

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) $\lim_{x \rightarrow 3} \frac{\sqrt{x+1} - 2}{x-3}$

Answer: _____

(b) $\lim_{x \rightarrow 0} \frac{\sin(4x)}{8x}$

Answer: _____

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

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

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

$$f(x) = \underline{\hspace{10cm}}$$

$$g(x) = \underline{\hspace{10cm}}$$

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.

$$f'(x) = \underline{\hspace{10cm}}$$

$$f''(x) = \underline{\hspace{10cm}}$$

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.