

Simplifying Rational Expressions Using Multiplication and Division

Simplify the rational expressions, if possible.

1. $\frac{x^2-8x-9}{x^2-1}$

Exc
 $x^2-1 \neq 0$
 $x^2 \neq 1$
 $x \neq \pm 1$

$$= \frac{(x-9)(x+1)}{(x+1)(x-1)}$$

$$= \frac{x-9}{x-1}$$

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

Exc
 $x^2+5x+6 \neq 0$
 $(x+3)(x+2) \neq 0$
 $x \neq -3, -2$

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

$$= \frac{1}{x+2}$$

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

Exc
 $x^2+4 \neq 0$
 $x^2 \neq -4$
 No excluded values

$$= \frac{x^2-4}{x^2+4}$$

Multiply or divide. Identify any x-values for which the expression is undefined.

4. $\frac{x^2-5x}{x^3} \cdot \frac{x-2}{x^2-3x-10}$

Exc
 $x^3 \neq 0$
 $x \neq 0$
 $x^2-3x-10 \neq 0$
 $(x-5)(x+2) \neq 0$
 $x \neq 5, -2$

$$= \frac{\cancel{x}(x-5)(x-2)}{x^2(x-5)(x+2)}$$

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

5. $\frac{x^2-49}{x^2-4} \div \frac{x^2-5x-14}{x^2-7x+10}$

Exc
 $x^2-4 \neq 0$
 $x^2 \neq 4$
 $x \neq \pm 2$
 $x^2-7x+10 \neq 0$
 $(x-5)(x-2) \neq 0$
 $x \neq 5, 2$

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

$$= \frac{(x+7)(x-5)}{(x+2)^2}$$

Exc
 $x^2-4 \neq 0$
 $x^2 \neq 4$
 $x \neq \pm 2$
 $x^2-7x+10 \neq 0$
 $(x-5)(x-2) \neq 0$
 $x \neq 5, 2$

$$6. \frac{w^2-6w+5}{w^2+3w+2} \div \frac{w^2-25}{w^2+6w+5}$$

$$= \frac{(w-5)(w-1)(w+5)(w+1)}{(w+2)(w+1)(w+5)(w-5)}$$

$$= \boxed{\frac{w-1}{w+2}}$$

Exc
 $w^2+3w+2 \neq 0$
 $(w+2)(w+1) \neq 0$
 $w \neq -2, -1$
 $w^2+6w+5 \neq 0$
 $(w+5)(w+1) \neq 0$
 $w \neq -5, -1$

$$7. \frac{x^2-x-12}{x^2+7x+12} \cdot \frac{x^2+6x+8}{x^2-5x+4}$$

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

$$= \boxed{\frac{x+2}{x-1}}$$

Exc
 $x^2+7x+12 \neq 0$
 $(x+4)(x+3) \neq 0$
 $x \neq -4, -3$
 $x^2-5x+4 \neq 0$
 $(x-4)(x-1) \neq 0$
 $x \neq 4, 1$

$$8. \frac{10x-40}{x^2-6x+8} \cdot \frac{x+3}{5x+15}$$

$$= \frac{10(x-4)(x+3)}{(x-2)(x-4) \cdot 5(x+3)}$$

$$= \boxed{\frac{2}{x-2}}$$

Exc
 $x^2-6x+8 \neq 0$
 $(x-4)(x-2) \neq 0$
 $x \neq 4, 2$
 $5x+15 \neq 0$
 $5x+15 \neq 0$
 $x \neq -3$

$$9. \frac{x}{15} \cdot \frac{x^7}{2x} \cdot \frac{20}{x^4}$$

$$= \frac{20x^8}{30x^5}$$

$$= \boxed{\frac{2x^3}{3}}$$

Exc
 $2x \neq 0$ or $x^4 \neq 0$
 $x \neq 0$