Name_____

Get your Rational off of my Rational!

Date_____

Simplify the following compound rational expressions by multiplying by a common denominator for ALL of the fractions.

1)

$$\frac{\left(1 + \dfrac{1}{x}\right)}{\left(1 - \dfrac{1}{x}\right)} \cdot \frac{x}{x} = \frac{x+1}{x-1}$$

2)

$$\frac{\left(\dfrac{1}{2} + \dfrac{3}{x}\right)}{\left(\dfrac{x+3}{2}\right)} \cdot \frac{2x}{2x} = \boxed{\frac{x+6}{x(x+3)}}$$

Chose a factor(s) that will divide out all the denominators!

Simplify the numerator and the denominator, then simplify the expression completely.

3)

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

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

or

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

4)

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

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

or

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

Get common denominators between the 2 fractions, then flip'n Multiply!

Use any method that you prefer to simplify the following compound rational expressions.

5)

$$\left(\frac{4}{1}+\frac{1}{x^2}\right) \cdot \frac{x^2}{x^2} = \boxed{\frac{4x^2+1}{3x^2-1}}$$
$$\left(\frac{3}{1}-\frac{1}{x^2}\right)$$

6)

$$\frac{\left(\frac{1}{x^2\cdot y}+\frac{1}{y^2}\right)}{\left(\frac{1}{x^2}+\frac{1}{xy^2}\right)} \cdot \frac{x^2y^2}{x^2y^2}$$

I'll show more steps here...

$$= \frac{\frac{x^2 y^2}{x^2 y} + \frac{x^2 y^2}{y^2}}{\frac{x^2 y^2}{x^2} + \frac{x^2 y^2}{xy^2}} = \boxed{\frac{y+x^2}{y^2+x}}$$

7)

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

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

8)

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

Be careful subtracting a negative

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

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

Simplify each expression.

$$\left(\frac{6}{a^2} + \frac{4}{a^2}\right) \cdot \frac{a^2}{2} = \frac{6+4}{2a^2}$$

$$= \frac{10}{2a^2} = \boxed{\frac{5}{a^2}}$$

10) $\dfrac{\dfrac{3}{(a+1)}}{\dfrac{1}{36} - \dfrac{1}{12}} \cdot \dfrac{36}{36} = \dfrac{108}{a+1-3}$

$$= \boxed{\frac{108}{a-2}}$$

11) $\dfrac{\dfrac{16}{6(m-3)} - \dfrac{1}{6} \cdot \dfrac{(m-3)}{(m-3)}}{\dfrac{m-3}{36}} \quad \dfrac{\dfrac{96-m+3}{6(m-3)}}{\dfrac{m-3}{36}}$

$$= \frac{99-m}{6(m-3)} \cdot \frac{36}{(m-3)}$$

$$\sqrt{} \quad \frac{6(99-m)}{(m-3)^2} \quad \text{or} \quad \frac{594-6m}{(m-3)^2}$$

12) $\dfrac{\dfrac{x}{x}\dfrac{(x+2)}{6} + \dfrac{(x+2)}{x} \cdot \dfrac{6}{6}}{\dfrac{(x+2)}{(x+2)}\dfrac{x+2}{x^2} + \dfrac{6}{(x+2)} \cdot \dfrac{x^2}{x^2}} = \dfrac{\dfrac{x^2+2x+6x+12}{6x}}{\dfrac{x^2+4x+4+6x^2}{x^2(x+2)}}$

$$= \frac{x^2+8x+12}{6x} \cdot \frac{x^2(x+2)}{7x^2+4x+4}$$

$$= \frac{x(x+2)(x+2)(x+6)}{6(7x^2+4x+4)} \sqrt{}$$

$$\text{or}$$

$$\frac{x^4+10x^3+28x^2+24x}{6(7x^2+4x+4)}$$

13) $\dfrac{\dfrac{u+1}{u-3}+\dfrac{2}{u-3}}{\dfrac{u-3}{u+1}-\dfrac{16}{u-3}}\cdot\dfrac{(u-3)(u+1)}{(u-3)(u+1)}=$

14) $\dfrac{\dfrac{1}{3}-\dfrac{x^2-2x}{9}}{\dfrac{x^2}{36}-\dfrac{2}{x-2}}\cdot\dfrac{36(x-2)}{36(x-2)}=$

Try to factor when done!

$$\frac{(u+1)(u+1)+2(u+1)}{(u-3)(u-3)-16(u+1)}$$

$$\frac{36(x-2)}{3}-\frac{36(x-2)(x^2-2x)}{9}$$

$$\frac{36x^2(x-2)}{36}-\frac{72(x-2)}{(x-2)}$$

$$\frac{u^2+2u+1+2u+2}{u^2-6u+9-16u-16}=\boxed{\dfrac{u^2+4u+3}{u^2-22u-7}}$$

$$\frac{12x-24-4(x-2)(x^2-2x)}{x^2(x-2)-72}=\boxed{\dfrac{-4x^3+16x^2-4x-24}{x^3-2x^2-72}}$$

$x^3-2x^2-2x^2+4x$

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15) $\dfrac{u+2}{u+2}\dfrac{\dfrac{1}{6}-\dfrac{u}{u+2}\cdot\dfrac{6}{6}}{\dfrac{1}{9}+\dfrac{u^2}{u+2}\cdot\dfrac{9}{9}}=\dfrac{\dfrac{u+2-6u}{6(u+2)}}{\dfrac{u+2+9u^2}{9(u+2)}}$

16) $\dfrac{(x+3)}{(x+3)}\dfrac{\dfrac{8}{3x+2}-\dfrac{4}{x+3}\cdot\dfrac{(3x+2)}{(3x+2)}}{\dfrac{3x+2}{2}+\dfrac{(x+3)}{(3x+2)}\cdot\dfrac{2}{2}}=\dfrac{\dfrac{8x+24-12x-8}{(x+3)(3x+2)}}{\dfrac{9x^2+12x+4+2x+6}{2(3x+2)}}$

$$=\frac{2-5u}{6(u+1)}\cdot\frac{9(u+2)}{9u^2+u+2}$$

$$=\frac{\dfrac{-4x+16}{(x+3)(3x+2)}}{\dfrac{9x^2+14x+10}{2(3x+2)}}=$$

$$=\boxed{\dfrac{3(2-5u)}{2(9u^2+u+2)}}$$

$$\frac{-4x+16}{(x+3)(3x+2)}\cdot\frac{2(3x+2)}{9x^2+14x+10}$$

$-4(x-4)$

$$\boxed{\dfrac{-8(x-4)}{(x+3)(9x^2+14x+10)}}$$

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