

Multiplying and Dividing Rational Expressions

Multiplying

- Step 1: Factor all numerators and denominators completely.
- Step 2: Cancel common factors vertically and diagonally.
- Step 3: Multiply across.

Dividing

- Step 1: Change the division symbol to multiplication and then flip the fraction that follows.
- Step 2: Factor all numerators and denominators completely.
- Step 3: Cancel common factors vertically and diagonally.
- Step 4: Multiply across.

Directions: Multiply or divide and express your answer in simplest form.

$$1. \frac{5x^2y^1 \cdot 6x^3y^2}{2xy^3 \cdot 10y^1} = \frac{\overset{3}{\cancel{30}} \overset{4}{x^5} y^3}{\underset{2}{\cancel{20}} x^1 y^4} = \boxed{\frac{3x^4}{2y}}$$

$$2. \frac{(2x)^2}{(3y)^3} \div \frac{2x^2}{3y^3} = \frac{(2x)^2}{(3y)^3} \cdot \frac{3y^3}{2x^2} = \frac{4x^2}{27y^3} \cdot \frac{3y^3}{2x^2} = \frac{\overset{2}{\cancel{12}} x^2 y^3}{9 \cdot \cancel{54} x^2 y^3} = \boxed{\frac{2}{9}}$$

$$3. \frac{xy+3y}{6x} \cdot \frac{2x^2-6x}{x^2-9} = \frac{\cancel{y}(x+3)}{6x} \cdot \frac{2x\cancel{(x-3)}}{\cancel{(x+3)}(x-3)} = \frac{\cancel{2xy}}{3 \cdot 6x} = \boxed{\frac{y}{3}}$$

$$\begin{array}{l} xy+3y \quad \text{GCF}=y \\ y(x+3) \end{array}$$

$$\begin{array}{l} 2x^2-6x \quad \text{GCF}=2x \\ 2x(x-3) \end{array}$$

$$\begin{array}{l} x^2-9 = (x+3)(x-3) \\ \underbrace{x^2}_{x \cdot x} \quad \underbrace{-9}_{3 \cdot 3} \end{array}$$

$$4. \frac{4x^2-4x}{2xy^3} \div \frac{6x^3y^2}{10y} = \frac{4x^2-4x}{2xy^3} \cdot \frac{10y}{6x^3y^2} = \frac{4x(x-1)}{2x^1y^3} \cdot \frac{10y}{6x^3y^2}$$

$$\begin{array}{l} 4x^2-4x \quad \text{GCF}=4x \\ 4x(x-1) \end{array} \quad = \frac{\overset{10}{\cancel{40x}}(x-1)}{\cancel{12x^4}y^5} = \boxed{\frac{10(x-1)}{3x^3y^4}}$$

$$5. \frac{(x+1)^2(x-1)^2}{x^3-x} = \frac{\cancel{(x+1)}(x+1)}{x\cancel{(x+1)}(x-1)} \cdot \frac{\cancel{(x-1)}(x-1)}{x^1} = \boxed{\frac{(x+1)(x-1)}{x^2}}$$

$$x^3 - x \quad \text{GCF} = x$$

$$x(x^2 - 1)$$

$$\begin{array}{cc} \wedge & \wedge \\ x & x & 1 & 1 \end{array}$$

$$x(x+1)(x-1)$$

$$6. \frac{x^2-6x+5}{1-x^2} \div \frac{x^2-25}{x^3+1} = \frac{x^2-6x+5}{1-x^2} \cdot \frac{x^3+1}{x^2-25} = \frac{\cancel{(x-5)}\cancel{(x-1)}}{\cancel{(1-x)}\cancel{(1-x)}} \cdot \frac{\cancel{(x+1)}(x^2-x+1)}{\cancel{(x+5)}\cancel{(x-5)}}$$

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

$$\boxed{\frac{-1(x^2-x+1)}{x+5}}$$

$$\begin{matrix} 1-x^2 \\ \wedge \quad \wedge \\ 1 \quad x \end{matrix} = (1+x)(1-x)$$

$$\begin{matrix} x^3+1 \\ \wedge \quad \wedge \\ x \quad x \end{matrix} = (x+1)(x^2-x+1)$$

$$\begin{matrix} x^2-25 \\ \wedge \quad \wedge \\ x \quad 5 \end{matrix} = (x+5)(x-5)$$

$$7. (2x+3) \div \frac{x^3+10x^2}{6x^3-9x^2} \cdot \frac{x^2+12x+20}{4x^2-9} = \frac{2x+3}{1} \cdot \frac{6x^3-9x^2}{x^3+10x^2} \cdot \frac{x^2+12x+20}{4x^2-9}$$

$$= \frac{\cancel{2x+3}}{1} \cdot \frac{3x^2\cancel{2x-3}}{x^2\cancel{(x+10)}} \cdot \frac{\cancel{(x+10)}(x+2)}{\cancel{(2x+3)}\cancel{(2x-3)}}$$

$$\frac{6x^3-9x^2}{3x^2(2x-3)} \quad \text{GCF} = 3x^2$$

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

$$\frac{x^3+10x^2}{x^2(x+10)} \quad \text{GCF} = x^2$$

$$\frac{x^2+12x+20}{(x+10)(x+2)}$$

$$\frac{4x^2-9}{\begin{matrix} \wedge \quad \wedge \\ 2x \quad 3 \end{matrix}} = (2x+3)(2x-3)$$