Spring 2004
Math 151
COMMON EXAM II
Test Form A

PRINT: Last Name: _____ **First Name:** _____

Signature: _____ **ID:** _____

Instructor's Name: _____ **Section #** _____

Instructor use only.

Multiple choice	
Q11	
Q12	
Q13	
Q14	
Q15	
Q16	
Q17	
Total	

INSTRUCTIONS

1. In **Part 1** (Problems 1–10), 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 11–17), write all solutions in the space provided. All work to be graded must be shown in the space provided. CLEARLY INDICATE YOUR FINAL ANSWERS.

Part I **Multiple Choice** **No Calculators**

(5 points each)

1. Find the derivative of the function $f(x) = \sqrt{x^3 + 3x - 1}$.

   (a) $f'(x) = \dfrac{1}{2\sqrt{3x^2+3}}$,

   (b) $f'(x) = \dfrac{1}{2\sqrt{x^3+3x-1}}$,

   (c) $f'(x) = \dfrac{3}{2}\sqrt{x} + \dfrac{\sqrt{3}}{2\sqrt{x}}$,

   (d) $f'(x) = \dfrac{3x^2+3}{2\sqrt{x^3+3x-1}}$,

   (e) $f'(x) = \dfrac{\sqrt{3x^2+3}}{2\sqrt{x^3+3x-1}}$

2. With $y = f(u)$ and $u = g(x)$, calculate $\left.\dfrac{dy}{dx}\right|_{x=2}$ by using the relevant information:

   $f(2) = 1, f'(2) = 3, g(2) = 7, g'(2) = 5, f(7) = -2, f'(7) = 4, f(3) = -1, f'(3) = 0, g(1) = 3,$
   $g'(1) = -3, g(0) = 2, g'(0) = -1.$

   (a) 15 (b) 0 (c) -9 (d) -3 (e) 20

3. Consider the motion of a particle whose position vector at time t is given by $\vec{r}(t) = \langle t^3 - t, 2t^2 + 3t\rangle$. Find the acceleration at $t = 2$.

   (a) $\langle 6, 14\rangle$ (b) $\langle 11, 11\rangle$ (c) $\langle 12, 4\rangle$ (d) $\langle 8, 8\rangle$ (e) $\dfrac{22}{5}\langle 3, 1\rangle$

4. Find the inverse function of $f(x) = \dfrac{3x-5}{7x+2}$.

   (a) $f^{-1}(x) = \dfrac{7x+2}{3x-5}$

   (b) $f^{-1}(x) = \dfrac{\frac{1}{7}x - \frac{2}{7}}{\frac{1}{3}x + \frac{5}{3}}$

   (c) $f^{-1}(x) = \dfrac{41}{(7x+2)^2}$

   (d) $f^{-1}(x) = \dfrac{2x+7}{5x-3}$

   (e) $f^{-1}(x) = \dfrac{2x+5}{-7x+3}$

5. Consider the curve given by the parametric equations $x = t^2 + 3t$, $y = 3t^3 - t$. Find the slope of the tangent line at $t = 2$.

   (a) $\dfrac{1}{5}$ (b) 5 (c) $\dfrac{7}{50}$ (d) $\dfrac{50}{7}$ (e) It is undefined.

6. $e^{3\ln\sqrt{5} - 2\ln(3) + 7} =$

   (a) $3\sqrt{5} + 1$ (b) $e^3\sqrt{5} - 2$ (c) $3e^{\sqrt{5}+7}/(\ln 3)^2$ (d) $5\sqrt{5} - 9 + e^7$ (e) $\dfrac{5}{9}\sqrt{5}\, e^7$

7. Compute $\lim_{x\to 0} \dfrac{\tan x - \sin x}{x^2}$.

(a) 0 (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{6}$ (e) The limit does not exist.

8. Find the derivative of $f(x) = e^{3x} - 7e^{-2x} + 5e^{x} + 3e^{-x}$.

(a) $f'(x) = 3e^{2x} + 14e^{-3x} + 5 - 3e^{-2x}$
(b) $f'(x) = 3e^{3x} + 14e^{-2x} + 5e^{x} - 3e^{-x}$
(c) $f'(x) = e^{3x} - 7e^{-2x} + 5e^{x} + 3e^{-x}$
(d) $f'(x) = 3xe^{3x-1} + 14xe^{-2x-1} + 5xe^{x-1} - 3xe^{-x-1}$
(e) $f'(x) = 3e^{x} - 14e^{-x} + e^{5x} - e^{3x}$

9. Approximate $\sqrt{79}$ by using the linear approximation of $f(x) = \sqrt{x}$ at $x = 81$.

(a) $\frac{80}{9}$ (b) $\frac{82}{9}$ (c) 9 (d) $\frac{161}{81}$ (e) $\frac{163}{81}$

10. Consider the motion of a particle whose position at time t is given by the parametric equations $x = \sin 3t, y = t + \cos 2t$. Find the speed of the particle at time $t = 0$.

(a) 1 (b) 0 (c) $\sqrt{2}$ (d) $\sqrt{14}$ (e) $\sqrt{10}$

Part II **Partial Credit** **Calculators Permitted**

Calculators are permitted for *checking* answers. Show your work to obtain credit. No credit will be given for unsupported answers or for answers supported only by calculator.

11. A car is traveling along a straight road at 60 mph. A camera mounted on a tripod 2 miles from the road is following the car's progress. How many radians per hour is the camera rotating when the car has already passed the point nearest the camera and is 3 miles beyond that point? (8 points)

12. Newton's method for solving the equation $f(x) = 0$ involves generating a sequence $x_1, x_2, x_3, \ldots$ of approximations based on the formula

$$x_{n+1} = x_n - f(x_n)/f'(x_n).$$

(a) Find a polynomial equation $f(x) = 0$ whose solution is $\sqrt[3]{5}$. (1 point)

(b) With $x_1 = 2$ as a first (lousy) guess at $\sqrt[3]{5}$, apply Newton's method to this equation. Calculate x_2 and x_3 only. (3 points)

13. Solve the equation $\ln x + \ln(x-3) = \ln 5 + 3\ln 2$. (5 points)

14. Differentiate the following functions. (4 points each)

(a) $f(x) = (x^3 + x + 2)^{17}$

(b) $f(x) = e^{1+x+\sqrt[3]{x}}$

(c) $f(x) = \sin^3 x + \tan^2 5x$

15. Calculate the following limits. (3 points each)

(a) $\lim\limits_{x\to 0} \dfrac{\tan 3x \sin 5x}{2x^2}$

(b) $\lim\limits_{x\to \pi} \dfrac{\cos\left(\frac{1}{2}x\right)}{x-\pi}$

16. Find the equation of the line tangent to the curve $x^2y^2 + 5x^3y + xy^3 = 7$ at the point (1,1). (8 points)

17. Find the quadratic approximation of $\sqrt[3]{x}$ for x near 8. (7 points)