MATH 151
FALL 2007

SAMPLE EXAM II
To be worked 10/24/2007
7:15-9:15 pm BLOC 102

NAME _____ _____
(print) LAST FIRST

Aggie Honor Code: "An Aggie does not lie, cheat, or steal, or tolerate those who do."

(By signing below, I acknowledge that all work on my exam is/will be my own and that I have not/will not give nor receive help from anyone else.)

SIGNATURE _____

SECTION NUMBER

INSTRUCTIONS

1. In Part I (Problems 1-19) circle the correct choice on your exam. Use the back of each page for scratch work. This part will be collected after 90 minutes; calculators will not be allowed during that hour.

2. In Part II (Problems 20-27), write all solutions in the space provided. Calculators are not allowed. CLEARLY INDICATE YOUR FINAL ANSWER.

Part I - Multiple Choice

For problems 1 through 19, circle the correct answer on your exam. Each question is worth 4 points.

1. Use differentials to approximate $\sqrt{11}$.

a) $\frac{8}{3}$ b) $\frac{11}{3}$ c) $\frac{23}{6}$

d) $\frac{21}{6}$ e) $\frac{10}{3}$

2. If $f(x) = 3x\cos^2(x^2)$, find $f'(0)$.

a) 0 b) -3

c) 3 d) 1

e) -9

3. Compute $\log_4 2$

a) 4 b) $\frac{3}{2}$ c) $\frac{1}{2}$

d) 2 e) $\frac{2}{3}$

4. Two sides of a triangle are fixed at 4cm and 6cm and the angle between them is increasing at a rate of .02 radians per second. How fast is the area of the triangle increasing when the angle between them is $\frac{\pi}{6}$?

a) $(.12)\sqrt{3}$ b) $\frac{.02}{6}$

c) $\frac{.02}{6\sqrt{3}}$ d) .12

e) $12\sin(.02)$

5. Let $f(x) = (1 + x^2)^{\frac{3}{2}}$. Then $f''(0) =$

a) 3 b) 0 c) 6

d) $\dfrac{3}{4\sqrt{2}}$ e) $\dfrac{3}{4}$

6. Solve for x: $\log(3-x)+\log(x+4)=1$

a) $x=\dfrac{-1\pm\sqrt{89}}{2}$

b) $x=1$ only

c) no solution

d) $x=\dfrac{-1+\sqrt{89}}{2}$ only

e) $x=1$ or $x=-2$

7. The function $f(x) = x^3 + 5x - 1$ is one-to-one. Let $g = f^{-1}$. Then $g'(5) =$

a) 8 b) $\frac{1}{80}$ c) $\frac{8}{25}$

d) $\frac{1}{8}$ e) 80

8. Given the curve parametrized by $x = t^3 - 3t^2 - 9t + 1$, $y = t^3 + 3t^2 - 9t + 1$, at which point does the curve have a vertical tangent?

a) $(1, -3)$ b) $(6, 12)$ c) $(-10, 6)$

d) $(-1, 3)$ e) $(1, 1)$

9. $\lim_{x \to 0} \dfrac{4 \cos x - 4 + 3 \sin x}{5x} =$

a) $\dfrac{4}{5}$ b) $-\dfrac{4}{5}$ c) $\dfrac{3}{5}$

d) 1 e) 0

10. Find the slope of the line tangent to the curve given by $y^2 + xy = 8$ at the point $(-2, -2)$.

a) -2 b) $-\frac{10}{3}$ c) $-\frac{1}{3}$

d) -3 e) 0

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11. Which of the following statements is true about the curve $(2+\cos t)\mathbf{i}+(1+\sin t)\mathbf{j}$?

a) Clockwise movement around the circle $(x-2)^2+(y-1)^2=1$

b) Counterclockwise movement around the circle $(x-2)^2+(y-1)^2=1$

c) Clockwise movement around the ellipse $x^2/4+y^2=1$

d) Counterclockwise movement around the ellipse $x^2/4+y^2=1$

e) None of the above statements is correct.

12. Let $f(x)$ be a differentiable function and let $g(x) = 3x^2 - 1$. Let $H(x) = f(g(x))$, the composit of f and g. If $f(0) = 1$, $f'(0) = -1$, $f(1) = 3$, $f'(1) = 2$, $f(2) = -1$, $f'(2) = 5$, find $H'(1)$.

a) 30

b) 12

c) -6

d) 6

e) 5 .

13. What is the domain of $\ln(x^2 - 4)$?

a) $|x| \geq 2$

b) $|x| > 2$

c) $|x| \leq 2$

d) $|x| < 2$ e) $x > 0$.

14. $\lim_{x \to \infty} 3^{1-x} =$

a) 0

b) ∞

c) $-\infty$

d) 1

e) 3 .

15. Find the domain and range of the inverse of $f(x) = \dfrac{3x-5}{7x+2}$

a) Domain: All real numbers except $\dfrac{2}{7}$; Range: All real numbers except $-\dfrac{3}{7}$

b) Domain: All real numbers except $-\dfrac{2}{7}$; Range: All real numbers except $\dfrac{3}{7}$

c) Domain: All real numbers except $\dfrac{3}{7}$; Range: All real numbers except $-\dfrac{2}{7}$

d) Domain: All real numbers except $\dfrac{5}{3}$; Range: All real numbers.

e) None of the above is correct. .

16. If $\langle \cos 3t, t \rangle$ is the position of an object at time t, find the acceleration of the object at time $t = \dfrac{\pi}{9}$.

a) $\left\langle \dfrac{1}{2}, 0 \right\rangle$

b) $\left\langle -\dfrac{1}{2}, 0 \right\rangle$

c) $\left\langle -\dfrac{9}{2}, 0 \right\rangle$

d) $\left\langle \dfrac{9}{2}, 0 \right\rangle$

e) $\langle 3, 0 \rangle$

17. If $f(x) = e^{x \tan x}$, find $f'(x)$.

a) $f'(x) = e^{x \tan x}$

b) $f'(x) = \sec^2 x e^{x \tan x}$

c) $f'(x) = (\tan x + x \sec^2 x) e^{x \tan x}$

d) $f'(x) = (\tan x + x \sec x \tan x) e^{x \tan x}$

e) $f'(x) = x \tan x e^{x \tan x - 1}$

18. Find the equation of the tangent line to the graph of $x = e^{2t}$, $y = te^t$ at the point $(1, 0)$.

a) $y = 2x - 1$

b) $y = 4x - 4$

c) $y = \frac{1}{2}x - \frac{1}{2}$

d) $y = \frac{1}{3}x - \frac{1}{3}$

e) $y = x - 1$

19. Find the quadratic approximation for $f(x) = \dfrac{1}{x}$ at $x = 1$.

a) $x^2 - 3x + 3$

b) $x^2 - x + 2$

c) $x^2 - 2x + 1$

d) $x^2 + 4x + 5$

e) $x^2 + x - 3$

Part II - Work Out Problems

Work the following problems in the space provided. No calculators

20. a.) Find the linear approximation for $f(x) = \sqrt[4]{x+1}$ at $x = 0$.
    b.) Use part a.) to obtain an approximation to $\sqrt[4]{1.01}$

21. The position of a particle is given by $\mathbf{r}(t) = \left\langle \dfrac{\cos t}{e^t}, \dfrac{\sin t}{e^t} \right\rangle$. Find the velocity and speed of the particle when $t = 0$.

22. The radius of a sphere was given to be 8 inches with a maximum possible error in measurement of 0.01 inches. Use differentials to estimate the maximum error in the calculated volume of the sphere.

23. Find all values of x between 0 and 2π where the tangent line to $f(x) = 2x - \tan x$ is horizontal.

24. A trough is 20 feet long. The end of the trough is an isosceles triangle with height 10 feet and length of 3 feet across the top. If water is poured in the trough at a rate of 3 cubic feet per minute, how fast is the water level rising when the height of the water is 1 foot?

25. Starting with $x_1 = 2$, apply Newton's Method once to get an approximate solution to $x^3 - 2x - 5 = 0$.

26. Find an equation (in any form) of the line tangent to the curve $\mathbf{r}(t) = (t^6 + t^3)\mathbf{i} + (t^4 + t^2)\mathbf{j}$ at the point where $t = 1$.

27. A rope is attached to the bow of a boat coming in for the evening. Assme the rope is drawn in over a pully 5 feet higher than the bow at a rate of 2 feet per second. How fast is the boat docking when the length of the rope from the bow to the pully is 13 feet?