Domain of Rational Functions

Rational Function - A function in the form $\frac{P}{Q}$ where $Q \neq 0$.

$$\frac{3}{x} \qquad \frac{x+1}{x+5} \qquad \frac{x^2+2x+1}{x^2+3x-4}$$

Domain - the x values

Undefined Fraction - when the denominator of a fraction is equal to zero

To Find the Domain of a Rational Function - set the denominator equal to zero

1. Find the domain of each rational function.

a) $y = \frac{3}{x}$

$x \neq 0$

$\boxed{\text{Domain: All real numbers } x \neq 0}$

b) $y = \frac{6}{4x-5} + 2$

$4x - 5 \neq 0$

$\quad +5 \quad +5$

$\frac{4x}{4} \neq \frac{5}{4}$

$x \neq 5/4$

$\boxed{\text{Domain: All real numbers } x \neq 5/4}$

c) $y = \dfrac{x+9}{x^2-81}$

$x^2 - 81 \neq 0$

$x \quad x \quad 9 \quad 9$

$(x+9)(x-9) \neq 0$

$x+9 \neq 0 \qquad x-9 \neq 0$

$-9 \quad -9 \qquad +9 \quad +9$

$x \neq -9 \qquad x \neq 9$

$\boxed{\text{Domain: all real Numbers } x \neq 9, -9}$

d) $y = \dfrac{x^2-4}{x^3+5x^2+6x}$

$\dfrac{x^3}{x} + \dfrac{5x^2}{x} + \dfrac{6x}{x} \neq 0$ GCF = x

$x(x^2 + 5x + 6) \neq 0$

1·6

$\boxed{2 \cdot 3}$

$x(x+2)(x+3) \neq 0$

$x \neq 0 \qquad x+2 \neq 0 \qquad x+3 \neq 0$

$-2 \quad -2 \qquad -3 \quad -3$

$x \neq -2 \qquad x \neq -3$

$\boxed{\text{D: all real numbers } x \neq 0, -2, -3}$

e) $y = \dfrac{5x^2}{x^2+1}$

$x^2 + 1 \neq 0$

$-1 \quad -1$

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

~~x =~~

$\boxed{\text{Domain: all real numbers}}$

f) $y = \dfrac{7-x}{25x^2-1}$

$25x^2 - 1 \neq 0$

$5x \quad 5x \quad 1 \quad 1$

$(5x+1)(5x-1) \neq 0$

$5x+1 \neq 0 \qquad 5x-1 \neq 0$

$-1 \quad -1 \qquad +1 \quad +1$

$\dfrac{5x}{5} \neq \dfrac{-1}{5} \qquad \dfrac{5x}{5} \neq \dfrac{1}{5}$

$x \neq -1/5 \qquad x \neq 1/5$

$\boxed{\text{D: } \mathbb{R} \quad x \neq \pm 1/5}$