Fall 1998
Math 151
Common Exam 3
Test Form A

<u>PRINT</u>: Last Name: ______________________________ **First Name:** ______________________

Signature: ____ **ID:** _________________________

Instructor's Name: ____ **Section #** _____________

<u>INSTRUCTIONS</u>

1. In **Part 1** (Problems 1–13), mark the correct choice on your ScanTron form using a #2 pencil. *For your own records, also record your choices on your exam!* The ScanTrons will be collected after 1 hour; they will NOT be returned.
2. In **Part 2** (Problems 14–18), write all solutions in the space provided. You may use the back of any page for scratch work, but all work to be graded must be shown in the space provided. CLEARLY INDICATE YOUR FINAL ANSWERS.

PART 1: MULTIPLE-CHOICE PROBLEMS

Each problem is worth 4 points; NO partial credit will be given. Calculators may NOT be used on this part. ScanTron forms will be collected after 1 hour, but may be turned in earlier.

1. $\lim_{x \to 0} \frac{2x}{\sin(3x)} =$

   (a) 0 (b) 2/3 (c) 1 (d) ∞ (e) undefined

2. Find the slope of the tangent line to $y = \sqrt{2 + \sec x}$ at $(\pi/3, 2)$.

   (a) 1/4 (b) $\sqrt{3}/2$ (c) 0 (d) 1/2 (e) $(2 + 2\sqrt{3})^{-1/2}$

3. If $f(x) = (e^x + e^{-x})^2$ then $f'(x) =$

   (a) $2(e^x + e^{-x})^{-1}$ (b) $2(e^x - e^{-x})$ (c) $e^{4x} - 1$ (d) $2(e^{2x} - e^{-2x})$ (e) $2x(e^{x^2} - e^{-x^2})$

4. The second derivative of $y = x\sin(x) + \cos(x)$ is $y'' =$

   (a) $x\sin(x) - \cos(x)$
   (b) $-\cos x - x\sin x$
   (c) $3\cos(x) - x\sin(x)$
   (d) $3\cos(x) + x\sin(x)$
   (e) $\cos(x) - x\sin(x)$

5. A circular oil slick spreads on a pond's surface. When the radius is 10 ft the radius grows at a rate of 2 ft/min. Give the rate of change, in ft^2/min, of the slick's area when the radius is 10 ft.
   (a) 10π (b) 20π (c) 40π (d) 50π (e) 100π

6. The quadratic approximation to $f(x) = \dfrac{8}{\sqrt{1+x}}$ near $a = 0$ is $f(x) \approx$
   (a) $8 - 4x + 3x^2$ (b) $8x - 4x^2$ (c) $8 - 4x + 6x^2$ (d) $8 + 4x - 3x^2$ (e) $8 - 4x - 6x^2$

7. If $f(x) = x^3 - 2x + 3$ and Newton's Method with $x_1 = 1$ is used to approximate a solution to $f(x) = 0$, then $x_2 =$
   (a) -1 (b) $-1/2$ (c) 1/2 (d) 3/2 (e) 3

8. Find $\frac{dy}{dx}$ when $x = 1$, if y satisfies $y^3 - xy = 2x + 4$ and $y = 2$ when $x = 1$.
(a) 4/11 (b) 8 (c) 2/11 (d) $1/3$ (e) 5/3

9. Find $\lim_{x\to\infty} \frac{2e^{2x} + e^{-2x}}{e^{2x} - e^{-2x}}$.
(a) 0 (b) 1/2 (c) 1 (d) 2 (e) ∞

10. If $g(x)$ is the inverse function of $f(x)$, $f(2) = 3$ and $f'(2) = 4$, then $g'(3) =$
(a) 2/4 (b) $-1/4$ (c) 2/3 (d) 1/4 (e) 3/2

11. The equation $\ln(x) + \ln(9 - 2x) = 2\ln 2$ has two solutions. Give the product of the solutions.
(a) 3 (b) -3 (c) 1 (d) 2 (e) 2/3

PART 2: WORK-OUT PROBLEMS

Each problem is worth 8 points; partial credit is possible. Calculators are permitted ONLY during the second hour. **SHOW ALL WORK ON EACH PROBLEM.**

12. Find the equation of the tangent line to the curve $y = e^x \cos(x)$ at (0,1). Show all work.

13. At what points on the curve $x = t^3 + t, y = t^2$ is the tangent parallel to the line with equations $y = 3 + \frac{x}{2}$?

14. In this problem distances are measured in meters and time in seconds. The position of a moving particle is $\mathbf{r}(t) = (t^2 - 3t)\mathbf{i} - \frac{1}{t}\mathbf{j}$. Give the acceleration and the magnitude of the acceleration when $t = 2$, and include appropriate units with the answer.

15. A ladder 10 feet long leans against a vertical wall. The bottom of the ladder slides away from the wall and moves at 2 ft/s when it is 8 ft from the wall. How fast is the ladder's top sliding down the wall then?

16. Let $f(x) = \ln(x + 2), x > -2$.

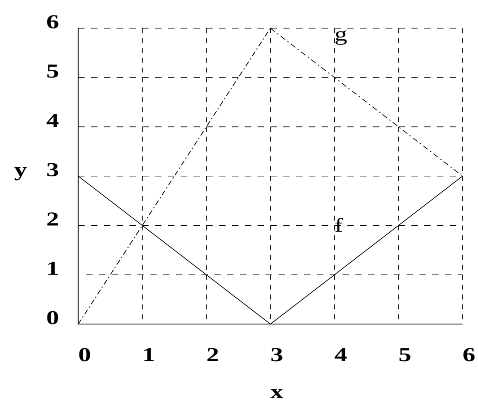
    (a) Find the inverse function of $f(x)$.

    (b) Give the range and domain of the inverse of $f(x)$.

17. Find $f'(x)$ for $f(x) = 2\cos(x) + [1 + \sin(x^2)]^{10}$. Show all work.

18. The sketch below shows two piecewise linear functions; the solid lines represent the graph of $y = f(x)$ and the dashed lines the graph of $y = g(x)$. Let $h(x) = g(f(x))$.

   (a) Find the value of $h(x)$ when $x = 5$.



   (b) Find the derivative of $h(x)$ when $x = 2$.