MATH 152, Spring 2013

Exam I    Form B

LAST NAME (print): ________________________________

FIRST NAME (print): ________________________________

SIGNATURE: ________________________________

INSTRUCTOR: ________________________________

SECTION NUMBER: ______

INSTRUCTIONS

1. In **Part 1** (Problems 1–11), mark the correct choice on your ScanTron form using a No. 2 pencil. **Record your choices on your exam. Scantrons will not be returned.**

2. Be sure to write your **name** and **section** number on your ScanTron.

3. In **Part 2** (Problems 12 – 15), present your solutions in the space provided. **Show all your work** neatly and concisely and **box your final answer.** You will be graded not merely on the final answer, but also on the quality and correctness of the work leading to it.

4. **THE USE OF CALCULATORS, BOOKS OR NOTES OF ANY SORT IS NOT PERMITTED IN THIS EXAMINATION. TURN OFF and HIDE YOUR CELL PHONES.**
1. Evaluate the definite integral \( \int_0^{\pi/4} \sin^2 x \, dx \)

(a) \( \pi/4 \)

(b) \( \pi/8 \)

(c) \( \pi/4 - 1 \)

(d) \( \pi/8 - 1/4 \)

(e) \( \pi/8 - 1/2 \)

2. Find the average value of the function \( f(x) = x \sin x \) on the interval \([0, \pi/2]\).

(a) \( 2/\pi \)

(b) \( \pi/2 \)

(c) \( 4/\pi \)

(d) 1

(e) \( \pi/4 \)

3. A cable that weighs 2 lb/ft is used to lift 800 lb of coal up a mineshaft 500 ft deep. Find the work done.

(a) 400,000 ft-lb

(b) 250,000 ft-lb

(c) 650,000 ft-lb

(d) 750,000 ft-lb

(e) 500,000 ft-lb
4. If $f$ is continuous and $\int_0^4 f(x)dx = 10$, find $\int_0^2 f(2x)dx$

(a) 1
(b) 10
(c) 2
(d) 5
(e) 20

5. Find the area of the region bounded by the line $y = 2x$ and the parabola $y = x^2 - 4x$.

(a) 63
(b) 36
(c) 25
(d) 52
(e) 48

6. If the work required to stretch the spring 1 ft beyond its natural length is 15 ft-lb, how much work is needed to stretch it 8 in. beyond its natural length?

(a) 27/4 ft-lb
(b) 4/27 ft-lb
(c) 20/3 ft-lb
(d) 3/20 ft-lb
(e) 30 ft-lb
7. Evaluate the definite integral \( \int_{1}^{e} \frac{\ln x}{x} \, dx \)

(a) \( 1/e \)
(b) \( 1/2 \)
(c) \( -1 \)
(d) \( e^2/2 \)
(e) \( e^2/2 - 1 \)

8. The base of a solid is the parabolic region between the graphs of \( y = 1 \) and \( y = x^2 \). Cross-sections perpendicular to the \( y \)-axis are squares. Find the volume of the solid.

(a) \( 4/3 \)
(b) \( 2 \)
(c) \( 3 \)
(d) \( 1 \)
(e) \( 1/3 \)

9. Using **cylindrical shells** which integral gives the volume of the solid obtained by rotating the region bounded by \( y = x, \ y = x^2 \) about the line \( y = 1 \)?

(a) \( 2\pi \int_{0}^{1} y(y - y^2) \, dy \)
(b) \( 2\pi \int_{0}^{1} (x - 1)(x - x^2) \, dx \)
(c) \( 2\pi \int_{0}^{1} x(x - x^2) \, dx \)
(d) \( 2\pi \int_{0}^{1} y(\sqrt{y} - y) \, dy \)
(e) \( 2\pi \int_{0}^{1} (1 - y)(\sqrt{y} - y) \, dy \)
10. Evaluate the definite integral \( \int_{0}^{4} \frac{x}{\sqrt{1 + 2x}} \, dx \)

(a) \(-5/3\)
(b) 4
(c) 1/3
(d) 10/3
(e) 0

11. Compute the definite integral \( \int_{1}^{e} x^2 \ln x \, dx \)

(a) \(\frac{2e^3 + 1}{9}\)
(b) \(\frac{e^3 - 1}{9}\)
(c) \(\frac{2e^3 - 1}{3}\)
(d) \(\frac{e^3 + 1}{9}\)
(e) \(\frac{2e^3 + 1}{3}\)
Partial credit is possible. No credit for unsupported answers will be given.

12. Evaluate the indefinite integrals.

(a) (8 pts) \[ \int x^2 e^{3x} \, dx \]

(b) (8 pts) \[ \int \sin^3 x \sqrt{\cos x} \, dx \]
(c) \( (8 \text{ pts}) \int \tan^2 x \sec^4 x \, dx \)

13. (9 pts) The tank in a shape of hemisphere with radius 5 ft is full of water. Find the work done in pumping all the water to the top of the tank. Use the fact that water weighs 62.5 lb/ft\(^3\).
14. Let $\mathcal{R}$ denote the region bounded by $y = \ln x$, $y = 0$, $x = 2$.

(a) (2 pts) Sketch the region $\mathcal{R}$.

(b) (5 pts) Using disks set up (do not evaluate) the integral that gives the volume of the solid generated by rotating the region $\mathcal{R}$ about the $x$-axis.

(c) (7 pts) Using washers set up (do not evaluate) the integral that gives the volume of the solid generated by rotating the region $\mathcal{R}$ about the line $x = 3$. 
15. Let $\mathcal{R}$ denote the region bounded by $y = e^x, y = e^{-x}$ between $x = -1$ and $x = 2$.

(a) (3 pts) Sketch the region $\mathcal{R}$.

(b) (3 pts) Set up the integral that gives the area of the region $\mathcal{R}$.

(c) (3 pts) Find the area of the region $\mathcal{R}$. 
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