Station 1: Rational Expressions — Combine & Reduce

Goal: Practice rational simplification by factoring and reducing

Simplify each of the following rational expressions

1. $\dfrac{x^2-9}{x^2-x-6} = \dfrac{(x+3)\cancel{(x-3)}}{\cancel{(x-3)}(x+2)} = \dfrac{x+3}{x+2}$

2. $\dfrac{x^2-4x}{x^2+5x} = \dfrac{\cancel{x}(x-4)}{\cancel{x}(x+5)} = \dfrac{x-4}{x+5}$

3. $\dfrac{x^4-16}{x+2} = \dfrac{(x^2-4)(x^2+4)}{x+2}$

$= \dfrac{\cancel{(x+2)}(x-2)(x^2+4)}{\cancel{x+2}}$

$= (x-2)(x^2+4)$

Station 2: Factor Then Simplify

Goal: Recognize factoring opportunities inside larger expressions

Simplify each of the following expressions

1. $\frac{x^2-9x}{x}+9 = \frac{\cancel{x}(x-9)}{\cancel{x}}+9 = x-9+9$
$= x$

2. $\frac{x^2+5x+6}{x^2-x-6} \cdot \frac{x^2-4x-12}{x^2+7x+12}$
$= \frac{(x+2)\cancel{(x+3)}}{(x-3)\cancel{(x+2)}} \cdot \frac{(x-6)\cancel{(x+2)}}{\cancel{(x+3)}(x+4)} = \frac{(x+2)(x-6)}{(x-3)(x+4)}$

3. $\frac{4x^2-9}{2x+3} = \frac{(2x-3)\cancel{(2x+3)}}{\cancel{2x+3}} = 2x-3$

Station 3: Basic Exponent Rules — Multiply, Divide, Power of a Power

Goal: Reinforce foundational exponent rules.

Simplify each of the following using exponent properties

1. $\dfrac{x^2y^4}{(2xy)^3}$ $= \dfrac{x^2y^4}{8x^3y^3} = \dfrac{y}{8x}$

2. $\left(\dfrac{x^{-3}}{3}\right)^{-2}$ $= \left(\dfrac{1}{3x^3}\right)^{-2} = \left(\dfrac{3x^3}{1}\right)^2 = 3^2(x^3)^2$
$= 9x^6$

3. $\sqrt{x^3} \cdot \sqrt[3]{x^2}$ $= x^{3/2} \cdot x^{2/3} = x^{3/2 + 2/3}$
$= x^{13/6}$

4. $\left(\dfrac{\sqrt{x}}{x^{1/4}}\right)^3$ $= \left(\dfrac{x^{1/2}}{x^{1/4}}\right)^3 = \left(x^{\frac{1}{2}-\frac{1}{4}}\right)^3$
$= \left(x^{1/4}\right)^3$
$= x^{3/4}$

Station 4: Complex Fractions — Clean It Up

Goal: Simplify complex (fractions within fractions) expressions by identifying least common denominators and multiplying strategically.

Simplify each of the complex fractions

1. $$\frac{\left(3+\frac{2}{x}\right)}{\left(1-\frac{1}{x}\right)}\left(\frac{x}{x}\right) = \frac{3x+2}{x-1}$$

LCD = x

2. $$\frac{\frac{6}{x+5}-\frac{1}{x}}{\frac{-2}{x}}\left(\frac{x(x+5)}{x(x+5)}\right) = \frac{6x-(x+5)}{-2(x+5)}$$

LCD = $x(x+5)$

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

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

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

Station 5: Expressions You'll Likely See in Calculus

Goal: Work with expressions resembling those in Calculus

Simplify each of the following expressions

1. $$\frac{(x+h)^2 - x^2}{h} = \frac{\cancel{x^2} + 2xh + h^2 - \cancel{x^2}}{h}$$

$$= \frac{2xh + h^2}{h}$$

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

$$= 2x + h$$

2. $$\frac{\frac{1}{x+h} - \frac{1}{x}}{h} \left(\frac{x(x+h)}{x(x+h)} \right) = \frac{x - (x+h)}{hx(x+h)}$$

$LCD = x(x+h)$

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

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