Precalculus Unit 3: 3.1-3.3 Review
Rational Functions, Scatter Plots, and Regression Equations

Complete the following problem.

1. For the function \( f(x) = \frac{x^2+x-12}{x^2-x-6} = \frac{(x+3)(x+4)}{(x-3)(x+2)} \)

   Domain: \( \mathbb{R}, \ x \neq 3, \ x \neq -2 \).

   Vertical Asymptote(s):
   \( x = -2 \).

   Hole: \( (3, \frac{7}{5}) \) \( \frac{x+4}{x-2} \Rightarrow \frac{7}{5} \)

   Horizontal/Slant Asymptote:
   \( \frac{\text{Deg}=2}{\text{Deg}=2} \quad y = 1 \)

   How did you find the horizontal/slant asymptote?
   The degree is the same so the leading coefficients are used to determine the horizontal asymptote.

   x-intercept(s):
   \( \frac{x+4}{x+2} = 0 \) \( x+4 = 0 \) \( x = -4 \)

   y-intercept:
   \( \frac{0^2+0-12}{0^2-0-6} = \frac{-12}{-6} = 2 \) \( y = 2 \)

   Sketch the function on the provided graph. Make sure to accurately plot all of the features of the graph found above.
2. Find the slant asymptote for the function \( f(x) = \frac{2x^3 + 3x^2 - 8x + 2}{x^2 + 4x - 1} \). 

\[ \frac{2x - 5}{x^2 + 4x - 1} \begin{vmatrix} 2x^3 + 3x^2 - 8x + 2 \\ + (2x^2 + 8x + 2) \end{vmatrix} 
\] 
\[ y = 2x - 5 \]

3. An engineer collects the following data showing the speed \( s \) of a Ford Taurus and its average miles per gallon, \( M \).

a. Draw a scatter plot of the data. Based on the scatter plot, what type of model does it look like you will use? 

\text{QUADRATIC & CUBIC ARE VERY SIMILAR. CUBIC HAS SLIGHTLY HIGHER } R^2 \text{ VALUE}

b. Using your calculator/computer, find the model that best fits this data. 

* CUBIC: \( y = -0.0063 x^3 + 0.003 x^2 + 0.141x + 2.142 \) 

* Best for: \( y = -.617 x^2 + 1.935 x - 25.341 \)

c. Use the function found in part b to determine the speed that maximizes miles per gallon. This can be done on the graph on the calculator.

\text{CUBIC: 56.404}

\text{QUAD.: 55.378}

d. Use the function found in part b to predict miles per gallon for a speed of 63 miles per hour.

\text{27.584 mpg.}

\text{27.212 (QUAD)}

e. Is the work in part d an example of interpolation or extrapolation?

\text{Interpolation – 63 is within the data set.}