Show all work for full credit.  
I have neither given nor received aid on this test.  *Pledged:*____________________
1. (4 points) Find the domain of \( g(t) = \sqrt{6 + t - t^2} \)

2. (3 points) Complete the square: \( x^2 + 6x + 7 \)

3. (8 points) Express the area of an equilateral triangle as a function of the length of one of the sides.
4. (8 points) Find all $\theta$ in $[0, 2\pi]$ such that $\sin(2\theta) = \cos(\theta)$

5. (6 points) Given $f(x) = \frac{1-x}{3x}$ and $g(x) = \frac{1}{1+3x}$, find and simplify $f \circ g$ and state its domain.

6. (8 points) Find $\lim_{x \to 0} (\sqrt{x^4 + x^2}) \sin \left( \frac{\pi}{x} \right)$
7. (12 points) Evaluate the following limits.

(a) \( \lim_{h \to 0} \frac{(3 + h)^{-1} - 3^{-1}}{h} \)

(b) \( \lim_{x \to 0} a \)

(c) \( \lim_{x \to 2} \sqrt{\frac{2x^2 + 1}{3x - 2}} \)

(d) \( \lim_{x \to 0} \frac{x + 3}{x^2} \)

(e) \( \lim_{u \to 1} \frac{u^4 - 1}{u^3 - 1} \)

(f) \( \lim_{x \to 0} \frac{1}{x} - \frac{1}{|x|} \)
8. (10 points) Use the $\delta$-$\epsilon$ definition of a limit to prove that $\lim_{x \to 1} \frac{x^2 - 1}{x - 1} = 2$

9. (8 points) Let $f(x) = \begin{cases} 
\cos(x) - 1 & x < 0 \\
0 & x = 0 \\
x - x^2 & x > 0 
\end{cases}$

Explain why $f$ is continuous on $(-\infty, \infty)$. 
10. (8 points)
   (a) State the Intermediate Value Theorem.

   (b) Show there exists a number in \([1, 2]\) that is exactly one less than its cube.

11. (10 points) Let \(f(x) = \sqrt{1 - 2x}\).
    (a) Find a formula for \(f'(x)\), using the limit definition of the derivative.

    (b) Give the equation of the line tangent to \(f\) at \((-4, 3)\).
12. (15 points) Let $f(x)$ be the function with the graph:

(a) At which points is $f$ not continuous? State which type of discontinuity occurs at each point.

(b) At which points is $f$ not differentiable?

(c) Sketch the graph of $f'(x)$