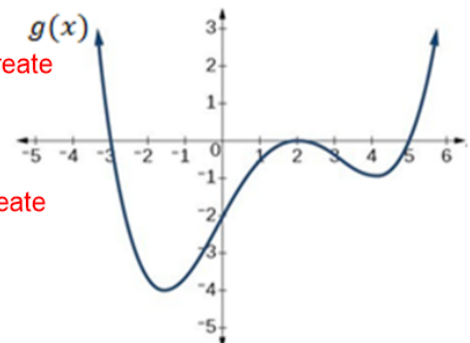
Yes, they are equivalent. Put in lowest terms and they are equivalent.

20. Given the graph of the polynomial  $g(x)$ .

- a. Write a possible equation of  $g(x)$ .

$$g(x) = (x+3)(x-2)^2(x-5)$$

Power must be even to create the "bounce"  
Other powers must be odd to create the "cross throughs"



- b. Describe the end behavior of  $g(x)$ .

$$x \rightarrow \infty \quad g(x) \rightarrow \infty$$

$$x \rightarrow -\infty \quad g(x) \rightarrow \infty$$