MATH 140A MIDTERM EXAMINATION II October 27, 2003

Name_____ ID #_____ Section #_____

There are 8 multiple choice questions, 10 True/False questions, and 4 free response questions. **To receive full credit for free response questions (problems 10, 11, 12 and 13) all work must be shown.**

THE USE OF CALCULATORS IS NOT PERMITTED IN THIS EXAMINATION.

THERE ARE 13 PROBLEMS ON 10 PAGES, INCLUDING THIS ONE.
CHECK YOUR BOOKLET NOW.

The space below is for the instructor's use.

MC _____

T/F _____

10. _____

11. _____

12. _____

13. _____

Total _____

1. (5 pts.) $\tan(-\pi/3) =$

   a) -1

   b) $-1/2$

   c) $-1/\sqrt{2}$

   d) $-\sqrt{3}/2$

   e) $-\sqrt{3}$

2. (5 pts.) If a ball is thrown vertically upward with a velocity of 96 ft/s, then its height after t seconds is $s = 96t - 16t^2$ in feet. What is the maximum height reached by the ball?

   a) 56 ft

   b) 64 ft

   c) 72 ft

   d) 144 ft

   e) 288 ft

3. (5 pts.) If θ is an obtuse angle with $\sin\theta = 3/5$, then

   a) $\tan\theta = 3/4$

   b) $\tan\theta = -4/5$

   c) $\cos\theta = -3/5$

   d) $\cos\theta = -4/5$

   e) $\cot\theta = 3/4$

4. (5 pts.) $\lim_{x\to 0} \dfrac{x^2 - \sin^2(3x)}{2x^2} =$

   a) -1

   b) -2

   c) -3

   d) -4

   e) Does not exist.

5. (5 pts.) Let x be such that $\sin x = \dfrac{2\sqrt{6}}{7}$ and $\dfrac{\pi}{2} < x < \pi$. Then $\sin 2x =$

a) $20\sqrt{6}/49$

b) $-5/49$

c) $1/49$

d) $-10\sqrt{6}/49$

e) $-20\sqrt{6}/49$

6. (5 pts.) $\dfrac{d}{dx}(\sec^2 x - \tan^2 x) =$

a) $2\sec^2 x \tan x$

b) $2\sec x - 2\tan x$

c) $(\sec^3 x - \tan^3 x)/3$

d) 1

e) 0

7. (5 pts.) $\lim_{h\to 0} \dfrac{\cos(\frac{\pi}{3}+h)-\frac{1}{2}}{h} =$

a) $-1/2$

b) $1/2$

c) $\sqrt{3}/2$

d) $-\sqrt{3}/2$

e) Does not exist.

8. (5 pts.) In a circle of radius 2, the area of the sector with central angle 45^0 is

a) $\pi/2$

b) π

c) $\pi/4$

d) $\pi/3$

e) $2\pi/3$

9. (10 pts. 2 pts. each) True or False: **(Circle the appropriate letter.)**

a) T F $\dfrac{d}{dx}(3\pi^2) = 6\pi$

b) T F $\dfrac{\sin x}{x} = 1$ for any real number x.

c) T F $\lim\limits_{x\to 0} \dfrac{\cos x}{x} = 1$

d) T F $30^0 = \pi/3$

e) T F $\cos \pi = -1$

f) T F If $f'(a)$ exists, then $\lim\limits_{x\to a} f(x) = f(a)$.

g) T F If the graph of f has a vertical tangent at a then f is differentiable at a.

h) T F If $g(x) = x^5$, then $\lim\limits_{x\to 2} \dfrac{g(x) - g(2)}{x - 2} = 80$.

i) T F If f and g are differentiable, then $\dfrac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$.

j) T F If f and g are differentiable, then $\dfrac{d}{dx}[f(x)g(x)] = f'(x)g'(x)$.

10. (10 pts.)

(a)(4 pts.)State the limit definition of the derivative $f'(x)$ of a function $f(x)$. (Your answer must be exact. Partial credit will not be given for this part.)

(b)(6 pts.) Use the definition of derivative to compute $f'(x)$ if $f(x) = 1 - x^2$. (Warning: No credit will be awarded for just giving the answer. You **must use the definition** from part (a)).

11. (10 pts.) Let $f(x) = \dfrac{2x^2}{x+1}$.

(a) Compute $f'(x)$.

(b) Find an equation of the tangent line to the graph of f at the point $(1, 1)$.

12. (10 pts.) Find all the solutions of

$$2\cos^2 x + 7\cos x - 4 = 0$$

on the interval $[0, 2\pi)$.

13. (10 pts.) The position x of a bee flying along a straight line is given by $x = 2t^3 - 6t^2 + 3$, where t represents time.

(a) Derive the expression for the velocity v of the bee as a function of t.

(b) When does the bee change the direction of motion, if ever? Give the $x-$coordinate at the place where it changes direction.

(c) Find the distance travelled by the bee between $t = 0$ and $t = 3$.