1-11	/55
12	/10
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15	/10
16	/10
Total	/105

Name____________________ ID___________

MATH 171 Final Exam Spring 2004

Sections 502 P. Yasskin

On the front of the Blue Book, on the Scantron and on this sheet
write your Name, your University ID and "Final Exam."

On the front of the Blue Book copy the Grading Grid shown at the right.

Enter your Multiple Choice answers on the Scantron
and CIRCLE them on this sheet.

Multiple Choice: (5 points each. No part credit.)

1. For what value(s) of p are the vectors $\vec{a} = (3,p)$ and $\vec{b} = (4,6)$, perpendicular?

a. 2 or -2 only

b. 2 only

c. -2 only

d. $\frac{1}{2}$ only

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

2. For what value of b does $\lim_{x\to 2} f(x)$ exist if $f(x) = \begin{cases} x+3 & \text{if } x<2 \\ 4 & \text{if } x=2 \\ x^2+b & \text{if } x>2 \end{cases}$

a. 1

b. 2

c. 3

d. 4

e. No values of b.

3. Compute $\lim_{x \to 3} \frac{x^2 - 4x + 3}{x^2 - 9}$

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

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

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

d. $\frac{2}{3}$

e. $\frac{5}{6}$

4. Compute $\lim_{x \to 0} \frac{\sin x - x}{x^3}$

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

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

c. 0

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

e. undefined

5. As $x \to \infty$, the function $f(x) = \sqrt{x^2 + 5x} - \sqrt{x^2 + 2x}$ has a horizontal asymptote at

a. $-\frac{3}{2}$

b. $-\frac{1}{2}$

c. 0

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

e. $\frac{3}{2}$

6. If $f(x) = \ln(x^2 + x)$ then $f'(2) =$

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

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

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

d. $\frac{2}{3}$

e. $\frac{5}{6}$

7. If Pete is walking up a hill whose slope is 0.2 and his horizontal velocity is $\frac{dx}{dt} = 6$ mi/hr, what is his vertical velocity, $\frac{dy}{dt}$?

a. 30 mi/hr

b. $0.03\bar{3}$ mi/hr

c. $0.83\bar{3}$ mi/hr

d. 1.2 mi/hr

e. 6.2 mi/hr

8. $x = 2$ is a critical point of the function $f(x) = \frac{1}{4}x^4 - 2x^3 + 6x^2 - 8x$.
By the Second Derivative Test, $x = 2$ is

a. a local minimum.

b. a local maximum.

c. an inflection point.

d. The Second Derivative Test FAILS.

9. If a rocket starts at $x(0) = 0$ m, with velocity $v(0) = 1$ m/sec, and accelerates at $a(t) = 4e^{-2t}$ m/sec^2, what is its position at $t = 1$ sec?

a. $2 - 16e^{-2}$

b. $2 + e^{-2}$

c. 3

d. $1 + e^{-2}$

e. $2 + 16e^{-2}$

10. Compute $\int_{1/2}^{1} \frac{1}{\sqrt{1 - x^2}}\, dx$

a. $\frac{\pi}{12}$

b. $\frac{\pi}{6}$

c. $\frac{\pi}{4}$

d. $\frac{\pi}{3}$

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

11. Compute $\int_{0}^{\pi} e^{\cos x} \sin x \, dx$

a. 0

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

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

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

e. $-e$

Work Out: (10 points each. Part credit possible.)

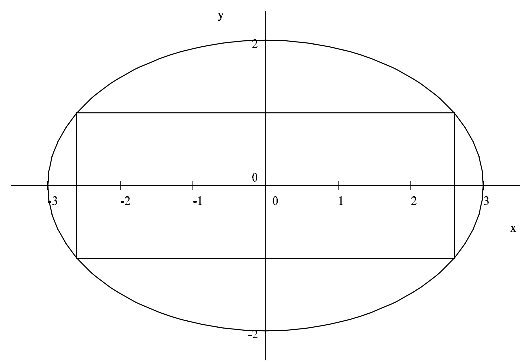
Start each problem on a new page of the Blue Book. Number the problem. Show all work.

12. Find the equation of the line tangent to $y = x^2$ at the general point $x = a$.
For what value(s) of a does the tangent line pass through the point $(3, 8)$?

13. The area of a rectangle is held constant at 36 cm^2 while the length and width are changing. If the length is currently 3 cm and is increasing at 2 cm/min, what is the width, is it increasing or decreasing and at what rate? Write your answer using sentences.

14. Determine exactly how many real solutions there are to the equation $x^{12} + x^4 + x^2 - 2 = 0$.
Use sentences and name any theorems you use.
Hint: Factor an x out of the derivative.

15. Find the dimensions and area of the largest rectangle that can be inscribed in the ellipse $4x^2 + 9y^2 = 36$.



16. Use the Method of Riemann Sums with Right Endpoints to compute the integral $\int_2^7 8(x-2)^3\,dx$.
Use the F.T.C. only to check your answer.

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