

TIMED

Name _____1

Student Number _____

Section Number _____

Instructor _____

Math 112 – Winter 2002

Departmental Final Exam Form B

Instructions:

- The time limit is 3 hours. There is a 10 minute grace period for turning your exam in. After that you will lose 1 point for each minute the exam is late.
 - Be sure to encode your name and student ID number on the bubble sheet.
 - Problems 1 through 8 are multiple choice questions. Their answers go on the bubble sheet.
 - Write the solutions to problems 9 through 17 directly on the exam paper in the space provided.
 - Please write neatly and show all work to receive full credit.
 - Work on scratch paper will not be graded.
 - Notes, books, and calculators are not allowed.
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For administrative use only:

M.C.	/24
9a	/4
9b	/4
9c	/4
10	/5
11	/10
12	/10
13	/8
14a	/5
14b	/5
14c	/5
15	/6
16	/5
17	/5
Total	/100

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PART I: MULTIPLE CHOICE (3 POINTS EACH)

1. $f(x) = x^3 + 9x^2 + 27x + 27$ has a point of inflection at $x =$
 (a) -2 (b) -1 (c) -3 (d) 2
 (e) $-\frac{7}{2}$ (f) -4 (g) -5 (h) None of the above
2. If $\lim_{x \rightarrow -2} f(x) = 7$, then $f(-2)$
 (a) Equals 7. (b) Is arbitrarily close to 7.
 (c) Does not exist. (d) Cannot be determined from the given information.
3. Find $\lim_{x \rightarrow 0} \left(\frac{\sqrt{3+x} - \sqrt{3}}{x} \right)$
 (a) 1 (b) 6 (c) $\frac{5}{3\sqrt{2}}$ (d) $\frac{0}{0}$
 (e) $\frac{1}{2\sqrt{2}}$ (f) $\frac{1}{2\sqrt{3}}$ (g) $\frac{1}{4}$ (h) None of the above
4. Use differentials to approximate $\sqrt{66}$.
 (a) $8\frac{1}{8}$ (b) $9\frac{1}{8}$ (c) $6\frac{1}{8}$ (d) $8\frac{3}{16}$
 (e) $8\frac{1}{9}$ (f) $8\frac{1}{10}$ (g) $8\frac{1}{4}$ (h) None of the above
5. Find $\int \frac{\cos x}{1 + \sin x} dx$.
 (a) $\ln|1 + \sin x| + C$ (b) $\ln|2 + \sin x| + C$ (c) $\ln|1 + \sin x| + \sin x + C$
 (d) $\ln|1 + \sin x| + 3 \sin 2x + C$ (e) $\ln|1 + 2 \sin x| + C$ (f) None of the above
6. Find $\frac{d}{dx} (x \sin x + \cos x)$
 (a) $\sin x + x \cos x$ (b) $x \cos x$ (c) $\sin x$
 (d) 1 (e) 0 (f) $1 + x \cos x$
 (g) $2 + x \cos x$ (h) None of the above
7. Which of the following equations is false?
 (a) $\int_0^1 x^2 dx = 1/3$ (b) $\int_0^\pi \sin x dx = 2$ (c) $\int_{-4}^4 (x^5 + 4x^3 + x) dx = 0$
 (d) $\int_{-1}^1 \frac{1}{x^2} dx = -2$ (e) $\int_0^{10} e^{-x} dx = 1 - e^{-10}$ (f) $\int_0^{\pi/4} \sec^2 x dx = 1$
 (g) $\int_0^1 \cosh x dx = \sinh 1$ (h) $\int_{-4}^4 \sqrt{16 - x^2} dx = 8\pi$ (i) $\int_0^1 \sqrt{x} dx = \frac{2}{3}$
 (j) None of the above
8. Find $\lim_{x \rightarrow 0} \frac{\tan x}{x \cos x}$.
 (a) $\frac{3}{2}$ (b) 0 (c) $\frac{5}{2}$ (d) $\frac{7}{4}$
 (e) $\frac{7}{2}$ (f) $\frac{9}{2}$ (g) 1 (h) None of the above

PART II: WRITTEN SOLUTIONS

Neatly write solutions to each of the following questions in the space provided. Show your work.

9. (4 points each) Evaluate the following derivatives:

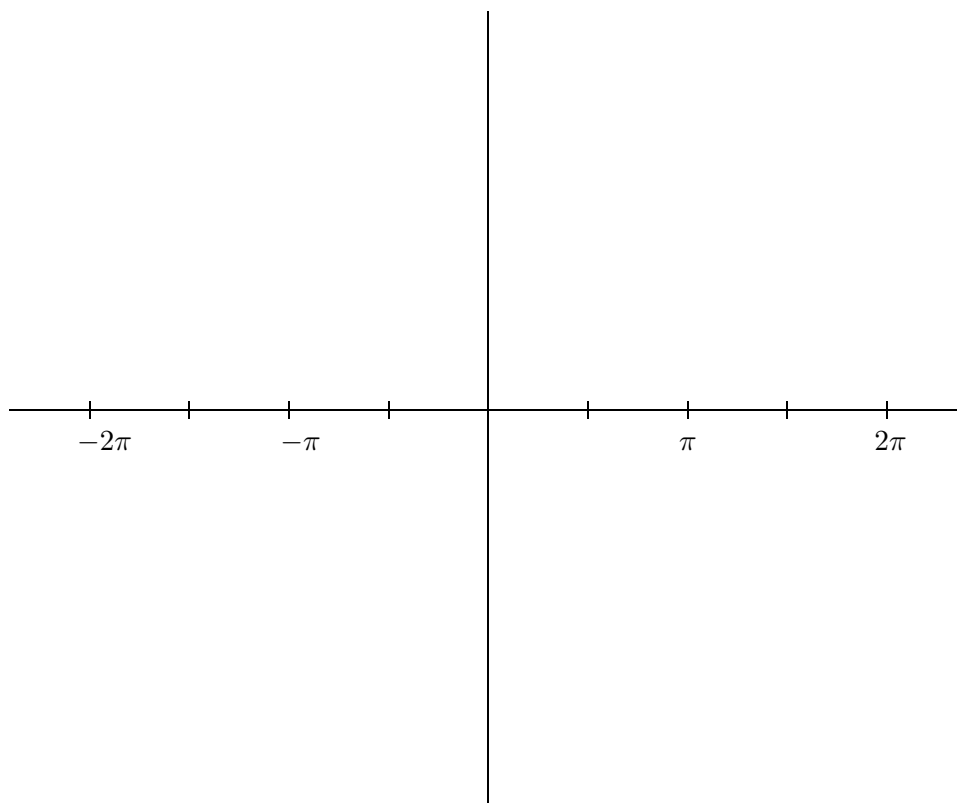
(a) $\frac{d}{dx} \left(\frac{\sin x}{x^2} \right)$

(b) $\frac{d}{dx} \left(x\sqrt{2x^2 + 1} \right)$

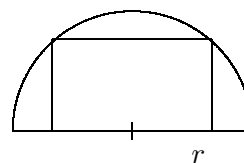
(c) $\frac{d}{dx} \left(\ln \left| \frac{x}{x+1} \right| \right)$

10. (5 points) Find the absolute maximum and absolute minimum of $f(x) = x + \frac{16}{x}$ on the interval $[1, 32]$.

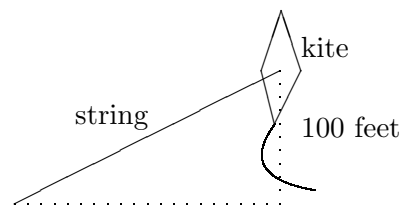
11. (10 points) Graph the function $y = (x/2) - \tan(x/4)$. Label on your graph the asymptotes and relative extreme points.



12. (10 points) Find the dimensions of the largest rectangle that can be inscribed in a semicircle of radius r where $r = 2$.



13. (8 points) A kite 100 feet above the ground is being blown away from the person holding its string in a direction parallel to the ground at the rate of 10 feet per second. At what rate must the string be let out when the length of string already let out is 200 feet?



14. (5 points each) Evaluate the following indefinite integrals:

(a) $\int_0^1 4x(x^2 + 1)^2 dx$

(b) $\int \frac{e^{1/x^2}}{x^3} dx$

(c) $\int_0^2 \frac{dx}{\sqrt{16 - x^2}}$

15. (6 points) Show the function $f(x) = \int_0^x \frac{dt}{1+t^2} + \int_0^{1/x} \frac{dt}{1+t^2}$ is a constant.

16. (5 points) Find the area of the region bounded by the curves $y = \frac{12}{x}$ and $y = 7 - x$.

17. (5 points) Find $\lim_{h \rightarrow 0} \frac{\frac{1}{\sqrt{x+h}} - \frac{1}{\sqrt{x}}}{h} =$