UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Math 181
Test 2A (Chapters 2 and 3)

Full Name _____
Section No. _____ Date _____

All questions worth 10 points except where noted.
No work = No credit. Scrap work not accepted.

1. State the definition of the derivative of a function $f(x)$ at any value for x. Use this definition to find the derivative of $f(x) = 2x - 1$.

For functions (2) through (4), calculate the **domain** of the given function, and its **derivative** (you do not need to simplify the derivative).

2. $y = [\sin^{-1}(3x)]^3$

3. $y = \dfrac{\sinh 2x}{e^{1-x}}$

4. $y(x) = e^{2x} \cdot \ln\left(\dfrac{x^2+4}{x-3}\right)$

5. Find the equation of the line tangent to the curve $x^2 + xy + y^2 = 19$ through the point (2,3).

6. Find the equation of the tangent line for $y = e^{-3x}$ at $x = 0$. Estimate $y(0.02)$ with this equation. What is the percentage error compared to what it should be (round to 4 decimal places)?

7. Find the inverse of $f(x) = 5e^{-2x} - 3$ and state its domain and range.

8. A substance has a half life of 21 minutes. There are initially 23 cells at 12pm. (Round all answers to 2 decimal places).

   a) Find the equation for the number of cells at any time

   b) How many cells will be there 1 day later (be careful of units and answer reasonably)?

   c) How many minutes later will there be only 5 cells left?

For questions (9) and (10), evaluate the following limits. You must solve the problem algebraically or by using L'Hopital's Rule.

9. $\lim_{x\to\infty}\left(1+\frac{a}{x}\right)^{bx}$

10. $\lim_{x\to 0}\left(\frac{\cos mx-\cos nx}{x^2}\right)$

FORMULA SHEET FOR TEST 2

TRIG FUNCTIONS:

$$\frac{d}{dx}(\sin x) = \qquad \frac{d}{dx}(\cos x) = \qquad \frac{d}{dx}(\tan x) = \sec^2 x$$

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

INVERSE TRIG FUNCTIONS:

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

$$\frac{d}{dx}(\csc^{-1} x) = \frac{-1}{x\sqrt{x^2-1}} \qquad \frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}} \qquad \frac{d}{dx}(\cot^{-1} x) = \frac{-1}{1+x^2}$$

HYPERBOLIC FUNCTIONS:

$$\frac{d}{dx}(\sinh x) = \qquad \frac{d}{dx}(\cosh x) = \qquad \frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$$

$$\frac{d}{dx}(\operatorname{csch} x) = -\operatorname{csch} x \coth x \qquad \frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \tanh x \qquad \frac{d}{dx}(\coth x) = -\operatorname{csch}^2 x$$

INVERSE HYPERBOLIC FUNCTIONS:

$$\frac{d}{dx}(\sinh^{-1} x) = \frac{1}{\sqrt{1+x^2}} \qquad \frac{d}{dx}(\cosh^{-1} x) = \frac{1}{\sqrt{x^2-1}} \qquad \frac{d}{dx}(\tanh^{-1} x) = \frac{1}{1-x^2}$$

$$\frac{d}{dx}(\operatorname{csch}^{-1} x) = \frac{-1}{|x|\sqrt{1+x^2}} \qquad \frac{d}{dx}(\operatorname{sech}^{-1} x) = \frac{-1}{x\sqrt{1-x^2}} \qquad \frac{d}{dx}(\coth^{-1} x) = \frac{1}{1-x^2}$$