

**MATH 152, FALL SEMESTER 2009  
COMMON EXAMINATION I - VERSION B**

Name (print): \_\_\_\_\_

Signature: \_\_\_\_\_

Instructor's name: \_\_\_\_\_

Section No: \_\_\_\_\_

**INSTRUCTIONS**

1. In Part 1 (Problems 1–10), mark your responses on your ScanTron form using a No. 2 pencil. *For your own record, mark your choices on the exam as well.*
2. Calculators **should not be used** throughout the examination.
3. In Part 2 (Problems 11–16), present your solutions in the space provided. **Show all your work** neatly and concisely, and **indicate your final answer clearly**. You will be graded, not merely on the final answer, but also on the quality and correctness of the work leading up to it.
4. Be sure to **write your name, section number, and version letter of the exam on the ScanTron form**.

**Part 1 – Multiple Choice (50 points)**

Each question is worth **5 points**. Mark your responses on the ScanTron form and on the exam itself.

1. Compute the indefinite integral  $\int x^3 \sqrt{2+x^4} dx$ .

(a)  $\frac{(2+x^4)^{3/2}}{4} + C$

(b)  $\frac{(2+x^4)^{3/2}}{6} + C$

(c)  $\frac{2(2+x^4)^{3/2}}{3} + C$

(d)  $\frac{(2+x^4)^{-1/2}}{8} + C$

(e)  $\frac{(2+x^4)^{-1/2}}{2} + C$

2. Compute the indefinite integral  $\int e^x(1+e^x)^{10} dx$ .

(a)  $10(1+e^x)^9 + C$

(b)  $(1+e^x)^{11} + C$

(c)  $\frac{(1+e^x)^{11}}{11} + C$

(d)  $e^x \frac{(1+e^x)^{11}}{11} + C$

(e)  $e^x + e^{10x} + C$

3. Evaluate the definite integral  $\int_0^{\pi/4} \frac{\sec^2 \theta}{3 + \tan \theta} d\theta$ .

(a)  $\ln\left(\frac{3}{2}\right)$

(b)  $\ln\left(\frac{\pi}{12}\right)$

(c)  $\ln\left(\frac{\pi}{4}\right)$

(d)  $\ln\left(\frac{\pi}{8}\right)$

(e)  $\ln\left(\frac{4}{3}\right)$

4. Determine the value of the positive number  $b$  for which the average value of the function  $f(x) = 2 + 6x$  on the interval  $[0, b]$  is 3.

(a) 3

(b)  $1/3$

(c)  $\frac{\sqrt{10} - 1}{3}$

(d) 2

(e)  $1/6$

5. Compute the indefinite integral  $\int xe^{-3x} dx$ .

(a)  $-\frac{xe^{-3x}}{3} - \frac{e^{-3x}}{9} + C$

(b)  $-\frac{xe^{-2x}}{2} - \frac{e^{-2x}}{4} + C$

(c)  $xe^{-2x} + e^{-2x} + C$

(d)  $xe^{-3x} + e^{-3x} + C$

(e)  $\frac{x^2 e^{-2x}}{2} + C$

6. Compute the indefinite integral  $\int 2 \cos^2 \theta \, d\theta$ .

(a)  $\theta - \frac{\sin(2\theta)}{2} + C$

(b)  $\theta + 2 \sin(2\theta) + C$

(c)  $\frac{\theta}{2} - \frac{\sin(2\theta)}{4} + C$

(d)  $\frac{\theta}{2} + \frac{\sin(2\theta)}{4} + C$

(e)  $\theta + \frac{\sin(2\theta)}{2} + C$

7. Calculate the area of the region enclosed by the  $x$ -axis,  $y = \ln x$ ,  $x = e$ , and  $x = e^3$ .

(a)  $e^2$

(b)  $\frac{1}{e^3} - \frac{1}{e}$

(c)  $\frac{1}{e^2} - \frac{1}{e}$

(d)  $2e^3$

(e)  $3/2$

8. An aquarium 2 m long, 1 m wide, and 1 m deep is full of water. Find the work needed to pump half the water out of the aquarium. (The density of water,  $\rho$ , is  $1000 \text{ kg/m}^3$ , and acceleration due to gravity,  $g$ , is  $9.8 \text{ m/s}^2$ .)

(a) 250 J

(b)  $9.8 \times 10^3 \text{ J}$

(c) 2.45 J

(d)  $2.45 \times 10^3 \text{ J}$

(e) 4.9 J

9. Let  $R$  denote the region enclosed by the  $y$ -axis, the line  $y = 1$ , and the curve  $y = \sqrt{x}$ . Compute the volume of the solid whose base is  $R$  and whose cross sections perpendicular to the  $y$ -axis are semicircles.

(a)  $\pi/2$

(b)  $\pi/10$

(c)  $\pi/20$

(d)  $\pi/24$

(e)  $\pi/40$

10. Suppose that  $f$  is continuous on  $(-\infty, \infty)$ , and that  $F$  is an antiderivative of  $f$  in  $(-\infty, \infty)$ . Which of following is an antiderivative of the function  $g(x) = f(3x - 2)$ ?

(a)  $\frac{F(2x - 3)}{2}$

(b)  $F(3x - 2)$

(c)  $F(2x - 3)$

(d)  $\frac{F(3x - 2)}{3}$

(e) insufficient information to make a determination

**Part 2 (56 points)**

*Present your solutions to the following problems (11–16) in the space provided. **Show all your work** neatly and concisely, and **indicate your final answer clearly**. You will be graded, not merely on the final answer, but also on the quality and correctness of the work leading up to it.*

**11. (10 points)** Compute the following integral:

$$\int \frac{\cos^3(\sqrt{x})}{\sqrt{x}} dx$$

12. (10 points) Compute the following integral:

$$\int \sec^3 x \tan^3 x \, dx$$

- 13.** (10 points) Let  $R$  denote the region bounded by the parabola  $y = 1 - x^2$  and the straight line  $y = -2x - 2$ . Sketch  $R$  and calculate its area.

14. (10 points) Let  $R$  denote the region enclosed (in the first quadrant) by the  $x$ -axis, the line  $x = 1$ , and the curve  $y = x^3$ . Sketch  $R$  and use the method of *cylindrical shells* to calculate the volume of the solid obtained by rotating  $R$  about the line  $x = 1$ .

15. (10 points) Let  $T$  denote the triangular region with vertices at  $(0, 0)$ ,  $(2, 1)$  and  $(4, 1)$ . Sketch  $T$  and use the method of *disks* to compute the volume of the solid obtained by rotating  $T$  about the  $y$ -axis.

16. (6 points) Let  $f$  be a function such that  $f''$  is continuous in the interval  $[0, \pi]$ . Given that

$$f(0) = -1, \quad f(\pi) = 1, \quad \text{and} \quad \int_0^\pi f(x) \sin x \, dx = 4,$$

evaluate

$$\int_0^\pi f''(x) \sin x \, dx.$$

**QN            PTS**

1-10

11

12

13

14

15

16

**TOTAL**