Name_____ ID_____

MATH 171 Exam 3 Spring 2004

Sections 502 P. Yasskin

1-10	/60
11	/15
12	/10
13	/15
Total	/100

On the front of the Blue Book, on the Scantron and on this sheet
write your Name, your University ID and "Exam 3."
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: (6 points each. No part credit.)

1. Find the absolute minimum and absolute maximum values of the function $f(x) = x^3 - \frac{9}{2}x^2 + 14$ on the interval $[-2, 4]$.

a. minimum $= -12$, maximum $= 6$

b. minimum $= -12$, maximum $= 14$

c. minimum $= -12$, maximum $= \frac{1}{2}$

d. minimum $= \frac{1}{2}$, maximum $= 14$

e. minimum $= \frac{1}{2}$, maximum $= 6$

2. Where is $f(x) = \frac{1}{4}x^4 - 6x^2$ concave up?

a. $x < -2$ or $x > 2$

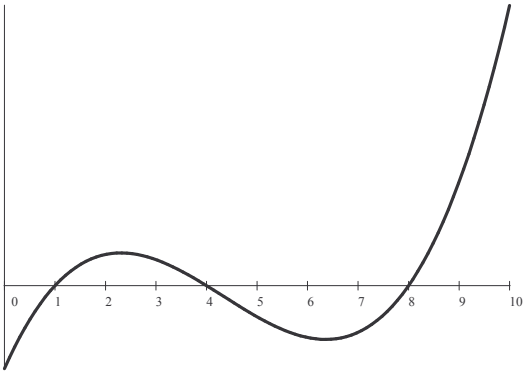
b. $-2 < x < 2$

c. $x < -\sqrt{12}$ or $0 < x < \sqrt{12}$

d. $-\sqrt{12} < x < 0$ or $x > \sqrt{12}$

e. $-\sqrt{12} < x < \sqrt{12}$

3. At the right is the graph of $y = f'(x)$.
Where is $f(x)$ increasing?



a. $[0, 2.5]$ and $[6.5, 10]$

b. $[0, 1]$ and $[4, 8]$

c. $[2.5, 6.5]$

d. $[1, 4]$ and $[8, 10]$

e. $[4.5, 10]$

4. The graph of $y = f'(x)$ appears in the previous problem. Where does $f(x)$ have a local maximum?

a. 1 and 8 only

b. 2.5 only

c. 4 only

d. $1,\ 4$ and 8 only

e. 2.5 and 10 only

5. Find all critical points of the function $f(x) = \sin x + \cos x$ on the interval $[0, 2\pi]$.

a. $\frac{\pi}{4}$ and $\frac{5\pi}{4}$ only

b. $\frac{\pi}{4}$ only

c. $\frac{5\pi}{4}$ only

d. $\frac{3\pi}{4}$ and $\frac{7\pi}{4}$ only

e. $\frac{3\pi}{4}$ only

6. A rocket starts at rest at ground level. It's vertical acceleration is $a(t) = 64\pi \sin(2t) - 32$ ft/sec^2 where t is in sec. What is it's velocity at $t = \frac{\pi}{2}$ sec?

a. 16π

b. 32π

c. 48π

d. 64π

e. 72π

7. Compute $\int_0^1 e^x \, dx.$

a. e^2

b. $\frac{e^2}{2}$

c. $\frac{e^2}{2} - e$

d. e

e. $e - 1$

8. Find the area under $y = x^3$ between $x = 0$ and $x = 4.$

a. 8

b. 16

c. 32

d. 64

e. 128

9. Compute $\int_0^1 x^2 \sin(4x^3) \, dx.$

a. $12 - 12\cos 4$

b. $12\cos 1 - 12$

c. $\frac{1}{12} - \frac{1}{12}\cos 4$

d. $\frac{1}{12}\cos 4 - \frac{1}{12}$

e. $\frac{1}{12}\cos 1 - \frac{1}{12}$

10. Compute $\int_1^e \frac{(\ln x)^2}{x}\,dx$.

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

b. 2

c. $\frac{e^3-1}{3}$

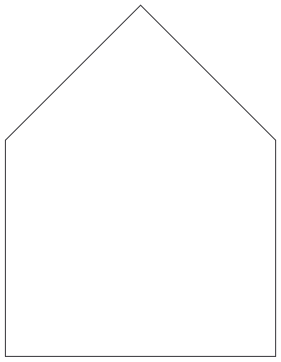
d. $2e-2$

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

Work Out: (Points indicated. Part credit possible.)

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

11. $(15$ points$)$ A church window will have the shape of a rectangle with an isosceles right triangle on top. The area of the window is to be $A = 1 + 2\sqrt{2}$. Since the window frame will be gold plated, we want to minimize the perimeter of the window. What are the dimensions of the rectangular part of the window which minimize the perimeter of the whole window?



You must explain your solution using sentences.

HINT: If a is the height of the rectangle and b is its width, then $\frac{b}{\sqrt{2}}$ is the length of each slanted side of the triangular top.

12. $(10$ points$)$ Let P_n denote the statement: $\sum_{i=1}^{n} 3^i = \frac{3^{n+1}-3}{2}$

Use mathematical induction to prove P_n is true for all integers $n \geq 1$.

13. $(15$ points$)$ Use the Method of Riemann Sums with Right Endpoints to compute the integral $\int_1^4 (x-1)^2\,dx$. Use the F.T.C. only to check your answer.

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