

Multiply and Simplify the following Rational Expressions (Hint: It helps to factor all of the numerators and denominators first.)

1.  $\frac{x+2}{x^2-4x-12} \cdot \frac{x^2-36}{x-2}$

$$\begin{array}{r} -12 \\ 1, -12 \\ -1, 12 \\ \hline 2, -6 \\ -2, 6 \\ \hline 3, -4 \\ -3, 4 \end{array}$$

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

$$\begin{array}{l} x+2 \neq 0 \\ -2 \quad -2 \\ \hline x \neq -2 \end{array} \quad \begin{array}{l} x-6 \neq 0 \\ +6 \quad +6 \\ \hline x \neq 6 \end{array}$$

1.  $\frac{x+6}{x-2}; x \neq -2, 6$

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

$$\begin{array}{r} -2 \\ 1, -2 \\ -1, 2 \\ \hline -1, 2 \end{array}$$

$$\frac{\cancel{(x-1)} \cancel{(x+2)} \cancel{(x+6)}}{\cancel{(x-1)} \cancel{(x+6)} (x+5)} = \frac{x+2}{x+5}$$

$$\begin{array}{l} x-1 \neq 0 \\ +1 \quad +1 \\ \hline x \neq 1 \end{array} \quad \begin{array}{l} x+6 \neq 0 \\ -6 \quad -6 \\ \hline x \neq -6 \end{array}$$

$$\begin{array}{r} -6 \\ 1, -6 \\ -1, 6 \\ \hline 2, -3 \\ -2, 3 \end{array}$$

2.  $\frac{x+2}{x+5}; x \neq -6, 1$

3.  $\frac{1}{3m+6} \cdot \frac{3}{m+3}$

$$\frac{\cancel{3}}{\cancel{3}(m+2)(m+3)} = \frac{3}{(m+2)(m+3)} \leftarrow \text{CORRECT ANSWER IN FACTORED FORM}$$

$$= \frac{3}{m^2+3m+2m+6}$$

CORRECT ANSWER IN EXPANDED FORM

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

4.  $\frac{2a+4}{8a^2} \cdot \frac{12a}{a+2}$

$$\frac{2(a+2) \cdot 12a}{8a^2 \cdot (a+2)} = \frac{\cancel{2} \cancel{4} a \cancel{(a+2)}}{\cancel{8} a \cdot a \cdot \cancel{(a+2)}} = \frac{3}{a}$$

$$\begin{array}{l} a+2 \neq 0 \\ -2 \quad -2 \\ \hline a \neq -2 \end{array}$$

$$a \neq 0$$

4.  $\frac{3}{a}; a \neq -2, 0$

5.  $\frac{y^2-2y-15}{y^2-3y-10} \cdot \frac{y^2-4y+3}{y^2-9}$

$$\begin{array}{r} -15 \\ 1, -15 \\ -1, 15 \\ \hline 3, -5 \\ -3, 5 \end{array} \quad \begin{array}{r} 3 \\ 1, 3 \\ -1, -3 \end{array} \quad \begin{array}{r} -10 \\ 1, -10 \\ -1, 10 \\ \hline 2, -5 \\ -2, 5 \end{array}$$

$$\frac{\cancel{(y+3)} \cancel{(y-5)} \cancel{(y-1)} \cancel{(y-3)}}{\cancel{(y+2)} \cancel{(y-5)} \cancel{(y+3)} \cancel{(y-3)}} = \frac{y-1}{y+2}$$

$$\begin{array}{l} y-5 \neq 0 \\ +5 \quad +5 \\ \hline y \neq 5 \end{array} \quad \begin{array}{l} y+3 \neq 0 \\ -3 \quad -3 \\ \hline y \neq -3 \end{array} \quad \begin{array}{l} y-3 \neq 0 \\ +3 \quad +3 \\ \hline y \neq 3 \end{array}$$

5.  $\frac{y-1}{y+2}; y \neq -3, 3, 5$

6.  $\frac{2x^2-3x-2}{3x-6} \cdot \frac{6x}{4x^2-1}$

$$\begin{array}{r} 2x^2-3x-2 \\ \hline 2x+1 \quad 2x-4 \\ \hline (2x+1)(x-2) \end{array} \quad \begin{array}{r} -4 \\ 1, -4 \\ -1, 4 \\ \hline -1, 4 \\ -1, 4 \\ \hline -1, 4 \\ -1, 4 \end{array}$$

$$\frac{\cancel{(2x+1)} \cancel{(x-2)} \cancel{6} x}{\cancel{3} \cancel{(x-2)} \cancel{(2x+1)} \cancel{(2x-1)}} = \frac{2x}{2x-1}$$

$$\begin{array}{l} x-2 \neq 0 \\ +2 \quad +2 \\ \hline x \neq 2 \end{array} \quad \begin{array}{l} 2x+1 \neq 0 \\ -1 \quad -1 \\ \hline \frac{2x}{2} \neq \frac{-1}{2} \\ x \neq -\frac{1}{2} \end{array}$$

6.  $\frac{2x}{2x-1}; x \neq -\frac{1}{2}, 2$

Divide and Simplify the following Rational Expressions (Hint: It helps to factor all of the numerators and denominators first.)

7.  $\frac{x^2+3x-10}{x^2-2x-15} \div \frac{x^2+x-6}{x^2+6x+9}$

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

$$\begin{array}{r} -10 \\ 1, -10 \\ -1, 10 \\ \hline 2, -5 \\ -2, 5 \end{array} \quad \begin{array}{r} -15 \\ 1, -15 \\ -1, 15 \\ \hline 3, -5 \\ -3, 5 \end{array}$$

$$\begin{array}{r} -6 \\ 1, -6 \\ -1, 6 \\ \hline 2, -3 \\ -2, 3 \end{array} \quad \begin{array}{r} 9 \\ 1, 9 \\ -1, -9 \\ \hline 3, 3 \\ -3, -3 \end{array}$$

$$\begin{array}{r} X+3 \neq 0 \\ -3 \quad -3 \\ \hline X \neq -3 \end{array} \quad \begin{array}{r} X-2 \neq 0 \\ +2 \quad +2 \\ \hline X \neq 2 \end{array}$$

7.  $\frac{x+5}{x-5}; x \neq -3, 2$

8.  $\frac{x+5}{2x} \div \frac{x+5}{8}$

$$\frac{(x+5) \cdot 8}{2x(x+5)} = \frac{4}{x}$$

$$\begin{array}{r} X+5 \neq 0 \\ -5 \quad -5 \\ \hline X \neq -5 \end{array}$$

8.  $\frac{4}{x}; x \neq -5$

9.  $\frac{m^2}{m+5} \div \frac{m^2+5m}{m^2+10m+25}$

$$\frac{M \cdot M (M+5)(M+5)}{(M+5) \cdot M (M+5)} = \frac{M}{1}$$

$$\begin{array}{r} 25 \\ 1, 25 \\ -1, -25 \\ \hline 5, 5 \\ -5, -5 \end{array}$$

$$\begin{array}{r} M+5 \neq 0 \\ -5 \quad -5 \\ \hline M \neq -5 \end{array}$$

9.  $M; M \neq -5, 0$

10.  $\frac{p^2+2p-3}{p^2+2p-8} \div \frac{p^2-1}{p-2}$

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

$$\begin{array}{r} P-2 \neq 0 \\ +2 \quad +2 \\ \hline P \neq 2 \end{array} \quad \begin{array}{r} P-1 \neq 0 \\ +1 \quad +1 \\ \hline P \neq 1 \end{array}$$

$$\begin{array}{r} -3 \\ 1, -3 \\ -1, 3 \\ \hline -2, 4 \\ 2, -4 \\ \hline -2, 4 \end{array} \quad \begin{array}{r} -8 \\ 1, -8 \\ -1, 8 \\ \hline 2, -4 \\ -2, 4 \end{array}$$

10.  $\frac{p+3}{p^2+5p+4}; p \neq 1, 2$

11.  $\frac{x^2-4x}{x^2-8x+16} \div \frac{12}{2x-8}$

$$\frac{x(x-4) \cdot 2 \cdot (x-4)}{(x-4)(x-4) \cdot 2 \cdot 6} = \frac{x}{6}$$

$$\begin{array}{r} 16 \\ 1, 16 \\ -1, -16 \\ \hline 2, 8 \\ -2, -8 \\ \hline 4, 4 \\ -4, -4 \end{array}$$

$$\begin{array}{r} X-4 \neq 0 \\ +4 \quad +4 \\ \hline X \neq 4 \end{array}$$

11.  $\frac{x}{6}; x \neq 4$

12.  $\frac{b+3}{b^2+6b+9} \div \frac{b+2}{b^2-9}$

$$\frac{(b+3)(b+3)(b-3)}{(b+3)(b+3)(b+2)} = \frac{b-3}{b+2}$$

$$\begin{array}{r} b+3 \neq 0 \\ -3 \quad -3 \\ \hline b \neq -3 \end{array} \quad \begin{array}{r} b^2-9 \neq 0 \\ (b+3)(b-3) \neq 0 \\ \downarrow \quad \downarrow \\ b+3 \neq 0 \quad b-3 \neq 0 \\ -3 \quad -3 \quad +3 \quad +3 \\ \hline b \neq -3 \quad b \neq 3 \end{array}$$

$$\begin{array}{r} 9 \\ 1, 9 \\ -1, -9 \\ \hline 3, 3 \\ -3, -3 \end{array}$$

12.  $\frac{b-3}{b+2}; b \neq -3, 3$