Name: _____ **Instructor:** _____

Math 10350, Calculus A
Fall Semester 2006
Exam 2

This Examination contains **16** problems, worth a total of **100** points, on **8** sheets of paper including the front cover. The first **12** problems (section A) are multiple choice with no partial credit, and each is worth **5** points. Record your answers to these problems by placing an $\times$ through one letter for each problem below:

1.	a	b	•	d	e	7.	a	b	•	d	e
2.	•	b	c	d	e	8.	•	b	c	d	e
3.	a	•	c	d	e	9.	a	•	c	d	e
4.	a	b	•	d	e	10.	a	b	c	•	e
5.	a	b	c	d	•	11.	a	•	c	d	e
6.	•	b	c	d	e	12.	a	b	c	•	e

The last **4** problems (section B) are partial credit problems worth **10** points each. For these problems, **show** your computations and **clearly** mark your answers on the page. Books and notes are not allowed. You may not use your calculator.

Sign the pledge: "On my honor, I have neither given nor received unauthorized aid on this Exam":

_____

GOOD LUCK

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Part A: Multiple Choice Problems

1. (5 points) Find $\dfrac{dy}{dx}$ by implicit differentiation of $y^2 + (\sin x)y = 10$.

a) $\dfrac{dy}{dx} = -\dfrac{y \sin x}{2y + \sin x}$ b) $\dfrac{dy}{dx} = -\dfrac{y \cos x}{2y + \cos x}$

c) $\dfrac{dy}{dx} = -\dfrac{y \cos x}{2y + \sin x}$

d) $\dfrac{dy}{dx} = \dfrac{y \cos x}{2y + \cos x}$ e) $\dfrac{dy}{dx} = \dfrac{y \cos x}{2y + \sin x}$

2. (5 points) The maximum value of $f(x) = x^3 - 3x$ on $[-3, 3]$ is:

a) 18 b) 2 c) 1 d) 36 e) 21

3. (5 points.) The critical numbers of $f(x) = x^{\frac{1}{3}} + \dfrac{x}{3}$ are:

a) $0, \ -1$ b) 0 c) There are none.

d) $\sqrt{27}, \ 0$ e) -1

4. (5 points) If $f(x)$ is continuous and differentiable everywhere and $f(a) = f(b)$, then

a) There exists c in (a, b) with $f'(c) > 0$.
b) There exists c in (a, b) with $f(c) = 0$.
c) There exists c in (a, b) with $f'(c) = 0$.
d) There exists c in (a, b) with $f'(c) < 0$.
e) There exists c in (a, b) with $f''(c) = 0$.

5. (5 points.) The function $f(x) = x^3 - \frac{9}{2}x^2 + 107$ is decreasing on:

a) $(-\infty, 0) \cup (0, \infty)$ b) $(-\infty, 0)$ c) $(3, \infty)$
d) $(-\infty, 0) \cup (3, \infty)$ e) $(0, 3)$

6. (5 points.) The graph of the function $f(x) = x^3 - \frac{9}{2}x^2$

a) is concave downward on $\left(-\infty, \frac{3}{2}\right)$ and concave upward on $\left(\frac{3}{2}, \infty\right)$.
b) is concave upward for all x.
c) is concave downward for all x.
d) has two inflection points.
e) is concave upward on $\left(-\infty, \frac{3}{2}\right)$ and concave downward on $\left(\frac{3}{2}, \infty\right)$.

7. (5 points.) According to the Second Derivative Test, the function $f(x) = \sin(3x)$ has

a) an inflection point at $x = \frac{\pi}{6}$.
b) a relative minimum at at $x = \frac{\pi}{6}$.
c) a relative maximum at $x = \frac{\pi}{6}$.
d) neither a relative maximum nor a relative minimum at $x = \frac{\pi}{6}$.
e) a point of discontinuity at $x = \frac{\pi}{6}$.

8. (5 points.)

$$\lim_{x \to -\infty} \frac{3x^7 + 18x^3 + 9x^2 + 1}{27x^7 + 7x^5 - 54x + 8} =$$

a) $\frac{1}{9}$ b) $-\frac{1}{9}$ c) ∞ d) 0 e) $-\infty$

9. (5 points.)

$$\lim_{x\to\infty} \frac{\cos x}{x} =$$

a) 1 b) 0 c) -1 d) it does not exist e) π

10. (5 points.) What is the derivative of $\sin^2(4x)$?

a) $2\sin(4x)\cos(4x)$ b) $8\sin(4x)$ c) $2\sin(4x)$

d) $8\sin(4x)\cos(4x)$ e) $16\sin(4x)\cos(4x)$

11. (5 points) A car leaves place A at 8am and travels along a straight road, arriving at place B at 10am. The distance between A and B is 120 miles. According to the Mean Value Theorem, what is the instantaneous velocity of the car at some time during the drive?

a) 50 miles/hour
b) 60 miles/hour
c) $\frac{1}{60}$ miles/hour
d) 0 miles/hour
e) 1 mile/hour

12. (5 points) The graph $y = x + \cos x,\ 0 \le x \le \pi,$ has a horizontal tangent at the point

a) $(\frac{\pi}{2}, \frac{\pi}{2} + 1)$
b) $(0, 1)$
c) $(\frac{\pi}{4}, \frac{\pi}{4} + \frac{\sqrt{2}}{2})$
d) $(\frac{\pi}{2}, \frac{\pi}{2})$
e) $(\frac{\pi}{4}, \frac{\pi}{4} - \frac{\sqrt{2}}{2})$

Part B: Partial Credit Problems

13. (10 points.) Ice in the shape of a cube is melting so that its volume is decreasing at the rate of 3 cubic inches per minute. How fast is its height decreasing when the ice cube is 6 inches high?

Answer:

14. (10 points.) Let $f(x) = \dfrac{x+1}{x-1}$.

a) What are the vertical asymptotes of the graph of f?

Answer:

b) What are the horizontal asymptotes of the graph of f?

Answer:

c) Determine the intervals where f is increasing or decreasing.

Answer:

15. (10 points.) a) An object moves along the circle $x^2+y^2 = 9$ so that $\dfrac{dy}{dt} = \sqrt{2}$. Find $\dfrac{dx}{dt}$ when the object is at the point $(1, 2\sqrt{2})$.

b) Find $\dfrac{dy}{dx}$ for the curve $x^2 + y^2 = 9$.

c) Determine the equation of the tangent line to the curve $x^2 + y^2 = 9$ at the point $(1, 2\sqrt{2})$.

16. (10 points.) Find all local extrema of $f(x) = 4x^5 - 5x^4$.