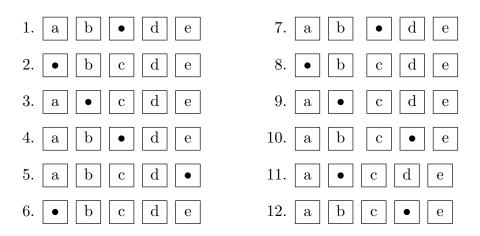
Instructor:

Name: _____

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:



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":

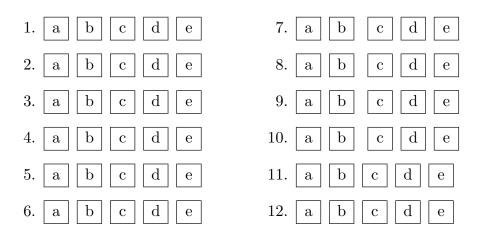
GOOD LUCK

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Part A: Multiple Choice Problems

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

a)
$$\frac{dy}{dx} = -\frac{y \sin x}{2y + \sin x}$$
 b) $\frac{dy}{dx} = -\frac{y \cos x}{2y + \cos x}$
c) $\frac{dy}{dx} = -\frac{y \cos x}{2y + \sin x}$
d) $\frac{dy}{dx} = \frac{y \cos x}{2y + \cos x}$ e) $\frac{dy}{dx} = \frac{y \cos x}{2y + \sin x}$

- **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 $f(x) = x^{\frac{1}{3}} + \frac{x}{3}$ 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 = π/6.
b) a relative minimum at at x = π/6.
c) a relative maximum at x = π/6.
d) neither a relative maximum nor a relative minimum at x = π/6.
e) a point of discontinuity at x = π/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) $\left(\frac{\pi}{2}, \frac{\pi}{2} + 1\right)$ b) (0, 1)c) $\left(\frac{\pi}{4}, \frac{\pi}{4} + \frac{\sqrt{2}}{2}\right)$ d) $\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$ e) $\left(\frac{\pi}{4}, \frac{\pi}{4} - \frac{\sqrt{2}}{2}\right)$

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?

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

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.

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

b) Find
$$\frac{dy}{dx}$$
 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 $f(x) = 4x^5 - 5x^4$.