92-131 **Final Exam (Brent Sec. 203 & 207)** **Fall 2009**

Determine the derivative of the following functions:

1) $f(x) = \tan(e^x)$ **2)** $s(x) = \arcsin(x^3)$ **3)** $y = e^{-4x}\sin(3x)$

4) $g(t) = \dfrac{t^3 - 1}{t^2 + 1}$ **5)** $y = \dfrac{3\ln x + 1}{x^3}$ **6)** $f(x) = \ln^2[\sqrt{x}]$

7) Using the limit definition of the derivative, calculate $\dfrac{df}{dx}$ for $f(x) = x^3 + 1$.

8) Suppose that $e^{x^2y^2-1} - y = 0$. Find $\dfrac{dy}{dx}$, then find the equation of the line tangent to the graph of this equation at the point $(1,1)$. Write your answer in slope-intercept form.

9) Suppose a ball is moving on a linear track so that its acceleration (in m/s^2) is given by:

$$a(t) = 16 - 3t^2, \text{ for } t \geq 0,$$

where *t* is time in seconds. The ball has initial position *s* = 2 m, and initial velocity *v* = 0 m/s. **a**)What is the ball's velocity after 3 seconds? **b)** When does it reverse direction? c**)** What is the ball's position $s(t)$?

10) Let $f(x) = e^{-x^2/2}$.

- **a)** Find the interval(s) on which *f* is increasing or decreasing.
- **b)** Find local (relative) maximum and minimum values of *f*.
- **c)** Determine intervals where the function is concave up and concave down.
- **d)** Determine any points of inflection.
- **e)** Are there any asymptotes?

11) A storage bin with a ceiling and floor is to be constructed in the shape of a cylinder. The cost of the material used for the two circular surfaces is $10 per square foot. The material used for the lateral surface costs $20 per square foot. What are the dimensions of the cheapest bin that can be built with a volume of $1{,}000\pi$ ft^3?

12) There is one positive value of *x* that solves the equation $x^3 - 3x = 0$.

- **a)** Give a recursion equation for solving this problem using Newton's method.
- **b)** Starting with $x_0 = \dfrac{3}{2}$, approximate the solution by x_2.