

Rational Expressions

Fractions of Algebraic Expressions.

ex) $\frac{8x^2y^2}{20x^2y}$; $\frac{x+4}{x^2-16}$; $\frac{x-6}{x^2-7x+6}$

Simplify Rational Expressions: $\frac{8 \div 8}{16 \div 8} = \frac{1}{2}$
GCF

1) $\frac{\cancel{8}x^{\cancel{2}}y^{\cancel{2}^{-1}}}{\cancel{20}x^{\cancel{2}}y^{\cancel{1}}}$ = $\frac{2y}{5}$

2) $\frac{\cancel{36}x^{\cancel{3}}y^{\cancel{4}}}{\cancel{12}x^{\cancel{1}}y^{\cancel{5}^{-4}}}$ = $\frac{3x^2}{y}$
difference of 2 squares

3) $\frac{x+4}{x^2-16} = \frac{\cancel{x+4}}{(\cancel{x+4})(x-4)}$
 = $\frac{1}{x-4}$

When there's "+" or "-" between each term, can't reduce directly!!

- 1) Factor both Top and Bottom
- 2) Cancel out any common terms on the top & bottom (one at a time)

$$4) \frac{x-6}{x^2-7x+6} = \frac{\cancel{x-6}}{(\cancel{x-6})(x-1)}$$

$\begin{matrix} \uparrow & \uparrow \\ x & = 6 \\ + & = -7 \end{matrix}$

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

- 1) Factor both top & Bottom.
- 2) Cancel any common terms on the top & bottom.

$$5) \frac{x^2+9x}{x^2-4x} = \frac{\cancel{x}(x+9)}{\cancel{x}(x-4)} = \boxed{\frac{x+9}{x-4}}$$

$$6) \frac{x^2+5x+6}{x^2+6x+8} = \frac{(x+3)\cancel{(x+2)}}{(x+4)\cancel{(x+2)}}$$

$x \Rightarrow 6 ; + \Rightarrow 5$
 $x \Rightarrow 8$
 $+ \Rightarrow 6$

$$= \boxed{\frac{x+3}{x+4}}$$

$$\text{Try 1)} \frac{\cancel{4}x^2 y^1 z^{\cancel{5}^{-2}}}{\cancel{6}x^2 y^{\cancel{3}^1} z^{\cancel{2}^0}} = \frac{2z^3}{3y^2}$$

$$\text{Try 2)} \frac{x^2 + 2x + 1}{x^2 - 1} = \frac{\cancel{(x+1)}(x+1)}{\cancel{(x+1)}(x-1)} = \frac{x+1}{x-1}$$

Multiply Rational Expressions:

$$7) \frac{\cancel{8}x^3 y}{\cancel{3}x^2} \cdot \frac{\cancel{9}y^3}{\cancel{4}x^2}$$

$$= \frac{6\cancel{x}^3 y^2}{\cancel{x}^4 \cancel{3}}$$

$$= \frac{6y^2}{x}$$

1) Reduce as much as you can.

2) Multiply & Reduce again w/ the variables.

$$8) \frac{x^2 - 16}{2x + 8} \cdot \frac{x + 4}{x^2 + 8x + 16}$$

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

$$\begin{aligned} x &\Rightarrow 16 \\ + &\Rightarrow 8 \end{aligned}$$

$$= \frac{x-4}{2(x+4)} = \boxed{\frac{x-4}{2x+8}}$$

Can't reduce directly !!

1) Factor All Parts.

2) Cancel any common terms.

3) Multiply the top and bottom

$$9) \frac{3x - 3y}{10xy} \cdot \frac{20x^2y^2}{x^2 - y^2}$$

$$= \frac{3(\cancel{x-y})}{\cancel{10}xy} \cdot \frac{\cancel{20}x^2y^{\cancel{2}-1}}{(x+y)(\cancel{x-y})}$$

$$= \boxed{\frac{6xy}{x+y}}$$

Divide Rational Expressions :

$$10) \frac{x^2 - 5x + 6}{x^2 + 3x} \div \frac{x - 3}{4x + 12}$$

(Keep)
or
stay

Change (Flip)

$$= \frac{x^2 - 5x + 6}{x^2 + 3x} \cdot \frac{4x + 12}{x - 3}$$

$x \Rightarrow 6; + \Rightarrow -5$

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

$$= \frac{4(x-2)}{x} = \boxed{\frac{4x+8}{x}}$$

$$\text{Try 1)} \quad \frac{2x+10}{8x+32} \cdot \frac{x^2-10x+24}{x^2-x-30}$$

$$= \frac{\cancel{2}(x+5)}{\cancel{8}(x+4)} \cdot \frac{\cancel{(x-6)}(x-4)}{\cancel{(x+5)}\cancel{(x-6)}} = \frac{x-4}{4(x+4)}$$

$$= \boxed{\frac{x-4}{4x+16}}$$

$$\text{Try 2)} \quad \frac{x^2-49}{x} \div \frac{x^2-13x+42}{3x^2}$$

$$= \frac{x^2-49}{x} \cdot \frac{3x^2}{x^2-13x+42}$$

$$= \frac{(x+7)\cancel{(x-7)}}{\cancel{x}} \cdot \frac{\cancel{3x^2}}{\cancel{(x-7)}(x-6)}$$

$$= \frac{3x(x+7)}{x-6}$$

$$= \boxed{\frac{3x^2+21x}{x-6}}$$