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## P.6 Rational Expressions

ex's  $\frac{x-2}{4}$  or  $\frac{x^2+1}{x^2+2x-3}$

$$\frac{4}{x-2}$$

exclude 2 from domain

$$x-2=0$$

$$x=2$$

$$\frac{4}{2x+1}$$

$$2x+1=0$$

$$\frac{2x}{2} = -\frac{1}{2}$$

$$x = -\frac{1}{2}$$

$$x^2 - 1 = 0$$

$$\sqrt{x^2 - 1} = \sqrt{x} = \pm 1$$

$$\frac{x}{x^2-1}$$

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

exclude  $x = \pm 1$

$$\frac{9x}{x^2+3x-18}$$

$$(x-3)(x+6)$$

exclude  $x = 3, -6$

a)  $\frac{x^3+x^2}{x+1} = \frac{x^2(x+1)}{x+1} = x^2 \quad x \neq -1$

b)  $\frac{x^2+6x+5}{x^2-25} = \frac{(x+5)(x+1)}{(x+5)(x-5)}$

$$\frac{x+1}{x-5}$$

exclude  $x=5$  from domain

$$\frac{x+1}{x-5} \quad x \neq 5, -5$$

Multiply

$$\frac{x-7}{x-1} \cdot \frac{\frac{(x-1)(x+1)}{x^2-1}}{\frac{3x-21}{3(x-7)}} = \frac{\cancel{(x-1)}(x+1)\cancel{(x-1)}}{3\cancel{(x-1)}\cancel{(x-7)}}$$

$$\boxed{\frac{x+1}{3} \quad x \neq 1, 7}$$

$$\frac{x+3}{x^2-4} \cdot \frac{\frac{(x-3)(x+2)}{x^2-x-6}}{\frac{x^2+6x+9}{(x+3)(x+3)}} = \frac{\cancel{(x+3)}(x-3)\cancel{(x+2)}}{\cancel{(x+2)}(x-2)\cancel{(x+3)}(x+3)}$$

$$\boxed{\frac{x-3}{(x-2)(x+3)} \quad x \neq \pm 2, -3}$$

Dividing : flip it & Multiply  
<sub>2<sup>nd</sup> one</sub>

$$\frac{x^2-2x-8}{x^2-9} \div \frac{x-4}{x+3} = \frac{x^2-2x-8}{x^2-9} \cdot \frac{x+3}{x-4} = \frac{\cancel{(x-4)}(x+2)\cancel{(x+3)}}{(x-3)\cancel{(x+3)}\cancel{(x-4)}}$$

$$\boxed{\frac{x+2}{x-3} \quad x \neq \pm 3, 4}$$

$$\frac{5x+1}{x^2-9} \overset{\text{Add/Subt}}{-} \frac{(4x-2)}{x^2-9} = \frac{5x+1-4x+2}{x^2-9}$$

$$= \frac{x+3}{x^2-9} = \frac{x+3}{(x+3)(x-3)} = \boxed{\frac{1}{x-3} \quad x \neq \pm 3}$$

$$\frac{x+2(x+3)}{2x-3(x+3)} - \frac{4(2x-3)}{x+3} = \frac{x^2+2x+3x+6 - 8x+12}{(2x-3)(x+3)}$$

$$= \boxed{\frac{x^2-3x+18}{(2x-3)(x+3)} \quad x \neq -3, \frac{3}{2}}$$

$$2x-3=0$$

$$\frac{2x}{2} = \frac{3}{2}$$

Find LCD

$$\frac{7}{5x^2+15x} \quad + \quad \frac{9}{x^2+6x+9}$$

$$5x(x+3) \quad (x+3)(x+3)$$

$$\text{LCD: } 5x(x+3)^2$$

$$\frac{x+3}{x^2+x-2} + \frac{2}{x^2-1}$$

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

$$\frac{x^2+3x+x+3 + 2x+4}{(x+2)(x-1)(x+1)} = \frac{x^2+6x+7}{(x+2)(x-1)(x+1)}$$

$$\boxed{\frac{x^2+6x+7}{(x+2)(x-1)(x+1)} \quad x \neq -2, \pm 1}$$

√ p+ 8

$$\frac{x^2}{x^2-10x+25} - \frac{x-4}{2x-10}$$

$$\frac{2x}{2(x-5)^2} - \frac{x^2-4x-5x+20}{2(x-5)^2}$$

$$\frac{-x^2+11x-20}{2(x-5)^2} = \frac{-1(x^2-11x+20)}{2(x-5)^2}$$

$$x \neq 5$$

# Complex Fractions

$$1 + \frac{1}{x} = \frac{1 \cdot x}{1 \cdot x} + \frac{1}{x} = \frac{x}{x} + \frac{1}{x} = \frac{x+1}{x}$$

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

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

$x=0$      $x-1=0$      $x=1$      $x \neq 0, 1$

√ P+ 9

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

$$\frac{2-3x}{2x} \cdot \frac{4x}{4+3x} = \frac{\cancel{4x}(2-3x)}{\cancel{2x}(4+3x)} = \frac{4-6x}{2(2-3x)} \cdot \frac{2(2-3x)}{4+3x} = \frac{4-6x}{4+3x}$$

$x \neq 0, -\frac{4}{3}$

$$\begin{array}{l} 2x=0 \\ x=0 \end{array} \quad \begin{array}{l} 4+3x=0 \\ x=-\frac{4}{3} \end{array} \quad \begin{array}{l} 3x=-4 \\ \frac{3x}{3} = -\frac{4}{3} \end{array}$$

$$\frac{\frac{1}{x+h} - \frac{1}{x}}{h}$$

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

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

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

$$\frac{-1}{x(x+h)} \quad \begin{matrix} x \neq 0, -h \\ h \neq 0 \end{matrix}$$

$$x=0 \quad h=0 \quad \begin{matrix} x+h=0 \\ -h=-h \\ x=-h \end{matrix}$$

# Homework

Not for my Pre-Calc Kids

pg 83; 8-28e, 34-44e, 60-66e

ec: 90,94

## Fractional Expressions in Calculus

$$\frac{\frac{\sqrt{9-x^2}}{1} + \frac{x^2}{\sqrt{9-x^2}}}{9-x^2} \quad \frac{\frac{(\sqrt{9-x^2})^2}{\sqrt{9-x^2}} + \frac{x^2}{\sqrt{9-x^2}}}{9-x^2} = \frac{9-x^2 + x^2}{9-x^2}$$

$$\frac{9}{\sqrt{9-x^2}} \cdot \frac{1}{9-x^2} = \frac{9}{(9-x^2)^1 \sqrt{9-x^2}} = \frac{9}{(9-x^2)^1 (9-x^2)^{\frac{1}{2}}}$$

↑  
rewrite with rational exponents
↑  
add exponents

$$= \frac{9}{(9-x^2)^{3/2}} \quad \text{then rewrite as a radical} \quad = \boxed{\frac{9}{\sqrt{(9-x^2)^3}}}$$

√pt II  $\frac{\sqrt{x} + \frac{1}{\sqrt{x}}}{x}$

$$\frac{\frac{\sqrt{x}}{1} + \frac{1}{\sqrt{x}}}{x} = \frac{\frac{(\sqrt{x})^2}{\sqrt{x}} + \frac{1}{\sqrt{x}}}{x}$$

$$= \frac{\frac{x+1}{\sqrt{x}}}{x} = \frac{x+1}{\sqrt{x}} \cdot \frac{1}{x} = \frac{x+1}{x\sqrt{x}} = \frac{x+1}{x^1 \cdot x^{\frac{1}{2}}}$$

$$= \frac{x+1}{x^{3/2}} = \boxed{\frac{x+1}{\sqrt{x^3}}}$$

# Homework

Extra problems for my Pre-Calc Kids

pg 83; 8-28e, 34-44e, 60-66e, 74-78e

ec: 90,94