

Multiplying and Dividing Rational Expressions

Multiplying

$$\frac{2}{3} \cdot \frac{6}{5} = \frac{12}{15}$$

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

1. Multiply.

$$\text{a) } \frac{x+2}{x^2+x} \cdot \frac{x^2}{x^2+5x+6} = \frac{\cancel{x+2}}{x(x+1)} \cdot \frac{x^{\cancel{2}1}}{(\cancel{x+2})(x+3)} = \boxed{\frac{x}{(x+1)(x+3)}}$$

$GCF=x$
 $x(x+1)$

$1-6$
 $\boxed{2 \cdot 3}$

$$\text{b) } \frac{5x^4}{3y^2} \cdot \frac{6}{5x^2} = \frac{x^{4-2}}{y^2} \cdot \frac{2}{3x^2} = \boxed{\frac{2x^2}{3y^2}}$$

$$c) \frac{x^2-144}{x^2} \cdot \frac{x}{2x-24} = \frac{(x+12)\cancel{(x-12)}}{x^2} \cdot \frac{\cancel{x}}{2\cancel{(x-12)}}$$

$$= \boxed{\frac{x+12}{2x}}$$

$$d) \frac{x^2-2x-15}{x^2+7x+12} \cdot \frac{x^2+11x+28}{x^2+2x-35} = \frac{(\cancel{x-5})(\cancel{x+3})}{(\cancel{x+3})(\cancel{x+4})} \cdot \frac{(\cancel{x+7})(\cancel{x+4})}{(\cancel{x+7})(\cancel{x-5})}$$

$$= \boxed{1}$$

Dividing

$$\frac{7}{4} \div \frac{21}{10} = \frac{\overset{1}{\cancel{7}}}{\underset{2}{\cancel{4}}} \cdot \frac{\overset{5}{\cancel{10}}}{\cancel{21} 3} = \boxed{\frac{5}{6}}$$

Step 1: Change from division to multiplication and flip the second fraction.

Step 2: Factor numerators and denominators completely.

Step 3: Cancel common factors vertically and diagonally.

2. Divide.

$$\text{a) } \frac{3}{x^2} \div \frac{18}{x^5} = \frac{\overset{1}{\cancel{3}}}{\cancel{x^2}} \cdot \frac{x^{\overset{5}{3}}}{\cancel{18} 6} = \boxed{\frac{x^3}{6}}$$

$$\text{b) } \frac{3x-21}{1-x^2} \div \frac{x^2-49}{x^2-2x+1} = \frac{3x-21}{1-x^2} \cdot \frac{x^2-2x+1}{x^2-49}$$

$$\frac{3(\cancel{x-7})}{(1+x)(\cancel{1-x})} \cdot \frac{\overset{-1}{(\cancel{x-7})(x-1)}}{(x+7)(\cancel{x-7})} = \boxed{\frac{-3(x-1)}{(1+x)(x+7)}}$$

$$c) \frac{2x+1}{2x+12} \div \frac{x^2+3x-4}{3x+18} = \frac{2x+1}{2x+12} \cdot \frac{3x+18}{x^2+3x-4} = \frac{2x+1}{2(x+6)} \cdot \frac{3(x+6)}{(x+4)(x-1)}$$

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