

Name _____ ID _____ SEC _____

MATH 151 Final Exam Version A Fall 2004
Sections 501-503, 515-517 P. Yasskin

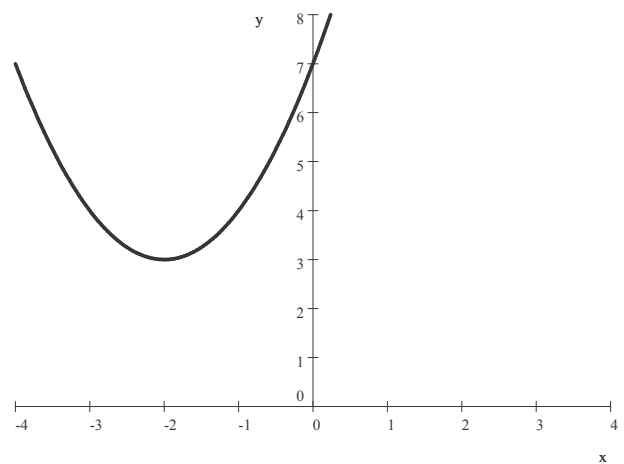
On the front of the Scantron and on this sheet
write your Name, your University ID and your Section.
Enter your Multiple Choice answers on the Scantron
and CIRCLE them on this sheet.

1-13	/52
14	/10
15	/10
16	/10
17	/10
18	/10
Total	/102

Multiple Choice: (4 points each. No part credit. No calculator.)

1. The plot at the right is which function?

- a. $(x + 2)^2 + 3$
- b. $(x + 2)^2 - 3$
- c. $(x - 2)^2 + 3$
- d. $(x - 3)^2 + 2$
- e. $(x + 3)^2 + 2$



2. Find the angle between the vectors $\vec{u} = (\sqrt{3}, 1)$ and $\vec{v} = (\sqrt{3} - 1, \sqrt{3} + 1)$.

- a. 30°
- b. 45°
- c. 60°
- d. 120°
- e. 135°

3. Compute $\lim_{x \rightarrow 3} \frac{x-3}{(x^2-9)}$

a. $\frac{1}{6}$

b. $\frac{1}{3}$

c. 0

d. $-\frac{1}{3}$

e. $-\frac{1}{6}$

4. For the function $f(x) = \begin{cases} 5+x & \text{if } x \leq 3 \\ x^2-2 & \text{if } x > 3 \end{cases}$ which of the following is FALSE?

a. $\lim_{x \rightarrow 3^-} f(x) = 8$

b. $\lim_{x \rightarrow 3^+} f(x) = 7$

c. $f(3) = 8$

d. f is continuous from the left at $x = 3$

e. f is continuous from the right at $x = 3$

5. Compute $\lim_{x \rightarrow 9^-} \frac{x+9}{x^2(x-9)}$

a. $-\infty$

b. $-\frac{2}{9}$

c. 0

d. $\frac{2}{9}$

e. ∞

6. If $f(x)$ satisfies $7x \leq f(x) \leq x^2 + 6$ for all $x \neq 1$ and $f(1) = 5$, then $\lim_{x \rightarrow 1} f(x) =$

a. undefined

b. 1

c. 5

d. 6

e. 7

7. Compute $\lim_{x \rightarrow e} \frac{\ln x - 1}{x - e}$

a. $-e$

b. $-\frac{1}{e}$

c. 0

d. $\frac{1}{e}$

e. $\frac{1}{2e}$

8. If $f(x) = \frac{\cos x}{1 + \sin x}$ then $f'(x) =$

a. $\frac{\sin x + 1}{\cos^2 x}$

b. $\frac{-\sin x + 1}{(1 + \sin x)^2}$

c. $\frac{-\sin x - 1}{(1 + \sin x)^2}$

d. $\frac{\sin x + 1}{(1 + \sin x)^2}$

e. $\frac{\sin x - 1}{(1 + \sin x)^2}$

9. If $f(x) = x^{\tan x}$ then $f'(x) =$

a. $(\tan x)x^{\tan x - 1}$

b. $x^{\tan x} \left[\frac{\tan x}{x} + \ln x \sec^2 x \right]$

c. $(\ln x)x^{\tan x}$

d. $(\ln x)x^{\tan x} \sec^2 x$

e. $x^{\tan x} \left[\frac{\tan x}{x} + \ln(\sec^2 x) \right]$

10. Find the critical numbers of the function $f(x) = |2x - x^2|$.

- a. -2
- b. $0, 1$
- c. $0, 2$
- d. $0, 1, 2$
- e. $-2, 0, 2$

11. If a car starts from rest at $x(0) = 0$ mi, and accelerates (and decelerates) at $a(t) = \sin(t)$ mi/hr², how far does it travel in 2π hours?

- a. 1 mi
- b. 2 mi
- c. $\frac{\pi}{2}$ mi
- d. π mi
- e. 2π mi

12. Compute $\int_4^9 (x^{1/2} + x^{-1/2}) dx$

- a. $-\frac{17}{432}$
- b. $\frac{17}{432}$
- c. $\frac{44}{3}$
- d. 24
- e. $\frac{4}{27}$

13. Compute $\int_0^{1/2} \frac{e^{2x}}{4 + e^{2x}} dx$

- a. $\ln \sqrt{5(4 + e)}$
- b. $\ln \sqrt{\frac{5}{4 + e}}$
- c. $\ln \sqrt{\frac{4 + e}{5}}$
- d. $\frac{1}{2} \ln \frac{1}{2} - \frac{1}{2} \ln 0$
- e. $\frac{1}{2} \ln \frac{1}{2}$

Work Out: (10 points each. Part credit possible. Calculators allowed. Show all work.)

14. Find the equation of the line tangent to $y = \frac{4e^x}{x}$ at $x = 2$.

15. If you start with 400 kg of radioactive element X which has a half life of 20 years, how much X will there be after 30 years?

16. The position and velocity of a mass hanging from a spring are related by $4x^2 + v^2 = 100$. At time $t = 7$, the position is $x(7) = 4$ and **increasing**.

a. (3 points) Find the velocity at $t = 7$, i.e. find $v(7) = \frac{dx}{dt}(7)$.

b. (5 points) Find the acceleration at $t = 7$, i.e. find $a(7) = \frac{dv}{dt}(7)$.

c. (2 points) Is the velocity increasing or decreasing? Why?

17. Find the area of the largest rectangle that can be inscribed in the triangle with vertices $(0,0)$, $(0,3)$ and $(4,0)$, if two edges of the rectangle are along the axes. Explain why your critical point is a local maximum.

18. Use the Method of Riemann Sums with equal intervals and Right Endpoints to compute the integral $\int_1^4 x(x-1) dx$.

Use the F.T.C. only to check your answer.

Hints: $\sum_{i=1}^n 1 = n$ $\sum_{i=1}^n i = \frac{n(n+1)}{2}$ $\sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$ $\sum_{i=1}^n i^3 = \left(\frac{n(n+1)}{2}\right)^2$