

Simplify (try to get no parenthesis).

$$\frac{x^2 + 3x - 4}{1 - x^2} = \frac{(x+4)(x-1)}{(1-x)(1+x)} \text{ the first step is to factor}$$

Example:  $= \frac{(-1)(x+4)}{1+x}$  then reduce:  $(x-1)$  and  $(1-x)$  reduce to  $(-1)$

$$= -\frac{x+4}{x+1}$$

$$1. \frac{8x+16}{8x-16} = \frac{\cancel{8}(x+2)}{\cancel{8}(x-2)}$$

$$= \boxed{\frac{x+2}{x-2}}$$

$$2. \frac{y^2+4y-12}{3y^2-12y+12} = \frac{(y+6)\cancel{(y-2)}}{3(y^2-4y+4)} = \frac{(y+6)\cancel{(y-2)}}{3(y-2)\cancel{(y-2)}}$$

$$= \boxed{\frac{y+6}{3(y-2)}}$$

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

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

$$4. \frac{x^2+2x-8}{(2x^3+6x^2)-(8x-24)} = \frac{(x+4)(x-2)}{(2x^2-8)(x+3)}$$

$$2x^2(x+3)-8(x+3)$$

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

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

$$= \boxed{\frac{x+4}{2(x+2)(x+3)}}$$

Multiply and simplify.

$$\frac{x-2}{x+1} \cdot \frac{x^2-1}{2x-4} = \frac{x-2}{x+1} \cdot \frac{(x-1)(x+1)}{2(x-2)}$$
 *the first step is still to factor if possible*

Example:  $= \frac{(x-2)(x-1)(x+1)}{2(x-2)(x+1)}$  *the next step is to multiply across the top and across the bottom*

$$= \frac{x-1}{2}$$
 *finally, reduce*

5.  $\frac{x^2-16}{x^2} \cdot \frac{x^2-4x}{x^2-x-12}$

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

$$= \boxed{\frac{(x-4)(x+4)}{x(x+3)}}$$

6.  $\frac{y^2-16}{2y+6} \cdot \frac{y+3}{y-4} = \frac{(y-4)(y+4)}{2(y+3)} \cdot \frac{(y+3)}{(y-4)}$

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

$$= \boxed{\frac{y+4}{2}}$$

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

$$= \boxed{\frac{1}{x+y}}$$

Add or subtract. Answers should be simplified when possible.

Example:

$$\frac{2}{x-1} - \frac{x+1}{x^2+4x-5} = \frac{2}{x-1} - \frac{x+1}{(x-1)(x+5)}$$

the first step is to factor denominators

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

now find a common denominator

$$= \frac{2x+10-(x+1)}{(x-1)(x+5)}$$

$$= \frac{x+9}{x^2+4x-5}$$

$$8. \frac{x \cdot 3}{x \cdot x} - \frac{8}{x^2} = \frac{3x-8}{x^2}$$

$$9. \frac{r^2}{r-s} + \frac{s^2}{s-r} \cdot \frac{(-1)}{(-1)} = \frac{r^2-s^2}{r-s}$$

$$= \frac{\cancel{(r-s)}(r+s)}{\cancel{r-s}}$$

$$= \boxed{r+s}$$

$$9. \frac{4xy}{x^2-y^2} + \frac{(x-y)(x-y)}{x+y(x-y)}$$

$$= \frac{4xy + x^2 - 2xy + y^2}{(x+y)(x-y)}$$

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

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

$$10. \frac{3y}{y^2-7y+10} - \frac{2y}{y^2-8y+15}$$

$$\frac{(y-3) \cdot 3y}{(y-3)(y-5)(y-2)} - \frac{2y \cdot (y-2)}{(y-5)(y-3)(y-2)}$$

$$\frac{3y^2-9y}{(y-3)(y-5)(y-2)} - \frac{2y^2-4y}{(y-3)(y-5)(y-2)}$$

$$\frac{3y^2-9y-2y^2+4y}{(y-3)(y-5)(y-2)} = \frac{y^2-5y}{(y-3)(y-5)(y-2)}$$

$$\frac{y \cdot \cancel{(y-5)}}{\cancel{(y-5)}(y-3)(y-2)} = \boxed{\frac{y}{(y-3)(y-2)}}$$

Simplify the complex rational expression.

Example:

$$\frac{\frac{1}{y} + 7}{\frac{1}{y} - 5} = \frac{\frac{1}{y} + \frac{7y}{y}}{\frac{1}{y} - \frac{5y}{y}}$$

The first step is the treat the numerator and the denominator as their own +/- problems

$$= \frac{\frac{1+7y}{y}}{\frac{1-5y}{y}}$$

The goal is to make it a fraction over another fraction.

$$= \frac{1+7y}{y} \div \frac{1-5y}{y}$$

Now rewrite as a division problem.

$$= \frac{1+7y}{y} \cdot \frac{y}{1-5y}$$

Now flip and multiply.

$$= \frac{1+7y}{1-5y}$$

11.  $\frac{\frac{x^2 - y^2}{xy}}{\frac{x-y}{y}} = \frac{y}{x-y}$

$$= \frac{(x-y)(x+y) \cdot y}{xy(x-y)}$$

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

12.  $\frac{\frac{y}{x} + \frac{4}{y}}{\frac{y}{x} - \frac{3}{y}} = \frac{xy}{4y-3x} \cdot \frac{xy}{xy}$

$$= \frac{3y+4x}{xy} \cdot \frac{xy}{4y-3x}$$

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

13.  $\frac{\frac{b}{a} - \frac{3a}{b}}{\frac{a}{b} - \frac{b}{a}} = \frac{ba-3a}{ab-b} \cdot \frac{a}{ab-b}$

$$= \frac{a(b-3) \cdot a}{b \cdot b(a-1)}$$

$$= \boxed{\frac{a^2(b-3)}{b^2(a-1)}}$$

14.  $\frac{\frac{x^2 - x - 12}{x^2 - 2x - 15}}{\frac{x^2 + 8x + 12}{x^2 - 5x - 14}} = \frac{(x-4)(x+3)}{(x-5)(x+3)} \cdot \frac{(x+6)(x+2)}{(x-7)(x+2)}$

$$= \frac{(x-4)}{(x-5)} \cdot \frac{(x-7)}{(x+6)} = \boxed{\frac{(x-4)(x-7)}{(x-5)(x+6)}}$$