Multiple Choice

1.(5 pts.) If

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

find the local maxima and minima of $f(x)$ assuming that the domain of $f(x)$ is all $x \neq -1$.
Note: you are given f', not f.

(a) f has a local minimum at $x = 0$; f has local maxima at $x = 1$ and $x = -1$.

(b) There are no local minima or local maxima.

(c) f has a local minimum at $x = 0$; there is no local maximum.

(d) f has a local minimum at $x = 0$; f has a local maximum at $x = 1$.

(e) f has a local minimum at $x = 1$; f has a local maximum at $x = -1$.

2.(5 pts.) If

$$f'(x) = \frac{x}{1+x^2}$$

and if $f(x)$ is defined for all x, find the x coordinates of the points of inflection.
Note: you are given f', not f or f''.

(a) Not enough information is given to find the points of inflection.

(b) $x = 1$.

(c) $x = 0$.

(d) $x = -1$ and $x = 1$.

(e) There are no points of inflection.

3.(5 pts.) If

$$y = \frac{\sqrt[3]{3x^3 + 2x + 3}}{2x + 4} \ ,$$

find the horizontal and vertical asymptotes.

(a) $y = \dfrac{4}{3}$ is a horizontal asymptote; $x = 2$ is a vertical asymptote.

(b) There are no horizontal asymptotes; $x = -2$ is a vertical asymptote.

(c) $y = \dfrac{3}{2}$ is a horizontal asymptote; $x = -2$ is a vertical asymptote.

(d) $y = 0$ is a horizontal asymptote; $x = -2$ is a vertical asymptote.

(e) $y = \dfrac{\sqrt[3]{3}}{2}$ is a horizontal asymptote; $x = -2$ is a vertical asymptote.

4.(5 pts.) Which formula below is the limit of Riemann sums for $\displaystyle\int_0^1 (1 - x^2)dx$ using the **left-hand-end-point** Riemann sums?

(a) $\displaystyle\lim_{n\to\infty} \sum_{i=0}^{n-1} \left(1 - \frac{i^2}{n^2}\right) \cdot \frac{1}{n}$

(b) $\displaystyle\lim_{n\to\infty} \sum_{i=0}^{n} \left(1 - \frac{i^2}{n^2}\right) \cdot \frac{1}{n}$

(c) $\displaystyle\lim_{n\to\infty} \sum_{i=0}^{n-2} \left(1 - \frac{i^2}{n^2}\right) \cdot \frac{1}{n}$

(d) $\displaystyle\lim_{n\to\infty} \sum_{i=1}^{n} \left(1 - \frac{i^2}{n^2}\right) \cdot \frac{1}{n}$

(e) $\displaystyle\lim_{n\to\infty} \sum_{i=2}^{n} \left(1 - \frac{i^2}{n^2}\right) \cdot \frac{1}{n}$

5.(5 pts.) Calculate the following indefinite integral

$$\int \frac{x^2 + 1}{\sqrt{x}} dx =$$

(a) $\dfrac{\frac{x^3}{3} + x}{\frac{2}{3}x^{\frac{3}{2}}} + C.$

(b) $\dfrac{2}{5}x^{\frac{5}{2}} + 2x^{\frac{1}{2}} + C.$

(c) $\dfrac{2}{5}x^{\frac{5}{2}} + 2x^{\frac{1}{2}}.$

(d) $\dfrac{2}{5}x^{\frac{5}{2}} + \dfrac{2}{3}x^{\frac{1}{2}}.$

(e) $\dfrac{2}{5}x^{\frac{5}{2}} + \dfrac{2}{3}x^{\frac{1}{2}} + C.$

6.(5 pts.) Calculate the following definite integral

$$\int_0^3 |x-1|dx =$$

(a) $\frac{5}{2}$. (b) -2. (c) $\frac{9}{2}$. (d) $\frac{3}{2}$. (e) 1.

7.(5 pts.) Let $g(x) = \int_2^{\sec x} \sqrt{1+t^2}\, dt$ with $0 \le x \le \frac{\pi}{3}$. What is $g'(x)$?

(a) $\left(\sqrt{1+\sec^2 x}\right)\sec x \tan x$. (b) $g'(x)$ does not exist.

(c) $\left(\sqrt{1+x^2}\right)\sec x \tan x$. (d) $\sqrt{1+\sec^2 x}$.

(e) $\left(\sqrt{1+\sec^2 x}\right)\tan^2 x$.

8.(5 pts.) What is the indefinite integral

$$\int x\sqrt{x-1}dx = ?$$

(a) $\frac{x^3}{3} - \frac{x^2}{2} + C$. (b) $\frac{2}{5}x^{\frac{5}{2}} + \frac{2}{3}x^{\frac{3}{2}}$.

(c) $\frac{2}{5}x^{\frac{5}{2}} + \frac{2}{3}x^{\frac{3}{2}} + C$. (d) $\frac{2}{5}(x-1)^{\frac{5}{2}} + \frac{2}{3}(x-1)^{\frac{3}{2}}$.

(e) $\frac{2}{5}(x-1)^{\frac{5}{2}} + \frac{2}{3}(x-1)^{\frac{3}{2}} + C$.

9.(5 pts.) Find the definite integral

$$\int_{-1}^1 x^3(x^2+1)^2\, dx\ .$$

(a) $\frac{17}{12}$. (b) $\frac{17}{24}$. (c) 2. (d) 0. (e) 1.

10.(5 pts.) Let $A = \displaystyle\int_0^1 \frac{x}{x+1} dx$. Which of the following is true of A?

(a) $\frac{1}{2} \leq A \leq \frac{3}{4}$. (b) $\frac{-1}{4} \leq A \leq 0$. (c) A is undefined.

(d) $0 \leq A \leq \frac{1}{2}$. (e) $A = 0$.

Partial Credit

You must show your work on the partial credit problems to receive credit!

11.(10 pts.) Answer the 8 questions, 1, 1a)-1c) and 2, 2a)-2c) below, and use your answers to graph

$$y = x + 2\cos x$$

on the interval $[0, 2\pi]$? Use the back of the previous page for your calculations.

1) $y' =$ _____

   a) On what interval(s) is y decreasing? _____

   b) Give both coordinates of any local maxima. _____

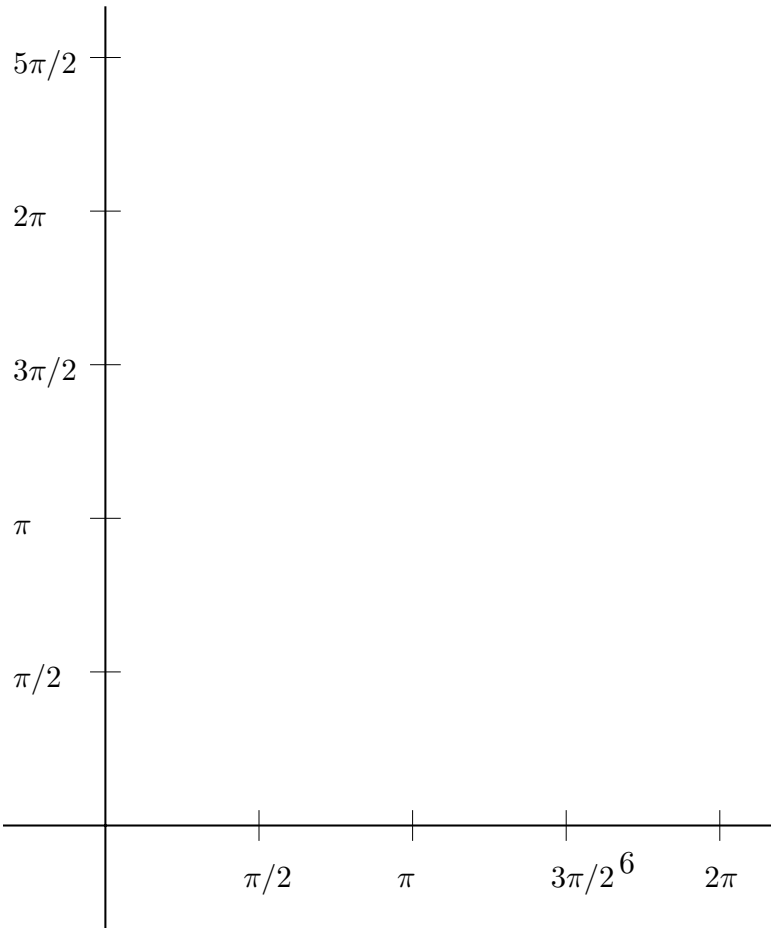
   c) Give both coordinates of any local minima. _____

2) $y'' =$ _____

   a) On what interval(s) is y concave down? _____

   b) Give both coordinates of any points of inflection. _____

   c) Give the slope of the tangent line at any points of inflection._____



12.(10 pts.) A ball is thrown upward from a height of 256 feet above the ground, with an initial velocity of 96 feet per second. The velocity of the ball at time t is $96 - 32t$ feet per second.

(a) Find $s(t)$, the function giving the height of the ball at time t.

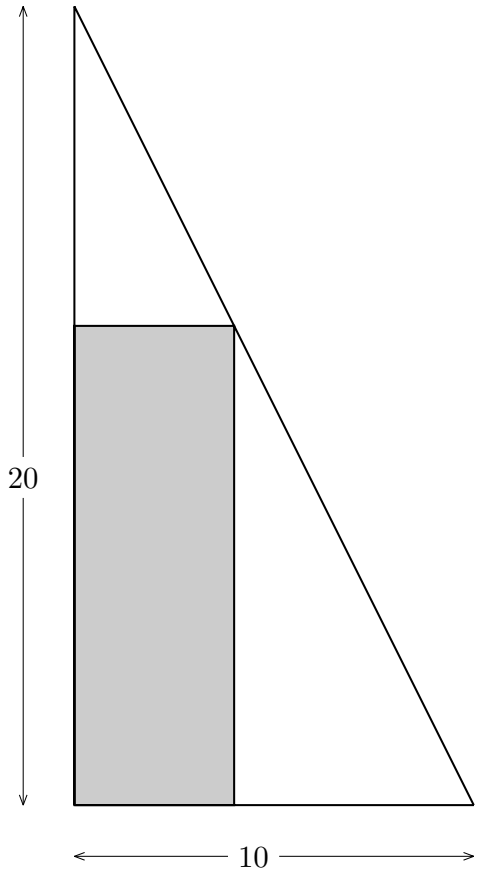
(b) How long will the ball take to reach the ground?

(c) How high will the ball go?

13.(10 pts.) Calculate the area bounded by the curves $y = x^2 + 2x + 3$ and $y = 2x + 4$.

14.(10 pts.) An open rectangular box (that is, a box with no top) with square base and with a volume of 125 cubic feet is needed. Material for the base costs \$6 per square foot, and material for the sides costs \$3 per square foot. **Determine the dimensions** of the box that will minimize the cost of materials. *Justify that your answer is a minimum.*

15.(10 pts.) **Determine the dimensions** of the rectangle of the largest area that can be inscribed in a right triangle with base 10 centimeters and height 20 centimeters. *Justify that your answer is a maximum.*



Name: ANSWERS

Instructor: ANSWERS

Exam III
December 3, 2002

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for one hour.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 7 pages of the test.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(•)	(d)	(e)
2.	(a)	(b)	(c)	(•)	(e)
3.	(a)	(b)	(c)	(d)	(•)
4.	(•)	(b)	(c)	(d)	(e)
5.	(a)	(•)	(c)	(d)	(e)
6.	(•)	(b)	(c)	(d)	(e)
7.	(•)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(•)
9.	(a)	(b)	(c)	(•)	(e)
10.	(a)	(b)	(c)	(•)	(e)

DO NOT WRITE IN THIS BOX!

Total multiple choice: _____

11. _____

12. _____

13. _____

14. _____

15. _____

Total: _____