A rational algebraic expression is a quotient of polynomials.

To simplify rational algebraic expressions:

1) Factor the numerator completely,
2) Factor the denomerator completely,
3) Reduce any like FACTORS (not terms)

Ex 1) Simplify: $\dfrac{x^2-5x}{x^2-25}$

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

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

$$= \frac{x}{x+5}$$

Ex 2) Simplify:

$$(9x^2+6xy-3y^2)(12x^2-12y^2)^{-1}$$

$$= \frac{9x^2+6xy-3y^2}{12x^2-12y^2}$$

$$= \frac{3(3x^2+2xy-y^2)}{12(x^2-y^2)}$$

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

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

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

A **rational function** is a function that is defined by a simplified rational expression in one variable.

Ex 3) Let $f(x) = \dfrac{2x^2 - 7x + 3}{x^3 + x^2 - 2x}$

3a) Find the domain of *f(x)*.
(Translation: What values of *x* are not allowed in the denominator?
Remember we can't have zero in the denominator of a fraction.)

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

Zero Prod. Prop.

$x \neq 0 \quad x - 1 \neq 0 \quad x + 2 \neq 0$

$x \neq 0 \quad x \neq 1 \quad x \neq -2$

Domain is $\mathbb{R}$ except 0, 1, 2

3b) Find the zeros of f, if any:
Hint: set the variables of the numerator equal to zero to find the zeros of the functions.

$2x-1=0$ or $x-3=0$

$2x=1$ $x=3$

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