

Investigating Rational Functions of the form $f(x) = \frac{ax+b}{cx+d}$

Date: _____

Graph each of the following rational functions and fill in the blanks below (check on the TI-83 calculator).

$$y = \frac{x+4}{x-2}$$

$$x-2 \neq 0$$

$$x \neq 2$$

$$\therefore x=2 \text{ is a VA}$$

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

$$y = 1 + \frac{6}{x-2}$$

$$y \neq 1$$

$$\therefore y=1 \text{ is HA}$$

$$y = \frac{x-3}{x-1}$$

$$x-1 \neq 0$$

$$x \neq 1$$

$$\therefore x=1 \text{ is VA}$$

$$y = \frac{x-3}{x-1} = \frac{x-1-2}{x-1}$$

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

$$y \neq 1$$

$$\therefore y=1 \text{ is a HA asymptote}$$

Domain: $\{x | x \in \mathbb{R}, x \neq 2\}$
 Vertical Asymptote (s): $x = 2$
 Horizontal Asymptote (s): $y = 1$
 Range: $\{y | y \in \mathbb{R}, y \neq 1\}$

Domain: $\{x | x \in \mathbb{R}, x \neq 1\}$
 Vertical Asymptote (s): $x = 1$
 Horizontal Asymptote (s): $y = 1$
 Range: $\{y | y \in \mathbb{R}, y \neq 1\}$

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

$$x-2 \neq 0, x \neq 2$$

$$\therefore x=2 \text{ is VA}$$

$$y = \frac{3x}{x-2} = \frac{3x-6+6}{x-2}$$

$$y = 3 + \frac{6}{x-2}$$

$$y \neq 3, \therefore y=3 \text{ is HA}$$

$$y = \frac{6x-2}{2x-1}$$

$$2x-1 \neq 0, x \neq \frac{1}{2}$$

$$y = \frac{6x-2}{2x-1} = \frac{6x-3+1}{2x-1}$$

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

Domain: $\{x | x \in \mathbb{R}, x \neq 2\}$
 Vertical Asymptote (s): $x = 2$
 Horizontal Asymptote (s): $y = 3$
 Range: $\{y | y \in \mathbb{R}, y \neq 3\}$

Domain: $\{x | x \in \mathbb{R}, x \neq \frac{1}{2}\}$
 Vertical Asymptote (s): $x = \frac{1}{2}$
 Horizontal Asymptote (s): $y = 3$
 Range: $\{y | y \in \mathbb{R}, y \neq 3\}$

For rational functions $f(x) = \frac{ax+b}{cx+d}$,

- Vertical asymptotes (may) occur where $x = -\frac{d}{c}$
- Horizontal asymptotes occur where $y = \frac{a}{c}$

as long as numerator does not have same zeroes as the denominator