Please show **all** your work! Answers without supporting work will not be given credit. Write answers in spaces provided. You have 1 hour and 50 minutes to complete this exam.

Name:_____

1. Calculate the following limits. If a limit is ∞ or $-\infty$, please say so. Make sure you show all your work and justify all your answers.

   (a) $\lim_{x \to 3} \dfrac{\sqrt{x+1}-2}{x-3}$

   Answer:_____

   (b) $\lim_{x \to 0} \dfrac{\sin(4x)}{8x}$

   Answer:_____

2. Use the ε-δ definition of limit to prove that

   $$\lim_{x \to 2} x^2 - 3x + 2 = 0$$

3. If $h(x) = \sqrt{x^2 + 2} - 1$, find a **non-trivial** decomposition of h into f and g such that $h = f \circ g$.

$f(x) =$_____

$g(x) =$_____

4. Find the first two derivatives of the function $f(x) = x^2 \cos(x)$. Simplify your answers as much as possible. Show all your work.

$f'(x) =$_____

$f''(x) =$_____

Cont.

5. Find the derivative of the function $f(x) = \int_{x^2}^{2} \frac{\cos(t)}{t}\, dt$.

Answer:_____

6. Set up, but do not evaluate, the integral for the volume of the solid obtained by rotating the area between the curves $y = x$ and $y = \sqrt{x}$ about the x-axis.

The End.