# Spring 2003
# Math 151
# COMMON EXAM 1
# Test Form A

**PRINT: Last Name:** ______________________________ **First Name:** ______________________

**Signature:** __________________________________________ **ID:** _________________________

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

## INSTRUCTIONS

1. In **Part 1** (Problems 1–11), 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 12–16), 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 I:** 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 one hour.

1. Calculate $\lim_{x\to\infty} \sin x$.
   - (a) $0$
   - (b) $1$
   - (c) $-1$
   - (d) The limit does not exist.
   - (e) $\frac{1}{2}$

2. Find the derivative of $f(x) = 3x^3 - 5x^2 + x - 7$.
   - (a) $x^2 - \frac{5}{2}x + 1$
   - (b) $9x^2 - 10x + 1$
   - (c) $\frac{3}{4}x^4 - \frac{5}{3}x^3 + \frac{1}{2}x^2 - 7x$
   - (d) $3x^2 - 5x + 1$
   - (e) $6x^2 - 5x$

3. Evaluate $\lim_{x\to\infty} \frac{5x^2 + 2x + 3}{3x^2 + 5x + 2}$
   - (a) $\frac{3}{2}$
   - (b) $\frac{2}{5}$
   - (c) $0$
   - (d) $\frac{5}{3}$
   - (e) $\infty$

4. A line is given by the parametric equations $x = 2t + 3$, $y = 7t - 2$. Find the slope of this line.
   - (a) $\frac{7}{2}$
   - (b) $-\frac{2}{7}$
   - (c) $\frac{3}{2}$
   - (d) $-\frac{2}{3}$
   - (e) $\frac{2}{7}$

5. The polynomial $x^3 + 3x - 5$ has only one real root. In which interval does it lie?

(a) $0 < x < 1$

(b) $-1 < x < 0$

(c) $1 < x < 3$

(d) $-5 < x < -1$

(e) $3 < x < 7$

6. Evaluate $\lim_{x \to -1} \dfrac{x^3 - x}{x^2 + 5x + 4}$.

(a) $0$

(b) $1$

(c) $\dfrac{2}{3}$

(d) $\dfrac{2}{5}$

(e) $\infty$

7. Consider the function $f(x) = \left\{ \begin{array}{ll} x^2 - c, & x \leq 1 \\ 2c - x, & x > 1 \end{array} \right\}$. For what value of $c$ is $f(x)$ continuous at $x = 1$?

(a) $c = 1$

(b) $c = \dfrac{2}{3}$

(c) $c = 0$

(d) $c = \dfrac{1}{2}$

(e) $c = \dfrac{1}{3}$

8. Find the vertical asymptotes of $y = \dfrac{2x^2 + 5x + 2}{3x^2 + 7x + 2}$.

(a) $x = -\dfrac{1}{3}$

(b) $x = -2$ and $x = -\dfrac{1}{3}$

(c) $x = -\dfrac{1}{2}$

(d) $x = -\dfrac{1}{2}$ and $x = -2$

(e) There are no vertical asymptotes.

9. Determine which vector is perpendicular to the line passing through the points (2,1) and (3,5).

   (a) $\langle 2, 1\rangle$
   (b) $\langle -1, 2\rangle$
   (c) $\langle 1, 4\rangle$
   (d) $\langle -4, 1\rangle$
   (e) $\langle 5, 3\rangle$

10. With $h(x) = f(x)g(x)$, suppose $f(2) = 1$, $f'(2) = 3$, $g(2) = 5$, and $g'(2) = 1$. Then

   (a) $h'(2) = 3$
   (b) $h'(2) = 16$
   (c) $h'(2) = 8$
   (d) $h'(2) = 4$
   (e) $h(x)$ is nondifferentiable at $x = 2$.

11. With $h(x) = f(x)g(x)$, suppose $\lim_{x\to c} f(x) = 5$, $f(c) = 3$, $\lim_{x\to c} g(x) = 7$, and $g(c) = 2$. Then

   (a) $\lim_{x\to c} h(x) = 31$
   (b) $\lim_{x\to c} h(x) = 35$
   (c) $\lim_{x\to c} h(x) = 6$
   (d) $\lim_{x\to c} h(x) = 7$
   (e) $\lim_{x\to c} h(x)$ does not exist.

**Part II:** Work-Out Problems.
Partial credit is possible. Calculators are permitted during the *second hour only*. *Show your work.* An answer with no work is *not acceptable.*

12. Consider the function $f(x) = \dfrac{1}{2x+3}$.

    (a) Calculate $f'(1)$ using only the definition of derivative. (6 points)

    (b) Find the equation of the line tangent to the curve $y = \dfrac{1}{2x+3}$ at the point $\left(1, \dfrac{1}{5}\right)$. (4 points)

13. Find parametric equations for the line passing through the points $(-1, 2)$ and (5,1). (8 points)

14. Find the derivative of $f(x)$ in each case. (4 points each)

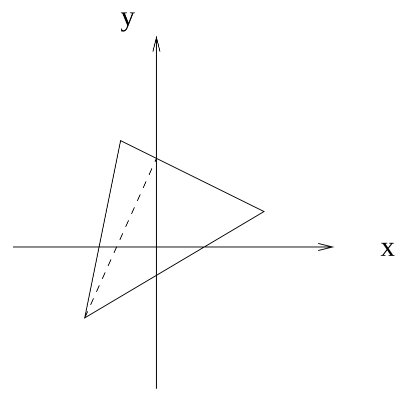
(a) $f(x) = \dfrac{5x - 2}{x^2 + 3x + 1}$.

(b) $f(x) = (3x^3 - 2x^2 + x - 7)(x^2 + 4x - 3)$

(c) $f(x) = x^3\sqrt{x}$.

15. Find $\lim_{x \to 0} (\sin x) \sin\left(\dfrac{1}{x}\right)$. Justify your answer. (7 points)

16. Consider the triangle whose vertices are $(-1,3)$, (3,1), and $(-2,-2)$. Choosing the segment $\overline{(-1,3)(3,1)}$ as the base of the triangle, find the altitude. (9 points)




17. Calculate the following limits. (5 points each)

(a) $\lim_{x\to 4} \frac{\sqrt{x}-2}{x^2-16}$

(b) $\lim_{x\to\infty} \frac{\sqrt{x^2+x+1}}{3x+4}$