



Math 181  
Test 2B (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.  $y = [\cos^{-1}(5x)]^5$

3.  $y = \frac{\cosh 3x}{e^{2-x}}$

4.  $y(x) = e^{3x} \cdot \ln\left(\frac{x^2 + 5}{x - 6}\right)$

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  $y = e^{-4x}$  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  $f(x) = 4e^{-3x} - 5$  and state its domain and range.

8. A substance has a half life of 17 minutes. There are initially 21 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.  $\lim_{x \rightarrow \infty} \left(1 + \frac{a}{x}\right)^{bx}$

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

## FORMULA SHEET FOR TEST 2

### TRIG FUNCTIONS:

$$\frac{d}{dx}(\sin x) =$$

$$\frac{d}{dx}(\cos x) =$$

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

$$\frac{d}{dx}(\csc x) = -\csc x \cot x$$

$$\frac{d}{dx}(\sec x) = \sec x \tan x$$

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

### INVERSE TRIG FUNCTIONS:

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

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

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

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

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

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

### HYPERBOLIC FUNCTIONS:

$$\frac{d}{dx}(\sinh x) =$$

$$\frac{d}{dx}(\cosh x) =$$

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

$$\frac{d}{dx}(\operatorname{csch} x) = -\operatorname{csch} x \operatorname{coth} x$$

$$\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \tanh x$$

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

### INVERSE HYPERBOLIC FUNCTIONS:

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

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

$$\frac{d}{dx}(\tanh^{-1} x) = \frac{1}{1-x^2}$$

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

$$\frac{d}{dx}(\operatorname{sech}^{-1} x) = \frac{-1}{x\sqrt{1-x^2}}$$

$$\frac{d}{dx}(\operatorname{coth}^{-1} x) = \frac{1}{1-x^2}$$