Name:

5 digit PIN number (if you want your grade posted):

Directions: This exam has three questions, spread across five pages (not counting this cover page). Answers must be justified appropriately on these pages; show all work and clearly mark your final answers. You may use a calculator, but you may not use a computer, notes or other study aids.

Grading:

Problem	Points Possible	Points Earned
1 (a-c)		
1 (d-f)		
2 (a-b)		
2 (c-d)		
3	15	
Total	100	

1. (11 pts each) Choose five of the six parts of this problem.

   Note: You will not receive credit for work on all six parts; if it is unclear from your work which part you do not want graded, draw an X through the letter of that part. Otherwise, I will grade the first five parts.

   (a) Find $f'(x)$ if $f(x) = 2\tan 5x - 4\sec x$.

   (b) Find $\frac{dy}{dx}$ if $y = 5x^2 \sin^{-1} x$.

   (c) Find the second derivative of $f(x) = 4\sin^2 x$.

(d) Find $f'(x)$ if $f(x) = \frac{\arctan x + 2}{4\sec x + \log_6 x}$.

(e) Find the derivative of $f(x) = \log(\csc x)$.

(f) Find $f'(x)$ if $f(x) = 2e^{2-x}\cos x$.

2. (10 pts each) Choose three of the four parts of this problem.

   Note: You will not receive credit for work on all four parts; if it is unclear from your work which part you do not want graded, draw an X through the letter of that part. Otherwise, I will grade the first three parts.

   (a) Find the instantaneous rate of change of y with respect to x if $y = e^{2x}\cos 4x$.

   (b) Find the equation of the line tangent to $f(x) = e^x + 4e^{-x}$ when $x = 0$.

(c) Suppose that an object is moving so that its position at time t is $f(t) = 4\sin 3t + 2\cos 2t$. Find the velocity of the object when $t = 60°$.

(d) Use Newton's method with initial guess $x_0 = 2$ to approximate (by computing x_2) a solution to the equation $\ln x + x = 4$.

3. (15 pts) Choose problem (a) or (b).

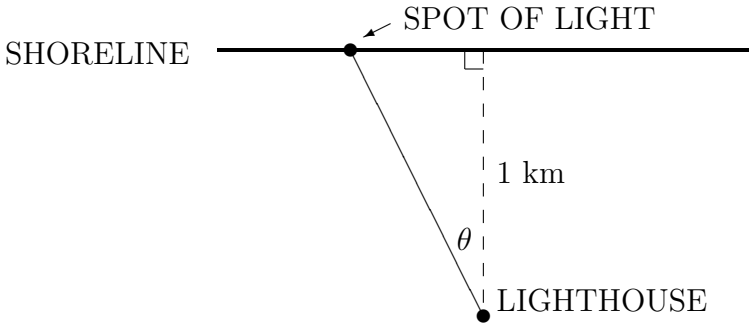
   Note: You will not receive credit for work on both parts; if it is unclear from your work which part you do not want graded, draw an X through the letter of that part. Otherwise, I will grade (a).

   (a) Suppose that the energy emitted by a radioactive particle at time t is given by

   $$f(t) = t\,2^{-t/10}.$$

   At what time is the energy emitted the greatest?

   (b) The beacon of a lighthouse 1 km from a straight shore revolves at an angular velocity of 10π radians per minute, and shines a spot of light on the shore as indicated in the figure below:



   How fast is the spot of light moving when $\theta = 30°$?

Formulas you may use on this exam

This sheet of paper does not need to be turned in.

$$\frac{d}{dx}(\tan x) = \sec^2 x$$
$$\frac{d}{dx}(\cot x) = -\csc^2 x$$
$$\frac{d}{dx}(\sec x) = \sec x \tan x$$
$$\frac{d}{dx}(\csc x) = -\csc x \cot x$$

$$\frac{d}{dx}\left(\sin^{-1} x\right) = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}\left(\cos^{-1} x\right) = \frac{-1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}\left(\tan^{-1} x\right) = \frac{1}{1+x^2}$$

$$\frac{d}{dx}(e^x) = e^x$$
$$\frac{d}{dx}(b^x) = b^x(\ln b)$$

$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$

$$\frac{d}{dx}(\log_b x) = \frac{1}{x} \cdot \frac{1}{\ln b}$$