**8.3 Rational Function and Their Graphs**.  
Objective: To identify properties of rational functions  
To graph rational functions

Some rational functions come in the form: 

**Vertical Asymptote:** set denominator equal to 0 and solve for x

**Horizontal Asymptote:**if degree in numerator is smaller y=0  
if degree in numerator is bigger then no horizontal asymptote  
if degree is equal then horizontal asymptote is a/c

**Continuous Graph:**  the graph is “nonstop” there are no jumps or breaks or holes in the graph (you can draw it without picking up your pencil from the paper)

**Discontinuous Graph:** there is a jump or break or hole in the graph because some value makes the denominator equal zero

**Point of Discontinuity:** the x value that makes the denominator zero  
  
**Removable Discontinuity:** you can redefine the function so that you can find a value of the point of discontinuity by simplifying the function

**Non-Removable Discontinuity:**  there is no way to redefine the function to find the value of the point of discontinuity

**Graphing**.

**Characteristics of the graph:**

1. The x-intercept of the graph of f are the real zeros of p(x)
2. The graph of f has vertical asymptote at each real zero of q(x)
3. The graph of f has at most one horizontal asymptote

If m<n (the degree of p(x) is m and degree of q(x) is n), the line y=0 is horizontal asy.

If m=n the line

If m>n the graph has no horizontal asy.

1. There is a hole when the zero of p(x) and q(x) are the same

**Steps to Graphing**:

1) Draw the asymptotes (and holes)

2) Plot 2 or 3 “smart” points on each side of the vertical asymptote

3) Use points and asymptotes to draw branches

*Example:*

Where are the points of Discontinuity? Is it a V.A. or Hole?

X=-5 x=-3 x=3 and x=1 no points x=-2 and x=-5

V.A. V.A. V.A. &V.A. none V.A. & Hole

*Example:*

Where is the Horizontal Asymptote (if there is one)?

Degree is same Degree in top Degree in top   
so x= is smaller so is bigger so

y=0 no H.A.

*Example:*

*Graph the function. State the domain and range.*

The numerator has no zeros, therefore no x-intercept

The denominator has no real zeros, so no vertical asy.

m<n because 0<2 so the line y=0 is a horizontal asy.

t-chart to find points

**HMWK: page 521 #1-10, 13-33 (odd), 43**