1.) Evaluate the following limits.

a.) \( \lim_{x \to 4} \frac{\sqrt{5} + x - 3}{\sqrt{x} - 2} \)

b.) \( \lim_{x \to \infty} (x - x \cos(4/x)) \)

c.) \( \lim_{x \to 0} \frac{2x}{\sin x - x} \) (HINT: \( \frac{\sin x}{x} \leq 1 \).)

2.) Use the Three Step Process (the definition of continuity) to determine if each of the following functions is continuous at the given \( x \)-value.

a.) \( f(x) = \begin{cases} x^2 + 2, & \text{if } x > 1 \\ 4, & \text{if } x = 1 \\ \frac{6}{x+1}, & \text{if } x < 1 \end{cases} \) at \( x = 1 \)

b.) \( g(x) = \begin{cases} \frac{x^2 + 2x + 1}{x^2 + 3x + 2}, & \text{if } x \neq -1 \\ 0, & \text{if } x = -1 \end{cases} \) at \( x = -1 \)

6.) For what \( x \)-values are the following functions continuous? Briefly explain using "short-cuts."

a.) \( y = x^5 + x^4 + x^3 + x^2 + x + 1 \)

b.) \( y = 7x^3 - \cos x \)

c.) \( y = \frac{x^2 - 4}{x^2 - 9} \)

d.) \( y = (x^2 - 3x) \sin x \)

e.) \( y = \sin(x^2 - 3x) \)

3.) Use the Intermediate Value Theorem (IMVT) to verify that each of the following equations is solvable. This is a writing exercise as well as a math exercise. Please be organized, clear, and precise in your writing:

a.) \( x^5 + x - 1 = 0 \)

b.) \( x^3 = 10 + \sqrt{x} \)

c.) \( \frac{x^2}{x^3 + 4} = 1 \)

4.) Use one-sided limits and limits to infinity to find all vertical and horizontal asymptotes for the following functions. Use the asymptotes together with \( x \)- and \( y \)-intercepts to sketch graphs of each function.

a.) \( y = \frac{x - 2}{x^2 - 9} \)

b.) \( y = \frac{x + 2}{x^2(x + 1)} \)

5.) Give an \( \varepsilon, \delta \)-proof for \( \lim_{x \to 1} \frac{x + 3}{1 + \sqrt{x}} = 2 \).

6.) Use the IMVT to determine if the following equation is solvable. This is a writing
exercise:  $x^3 + x - \sqrt{x + 4} = 0$.

7.) In the given diagram the smaller circle is the largest one that can be inscribed in the given semi-circle. If the larger circle has circumference $4\pi$ in., what is the area of the inscribed shaded square?

8.) Determine the $x$-values for which the following function is continuous. It is not necessary to graph the function:

$$f(x) = \begin{cases} 
\sin 3x, & \text{if } x < 0 \\
\frac{x}{3.01}, & \text{if } x = 0 \\
\frac{x - 1}{\sqrt{x - 1}}, & \text{if } 0 < x < 1 \\
2, & \text{if } x \geq 1.
\end{cases}$$

The following problem is for recreational purposes only.

9.) Without lifting your pencil, join all sixteen dots with six straight lines.