1. (4 points) Circle ALL of the following equations that are NOT polynomials: (no work needed)
   a. \( f(x) = -\sqrt{2} x^4 + 3x - 5 \)
   b. \( f(x) = 5 \)
   c. \( f(x) = x^2 - \sqrt{x} + 3 \)
   d. \( f(x) = \frac{x^2-1}{3x^2+3} \)

2. (8 points) Given \( g(x) = x^3 + x^2 - 5x + 3 \) and \( g(1) = 0 \), find all zeros of the polynomial.
   \[
   \begin{array}{c|cccc}
   & 1 & 1 & -5 & 3 \\
   \hline
   1 & 1 & 2 & -3 \\
   \hline
   & 1 & 2 & -3 & 0
   \end{array}
   \]
   \( \text{zeros} = \{1, -3\} \)

3. (8 points) Given the graph of \( f(x) \) to the right, answer the following: (no work needed)
   a. The degree is: even / odd/ positive / negative.
      (Circle only one.)
   b. The leading coefficient is: even / odd/ positive / negative.
      (Circle only one.)
   c. The minimum degree possible is: 3/ 4/ 5/ 6. Circle only one.
   d. What are the zeros of \( y = 3 f(x + 1) \)?
      \( f(x) \) has zeros \( x = -3, -1, \) and 1
      \( y \) has zeros \( x = -4, -2, \) and 0
4. (14 points) Given \( f(x) = 16^{-x/4} \), answer the following:

a. The function has a: vertical/horizontal (Circle one) asymptote at \( y = 0 \)

b. The function is equivalent to: \( y = \left(\frac{1}{16}\right)^{x/4} \) What goes in the box? \( x/4 \)

Find the function values if possible. If not possible, write DNE

c. \[ f(2) = \frac{16^{-2/4}}{16^{1/4}} = \frac{1}{\sqrt[4]{16}} = \sqrt{\frac{1}{4}} \]

d. Solve for when \( f(x) = 0 \). \( \text{DNE} \)

5. (15 points) Given \( f(x) = \log_{25}(4 - x) \), answer the following:

a. The function has a: vertical/horizontal (Circle one) asymptote at \( x = 4 \)

b. Give the domain of the function in interval notation.

\[ 4 - x > 0 \quad \implies \quad (x, 4) \]

Find the function values if possible. If not possible, write DNE

c. \( f(-1) = \frac{\log_{25}(5)}{\log_{25}(4+1)} = \frac{1}{3} = \left(\frac{1}{8}\right) \)

d. \( f^{-1}(0) = \left(\frac{3}{5}\right) \)
6. (16 points) The following problems are not related.

a. Solve \( \ln x^2 = \ln(12 - x) \)

\[
\begin{align*}
\chi^2 &= 12 - x \\
\chi^2 + x - 12 &= 0 \\
(x + 4)(x - 3) &= 0
\end{align*}
\]

\( x = -4, 3 \)

b. Find an exponential function of the form \( f(x) = b \cdot a^x \) that has a y-intercept of \((0,8)\) and passes through the point \((3,1)\).

\[
\begin{align*}
8 &= b \cdot a^0 \Rightarrow 8 &= b \\
1 &= 8 \cdot a^3 \Rightarrow a = \frac{1}{2}
\end{align*}
\]

7. (15 points) From a rectangular piece of cardboard having dimensions 20 inches by 10 inches, an open box is to be made by removing squares of area \( x^2 \) from each corner and turning up the sides. The volume of this box is given by the function 

\[ V(x) = (20 - 2x)(10 - 2x)x \]

a. Sketch the graph of \( V(x) \).

b. For what values of \( x \) is \( V(x) > 0? \)

\( (0,5) \cup (10, \infty) \)

c. Between what values of \( x \) will the maximum value of the volume lie?

\( (0,5) \)
8. (20 points) Consider the rational function \( f(x) = \frac{x^3 - 1}{x^2 - 1} \).

[Hint: The factoring a cube formula is \( a^3 - b^3 = (a - b)(a^2 + ab + b^2) \).]

Give all of the following:

a. X-intercept and Y-intercepts. Give the \((x, y)\) coordinates. If there are none state NONE.

\[ X\text{-int} \Rightarrow \text{NONE} \quad \text{y-int} \Rightarrow (0, 1) \]

b. Vertical asymptotes. If there are no vertical asymptotes state NONE.

\[ x = -1 \]

c. Horizontal asymptotes. If there are no horizontal asymptotes state NONE.

\[ \text{NONE} \]

d. Slant asymptotes. If there are no slant asymptotes state NONE.

\[ y = x \]

e. Holes. Give the \((x, y)\) coordinates.

\[ (1, \frac{3}{2}) \quad \text{Sub } x = 1 \text{ into reduced function.} \]

f. Sketch.

\[ y = -1 \quad y = x \]