Name_____ ID_____

MATH 171   Exam 2   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 "Exam 2."

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.

1-10	/40
11	/15
12	/15
13	/15
14	/15
Total	/100

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

1. If $f(x) = 3x^3 - 7x^2 + 2$ then $f'(x) =$

  a. $6x^2 - 7x$

  b. $6x^2 - 7x + 2$

  c. $3x^2 - 7x + 2$

  d. $9x^2 - 14x$

  e. $9x^2 - 14x + 2$

2. If $f(x) = \dfrac{x}{x+1}$ then $\dfrac{df}{dx} =$

  a. $\dfrac{1}{(x+1)^2}$

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

  c. $\dfrac{2x+1}{(x+1)^2}$

  d. $\dfrac{2x-1}{x+1}$

  e. $\dfrac{2x+1}{x+1}$

1

3. If $f(x) = x^2 \cos x$ then $f'\left(\frac{\pi}{2}\right) =$

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

   b. π

   c. $-\pi$

   d. $\frac{\pi^2}{4}$

   e. $\frac{-\pi^2}{4}$

4. If $f(x) = e^x + x^e$ then $\frac{df}{dx} =$

   a. $x e^{x-1} + e x^{e-1}$

   b. $e^x + x^e$

   c. $e^x + e x^{e-1}$

   d. $e^x + (\ln x) x^e$

   e. $e^x + \frac{x^e}{\ln x}$

5. Find the equation of the line tangent to the graph of $y = x^{1/2}$ at $x = 4$. What is its y-intercept?

   a. 0

   b. 1

   c. 2

   d. 3

   e. $\frac{1}{4}$

6. Compute $\frac{d}{dx} \ln(x^2 + 3)$.

   a. $\frac{2x + 3}{x^2 + 3}$

   b. $\frac{2x}{(x^2 + 3)^2}$

   c. $\frac{1}{x^2 + 3}$

   d. $\frac{2x}{x^2 + 3}$

   e. $\frac{1}{\ln x} \frac{1}{x^2 + 3}$

7. Find the slope of the tangent line to the graph of $x^3 + 3xy + y^3 = 15$ at $(1,2)$.

a. $\frac{-4}{5}$

b. $\frac{-3}{5}$

c. $\frac{-1}{5}$

d. $\frac{3}{5}$

e. $\frac{4}{5}$

8. If the position of a rocket is $\vec{r}(t) = (t^3 - 9t, \sin t)$, find its acceleration at $t = \frac{\pi}{2}$.

a. $\left(\frac{3\pi^2}{4} - 9, 0 \right)$

b. $(3\pi - 9, 1)$

c. $(3\pi, 1)$

d. $(3\pi - 9, -1)$

e. $(3\pi, -1)$

9. Use Newton's method to find an approximate solution to $x^3 - 2x - 3 = 0$. If $x_0 = 2$, then

a. $x_1 = 1.90$

b. $x_1 = 1.99$

c. $x_1 = 2.01$

d. $x_1 = 2.1$

e. $x_1 = 2.2$

10. Suppose $g(x)$ is the inverse function of $f(x)$, which satisfies
$$f(2) = 3 \quad f(3) = 4 \quad f'(2) = 5 \quad f'(3) = 6 \quad f'(4) = 7$$
Then $g'(3) =$

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

b. $\frac{1}{4}$

c. $\frac{1}{5}$

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

e. $\frac{1}{7}$

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) As Duke Skywater flies across the galaxy, he measures the density of the polaron field $P(t)$ as a function of time. After $t = 3$ hours of travelling, he measures the polaron density is $P(3) = 132$ wookies/meter^3 and is increasing by $\frac{dP}{dt}(3) = 4$ wookies/meter^3/hour. Approximately what will the polaron density be at $t = 5$ hours?

12. (15 points) A 10 ft ladder is leaning against a vertical wall but sliding down. The base of the ladder is currently 6 ft from the wall and moving away at 2 ft/sec. How fast is the top of the ladder moving down the wall? You must explain your solution using sentences.

13. (15 points) Given that $\frac{d}{dx}\tan x = \sec^2 x,$ derive $\frac{d}{dx}\arctan x.$

The answer must be a function of $x,$ not $y.$ Here are some identities:

$$\sin^2\theta + \cos^2\theta = 1 \qquad \tan^2\theta + 1 = \sec^2\theta \qquad 1 + \cot^2\theta = \csc^2\theta$$

14. (15 points) In 3 days a 100 kg sample of radon-222 decays into 58 kg.

(Round answers to 3 digits.)

a. Find a formula, $A(t)$, for the amount of radon-222 after t days.

b. What is the half-life of radon-222?

c. How many days will it take for a 100 kg sample of radon-222 to decay into 10 kg?