Math 10550, Practice Exam III

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for 1 hour and 15 minutes.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 12 problems.

Good Luck!

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Total multiple choice: __________

9. __________

10. __________

11. __________

12. __________

Total: __________
Multiple Choice Questions

1. (7 pts.) Solving the equation $3x - \cos x = 0$ using the Newton’s method with initial approximation $x_1 = 0$, what is $x_2$?

(a) $\frac{1}{3}$  (b) $-\frac{1}{3}$  (c) $0$  (d) $\frac{1}{4}$  (e) $\frac{1}{2}$

2. (7 pts.) A farmer has 4000 feet of fencing and wants to fence off a rectangular field that border a straight river. No fence is needed along the river. Find the dimension of this rectangle that will maximize the area.

(a) $1000 ft \times 1000 ft$  (b) $2000 ft \times 1000 ft$
(c) $1200 ft \times 800 ft$  (d) $2000 ft \times 2000 ft$
(e) $2000 ft \times 500 ft$
3. (7 pts.) Calculate the following indefinite integral

\[ \int \frac{x^2 + 1}{\sqrt{x}} \, dx = \]

(a) \( \frac{2}{5} x^{5/2} + 2x^{1/2} + C \)

(b) \( \frac{1}{3} x^3 + x + C \)

(c) \( \frac{2}{3} x^{5/2} - \frac{1}{2} x^{1/2} + C \)

(d) \( \frac{2}{5} x^{5/2} + 2x^{1/2} \)

(e) \( \frac{2}{3} x^{5/2} - \frac{1}{2} x^{1/2} \)

4. (7 pts.) Calculate the following definite integral

\[ \int_0^3 |x - 1| \, dx = \]

(a) \( \frac{3}{2} \)

(b) \( \frac{5}{2} \)

(c) 1

(d) \( \frac{9}{2} \)

(e) -2
5. (7 pts.) What is the indefinite integral

\[ \int x\sqrt{x-1} \, dx =? \]

(a) \( \frac{2}{5} x^{5/2} + \frac{2}{3} x^{3/2} \)
(b) \( \frac{1}{3} (x-1)^3 - \frac{1}{2} (x-1)^2 + C \)
(c) \( \frac{2}{5} (x-1)^{5/2} + \frac{2}{3} (x-1)^{3/2} + C \)
(d) \( \frac{2}{5} x^{5/2} + \frac{2}{3} x^{3/2} + C \)
(e) \( \frac{2}{5} (x-1)^{5/2} + \frac{2}{3} (x-1)^{3/2} \)

6. (7 pts.) The equation of the slant asymptote of the curve \( y = \frac{3x^3 + 2x^2 + x + 3}{x^2 + 2x} \) is:

(a) \( y = 0 \)
(b) \( y = 3x + 1 \)
(c) \( y = 3x - 2 \)
(d) \( y = 3x + 2 \)
(e) \( y = 3x - 4 \)
7. (7 pts.) Evaluate the definite integral
\[ \int_0^2 \sqrt{4 - x^2} \, dx. \]

Hint: A definite integral represents an area.

(a) 8 (b) \(2\pi\) (c) \(-\frac{16}{3}\) (d) \(\pi\) (e) \(\frac{16}{3}\)

8. (7 pts.) Let \(g(x) = \int_0^x \sqrt{1 + \sin^2 t} \, dt\). Find \(g'(x)\).

(a) \(3x^2\sqrt{1 + \sin^2 x}\) (b) \(\sqrt{1 + \sin^2 x^3}\)
(c) \(\frac{\sin x^3 \cdot \cos x^3}{\sqrt{1 + \sin^2 x^3}}\) (d) \(3x^2 \sqrt{1 + \sin^2 x^3}\)
(e) \(\sqrt{1 + \sin^2 x}\)
9. (11 pts.) Calculate the area bounded by the curves $y = x^2 + 2x + 3$ and $y = 2x + 4$. 

Partial Credit

You must show your work on the partial credit problems to receive credit!
10. (11 pts.)

(a) Evaluate the definite integral \( \int_0^2 x^2 \, dx \) by the limit definition.

Hint: \( 1^2 + 2^2 + 3^2 + \cdots + n^2 = \sum_{i=1}^{n} i^2 = \frac{n(n + 1)(2n + 1)}{6} \)

(b) Verify your result using the fundamental theorem of calculus.
11. (11 pts.) Find the point on the line $3x + y = 9$ that is closest to the point $(1, -2)$. 
12. (11 pts.) If 1200 \( cm^2 \) of material is available to make a box with a square base and an open top, find the largest possible volume of the box.
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