

Graphing Rational Functions

1) **Factor** the numerator and denominator and cancel like terms to simplify.

2) **Removable Discontinuities (Holes)**

- a. Cancel any like terms after factoring.
- b. Set all cancelled terms equal to zero – this is the x value of the hole.
- c. Substitute the x value of the discontinuity into the reduced function – this is the y value of the hole.
- d. Plot as an open circle on the graph.

3) **Non-removable Discontinuities (Asymptotes)**

a. **Horizontal/Slant Asymptote:** Always written as $y = \#$

$$f(x) = \frac{ax^n + \dots}{bx^m + \dots}, \text{ where } n \text{ is the degree of the numerator and } m \text{ is the degree of the denominator.}$$

- i. If $n < m$, there is a horizontal asymptote at $y = 0$.
- ii. If $n > m$, no horizontal asymptote exists. Instead, there will be a slant asymptote.
- iii. If $n = m$, there is a horizontal asymptote at $y = \frac{a}{b}$.

b. **Vertical Asymptote(s):** Always written $x = \#$

- i. Set each factor in the denominator of the reduced function equal to zero.
- ii. There may be more than one vertical asymptote.

4) **Intercepts**

a. **X intercept(s):** Always written $(\#, 0)$

- i. Set the numerator of the reduced function equal to zero and solve.
- ii. There may be more than one x intercept.

b. **Y intercept:** Always written $(0, \#)$

- i. Substitute 0 for all x values.
- ii. There will NEVER be more than one y intercept.