Complex Fractions
And
Evaluating Rational Expressions

A rational expression with fractions in the numerator, denominator or both is called a complex fraction. Simplify by clearing fractions using the LCD of all the fractions within the expression.

- $$\dfrac{\dfrac{1}{w}+\dfrac{2}{w-1}}{\dfrac{5}{w-1}}$$ ⇐ find the LCD of the three inner fractions. LCD is $w(w-1)$

- $$\dfrac{\dfrac{1w(w-1)}{w}+\dfrac{2w(w-1)}{w-1}}{\dfrac{5w(w-1)}{w-1}}$$ ⇐ clear fractions by distributing the LCD to all the numerators

- $$\dfrac{\dfrac{1w(w-1)}{w}+\dfrac{2w(w-1)}{(w-1)}}{\dfrac{5w(w-1)}{(w-1)}}$$ ⇐ reduce all three fractions within the complex fraction

- $$\dfrac{w-1+2w}{5w} \Rightarrow \dfrac{3w-1}{5w}$$ ⇐ combine like terms and reduce if possible.

➢ Evaluate the rational expression given a numerical value for each variable.

Example: Given $x=3$ $y=-2$

- $$\dfrac{(x-5)^4}{y^2-14x^3}$$ ⇐ change all variables to empty parentheses then substitute the number

- $$\dfrac{((\ )-5)^4}{(\ )^2-14(\ )^3}$$ ⇐ use the parentheses to avoid errors when substituting

- $$\dfrac{((3)-5)^4}{(-2)^2-14(3)^3}$$ ⇐ use order of operations to evaluate to a single number

- $$\dfrac{16}{-374} \Rightarrow -\dfrac{8}{187}$$ ⇐ reduce if possible

Practice Problems

Evaluate each rational expression when $x = -3$ $y = 4$ $z = -1$

1) $\dfrac{(x-z)\sqrt{36}}{y^2}$

2) $\dfrac{-x+\sqrt{x^2-4yz}}{2y}$

3) $\dfrac{2y^3-6x^2-8z}{8x+6}$

4) $\dfrac{(-4z+y)^3}{5x^2}$

Simplify each complex fraction

5) $\dfrac{\dfrac{1}{a}+\dfrac{2}{b}}{\dfrac{a+1}{ab}}$

6) $\dfrac{\dfrac{4}{x^2y}-\dfrac{3}{xy^2}}{\dfrac{1}{xy}+3}$

7) $\dfrac{\dfrac{1}{m+1}-\dfrac{2}{m-1}}{\dfrac{2}{m-1}+\dfrac{1}{m+1}}$

8) $\dfrac{\dfrac{3}{x^2-16}}{\dfrac{1}{x+4}}$

Answer Key

1) $-\dfrac{3}{4}$

2) 1

3) $-\dfrac{41}{9}$

4) $\dfrac{512}{45}$

5) $\dfrac{2a+b}{a+1}$

6) $\dfrac{4y-3x}{xy+3x^2y^2}$

7) $-\dfrac{m+3}{3m+1}$

8) $\dfrac{3}{x-4}$