Show all your work on the exam paper, legibly and in detail, to receive full credit. No Calculators please.

1. An open box is to be constructed from a 6-inch square piece of metal by cutting out squares of length $x$ from each corner and bending up the sides.
   a. Express the volume $V$ as a function of $x$.
   b. Find the domain of $V$.

2. The function $f$ has the graph shown to the right. In each part (A) through (F), put the letter of the graph that matches the given function.

   (A) $(1/2)f(x) \quad$ (B) $f(x + 1) + 1 \quad$ (C) $f(3x) \quad$
   (D) $f(x - 1) + 1 \quad$ (E) $-f(x) \quad$ (F) $f(-x)$
3. Let \( f(x) = \sqrt{x} \) and \( g(x) = x^3 + 1 \)
Find the following:
   \( a. \ f(g(2)) \)
   
   \( b. \ g(f(4)) \)
   
   \( c. \ f(f(16)) \)

4. Express \( f \) as a composition of two functions; that is, find \( g \) and \( h \) such that
   \[ f = g \circ h \]
   
   \( a. \ f(x) = \sqrt{x + 2} \)
   
   \( b. \ f(x) = \sin^2 x \)
   
   \( c. \ f(x) = 3\sin^2 x + 4\sin x \)
5. Find the formula for \( f^{-1}(x) \), and state the domain of the function \( f^{-1} \).

a. \( f(x) = (x + 2)^4, \ x \geq 0 \)

b. \( f(x) = x - 5x^2, \ x \geq 1 \)

6. Solve for \( x \).

a. \( \ln x^2 = 4 \)

b. \( \ln \left( \frac{1}{x} \right) + \ln(2x^3) = \ln 3 \)

c. \( 3e^{-2x} = 5 \)

d. \( e^x - 2xe^x = 0 \)
7. Let \( f(x) = \begin{cases} 
  x - 1 & x \leq 3 \\
  3x - 7 & x > 3
\end{cases} \)

Find
a. \( \lim_{x \to 3^-} f(x) \)

b. \( \lim_{x \to 3^+} f(x) \)

c. \( \lim_{x \to 3} f(x) \)

8. Find the following limits:

a. \( \lim_{y \to 6} \frac{y + 6}{y^2 - 36} \)

b. \( \lim_{x \to 4} \frac{3 - x}{x^2 - 2x - 8} \)

c. \( \lim_{x \to 3} \frac{1}{|x - 3|} \)
d. \( \lim_{x \to +\infty} \frac{3x + 1}{2x - 5} \)

e. \( \lim_{x \to -\infty} \frac{\sqrt{5x^2} - 2}{x + 3} \)

f. \( \lim_{x \to 0^+} e^x \)

g. \( \lim_{x \to +\infty} \ln(x^2 - 1) - \ln(x + 1) \)