Directions:

- No notes or electronic devices of any kind are permitted.
- All work and answers provided must be your own.
- CU Honor Code applies.
- All work must be shown on this exam paper. Correct answers without supporting work may not receive full credit, unless otherwise indicated.

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.

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 \( y = 3 f(x+1) \)?
4. (14 points) Given \( f(x) = 16^{-x/4} \), answer the following:

a. The function has a: vertical/ horizontal (Circle one) asymptote at ______________

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

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

c. \( f(2) = \) ______________

d. Solve for when \( f(x) = 0 \). ______________

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

a. The function has a: vertical/ horizontal (Circle one) asymptote at ______________

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

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

c. \( f(-1) = \) ______________

d. \( f^{-1}(0) = \) ______________
6. (16 points) The following problems are not related.
   a. Solve \( \ln x^2 = \ln (12 - x) \)

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

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 \( V(x) > 0? \)

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

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

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

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

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

f. Sketch.