Signature

I certify that I did not use my computational device for data storage or symbolic manipulation.

Total: Name:

Math 125 **Second Exam** **Fall 2009**

Write neat, concise, and accurate solutions to each of the problems below—I will not give partial credit for steps I cannot follow. Include all relevant details, use correct notation, and finish problems with a complete sentence when appropriate. Each problem is worth 6 points.

1. State the definition of the derivative of a function f.

2. Find and simplify the derivative of the function f defined by $f(x) = e^{-2x}\cos(4x)$.

3. Find and simplify the derivative of the function g defined by $g(x) = \arcsin(x/7)$. Avoid compound fractions.

4. Find and simplify the derivative of the function h defined by $h(x) = \dfrac{\ln x}{x^4}$.

5. The position s in meters of a particle at time $t \geq 0$ seconds is given by $s = 20t + 64\left(e^{-t/2} - 1\right)$. Determine the time when the velocity of the particle is 8 meters per second. Give both the exact answer and the answer to the nearest thousandth.

6. Find the maximum and minimum outputs of the function f defined by $f(x) = \ln\left(x^2 - 8x + 20\right)$ on the interval $[0, 10]$.

7. Find the x-intercept of the line tangent to the graph of $y = x \sin x$ at the point $x = 2$. Give your answer correct to the nearest thousandth.

8. Suppose that f is a function whose derivative is given by $f'(x) = 7(x^2 - 70)(x - 5)^4$. Determine the nature of all the critical inputs of the function f. That is, determine whether or not f has a relative maximum, a relative minimum, or neither at each critical input.

9. Determine the intervals on which the function f defined by $f(x) = x + \dfrac{8a^5}{x^4}$ is increasing and those on which it is decreasing. Treat a as a positive constant.

10. An oil rig is located in the ocean one kilometer away from the end of a long straight beach that is ten kilometers long. Suppose you can swim at a rate of five kilometers per hour and can run at a rate of ten kilometers per hour. Find the least amount of time required to get to the far end of the beach from the oil rig using some combination of swimming and running. Ignore transition time, tides, etc. and give your answer to the nearest second. Remember to include all of the parts of a solution to a word problem of this type.