

Last Name:
Name:
Instructor:

Math 150
Group Final (Fall 2007)

You are not allowed to use notes, books, calculators, personal stereos or cell phones.

You have exactly two hours.

Write clearly so that you can avoid mistakes and count on partial credits. Carry out the obvious simplifications so that you can display your answers in an easily readable manner.

The following list is for the recording of the points only. Do not write your answers on this page.

Points

- 1 _____/4
- 2 _____/4
- 3 _____/4
- 4 _____/4
- 5 _____/4
- 6 _____/4
- 7 _____/4
- 8 _____/6
- 9 _____/8
- 10 _____/6
- 11 _____/8
- 12 _____/6
- 13 _____/8
- 14 _____/4
- 15 _____/4
- 16 _____/4
- 17 _____/6
- 18 _____/4
- 19 _____/8

Total: /100

1 (4 pts.) Determine

$$\lim_{x \rightarrow 2^-} \frac{x^2 + x - 6}{(x - 2)^2}$$

2 (4 pts.) Determine

$$\lim_{x \rightarrow +\infty} x2^{-x}.$$

by using **L'Hospital's Rule**.

3 (4 pts.) Determine

$$\lim_{x \rightarrow \pi/6} \frac{2 \sin(x) - 1}{6x - \pi}$$

In problems 4-7 determine $f'(x)$. Carry out the obvious simplifications.

4 (4 pts.)

$$f(x) = x^2 \cos\left(\frac{x}{2}\right)$$

5 (4 pts.)

$$f(x) = \ln\left((x+1)^{1/3}(x+2)\right)$$

6 (4 pts.)

$$f(x) = \arcsin(x^2)$$

7 (4 pts.)

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

(Reminder: Simplify the expression for $f'(x)$).

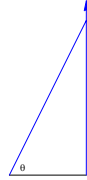
8. Let

$$f(x) = x^{3/4}$$

a) (4 pts.) Determine the linearization of f at 16 (i.e., the linear approximation to f based at 16).

b) (2 pts.) Make use of the result of part a) to approximate $(16.2)^{3/4}$

9 (8 pts.) An observer is tracking the vertical lift-off of a rocket from a horizontal distance of 4 km. The rocket is climbing at a rate of 400 km/min. Determine the rate of change of the angle between the ground level and the observer's line of sight at the instant the rocket is at a height of 8 km.



10 (6 pts.) Assume that $y(x)$ is defined implicitly by the equation

$$x^3 + y^3 - y + 2x = 9$$

and $y(1) = 2$. Determine $y'(1)$.

11 (8 pts.) Let

$$f(x) = -\frac{1}{12}x^4 - \frac{1}{3}x^3 + 4x^2$$

Determine the intervals on which the graph of f is concave up/concave down, and the x -coordinates of the points of inflection of the graph of f .

12 (6 pts.) Let

$$f(x) = x^3 + 3x^2 - 9x.$$

Determine the absolute maximum and the absolute minimum of f on the interval $[-2, 2]$.

13 Let

$$f(x) = \frac{1}{x^2 - x - 6}.$$

a) (4 pts.) Determine the domain of f . Make use of the first derivative test to determine the intervals on which f is increasing/decreasing and the points at which f has a local maximum or a local minimum.

b) (4 pts.) Determine the horizontal and vertical asymptotes of the graph of f (you need not justify your assertions). Sketch the graph of f . Indicate the vertical asymptotes and the local extrema clearly.

14 (4 pts.) Compute

$$\int_1^2 \frac{d}{dx} \left(\frac{1}{\sqrt{9-x^2}} \right) dx$$

15 (4 pts.) Determine

$$\frac{d}{dx} \int_{\pi/4}^x \cos(t^2) dt$$

16 (4 pts.) Determine

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

17 (6 pts.) Compute

$$\int_{e^2}^{e^4} \frac{\ln(x)}{x} dx$$

(Reminder: You need to carry out the obvious simplifications).

18 (4 pts.) Compute

$$\int \frac{1}{1+16x^2} dx$$

19 (8 pts.) Assume that the velocity of an object moving along a line is

$$\sin(t/4)$$

at time t , and its position at $t = 0$ is 4. Determine the position of the object at $t = 2\pi$.