

Fall 2004
Math 152
COMMON EXAM 2
Test Form A

PRINT: Last Name: _____ First Name: _____

Signature: _____ ID: _____

Instructor's Name: _____ Section # _____

Instructor use only.

Multiple choice	
Q11	
Q12	
Q13	
Q14	
Q15	
Q16	
Total	

INSTRUCTIONS

1. In **Part 1** (Problems 1–10), mark the correct choice on your ScanTron form using a #2 pencil. *For your own records, also record your choices on your exam!* The ScanTrons will be collected after 1 hour; they will NOT be returned.
2. In **Part 2** (Problems 11–16), write all solutions in the space provided. All work to be graded must be shown in the space provided. **CLEARLY INDICATE YOUR FINAL ANSWERS.**

Part 1: Multiple Choice Problems. Each problem is worth 4 points each: NO partial credit will be given. Calculators may not be used. ScanTron forms will be collected at the end of 1 hour.

1. In evaluating the integral $\int_0^1 (3x^2 + 2x + 1)dx$, which method below gives the best results:

- (a) midpoint rule
- (b) trapezoidal rule
- (c) Simpson's rule
- (d) left end point approximation
- (e) no conclusion can be made based on the information above

2. The comparison theorem implies that the integral

$$\int_1^{\infty} (x^2 + \ln x)^{-1} dx$$

- (a) converges to a positive number
- (b) converges to a negative number
- (c) diverges to infinity
- (d) diverges to negative infinity
- (e) converges to zero

3. The integral $\int_{-\infty}^0 e^{3x} dx$

- (a) converges to 1
- (b) converges to 3
- (c) converges to 1/3
- (d) diverges
- (e) neither diverges or converges

4. Let $y(x)$ be the solution of the equation $y' = xy$ with $y(0) = 1$. Which of the following is true:

- (a) $y(1) = e^{1/2}$
- (b) $y(1) = 2e^{1/2}$
- (c) $y(1) = 3e^{1/2}$
- (d) $y(1) = 2$
- (e) $y(1) = 0$

5. An integrating factor for $y' + y \cos x = x^2 + y \tan x$, where $0 \leq x \leq \pi/4$ is

- (a) $e^{-\sin x} + \cos x$
- (b) $e^{-\sin x} \cos x$
- (c) $e^{\sin x} \cdot \cos x$
- (d) $\sin x$
- (e) None of the above

6. The arc length once around the closed curve described by $x = 2 \sin 2t, y = 3 \cos 2t$ is given by

- (a) $\int_0^{2\pi} \sqrt{4 \cos^2 2t + 9 \sin^2 2t} dt$
- (b) $\int_0^{2\pi} \sqrt{16 \sin^2 2t - 36 \cos^2 2t} dt$
- (c) $\int_{-\pi/2}^{\pi/2} \sqrt{16 \sin^2 2t + 36 \cos^2 2t} dt$
- (d) 5π
- (e) None of the above

7. The area of the surface obtained by rotating the curve

$$x = \frac{1}{3}(y^2 + 2)^{3/2}, \quad 1 \leq y \leq 2$$

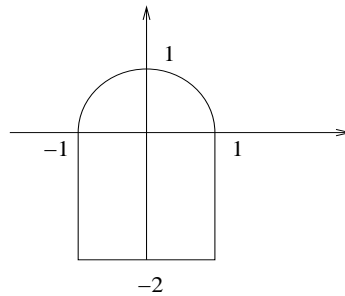
around the x -axis is given by

- (a) $\int_1^2 2\pi x \sqrt{1 + (y^2 + 2)} dy$
- (b) $\int_1^2 2\pi y \sqrt{1 + y^2(y^2 + 2)^2} dy$
- (c) $\int_1^2 2\pi(y^3 + y) dy$
- (d) (b) and (c)
- (e) None of the above

8. The center of mass of the system of objects that have masses $m_1 = 3 \text{ kg}$, $m_2 = 4 \text{ kg}$, $m_3 = 8 \text{ kg}$ and are located at $P_1(-1, 1)$, $P_2(2, -1)$, $P_3(3, 2)$ is equal to:

- (a) $\left(\frac{29}{15}, 1\right)$
- (b) $(29, 15)$
- (c) $\left(\frac{15}{29}, 0\right)$
- (d) $\left(\frac{32}{15}, \frac{2}{15}\right)$
- (e) $\left(30, \frac{1}{2}\right)$

9. The center of mass of a thin plate that has the shape of a semicircle above a rectangle as below



is situated at:

- (a) $\left(\frac{20}{3(\pi + 8)}, 0\right)$
- (b) $\left(0, -\frac{20}{3(\pi + 8)}\right)$
- (c) $\left(0, \frac{1}{\pi + 8}\right)$
- (d) $\left(-\frac{50}{3}, \frac{5(\pi + 8)}{2}\right)$
- (e) $\left(\frac{5(\pi + 8)}{2}, 0\right)$

10. The hydrostatic force on the bottom of an aquarium 2 m long, 1 m wide and 1 m deep that is full of water is equal to ($\rho = 1000 \text{ kg/m}^3$ and $g = 9.8 \text{ m/s}^2$)

- (a) $1.96 \times 10^4 \text{ N}$
- (b) 9.8 kPa
- (c) $4.9 \times 10^3 \text{ N}$
- (d) $9.8 \times 10^5 \text{ N}$
- (e) 0

Part 2: Work-Out Problems. Partial credit is possible. SHOW ALL WORK in the space provided. Lack of detail or clarity is subject to penalty. NO CALCULATORS.

11. (10pts) A tank contains 1000 L of brine with 10 kg dissolved salt. Pure water enters tank at the rate of 10 L/min. The solution is kept thoroughly mixed and drains from the tank at the same rate. Find $y(t)$, the amount of salt after t minutes. At what time will there be 5 kg of salt in tank?

12. (10pts) Evaluate the integral

$$\int_1^{\infty} \frac{\ln x}{x^2} dx$$

if it is convergent.

13. (10pts) Solve the initial value problem

$$x \frac{dy}{dx} - \frac{y}{x+1} = x, \quad y(1) = 0, x > 0.$$

14. (10pts) Consider the curve

$$C: y = 1 - x^2, \quad 0 \leq x \leq 1.$$

- (a) Set up (do not evaluate). The integral representing the area of the surface obtained from rotating C around the x -axis.
- (b) Set up the integral for the area of the surface obtained from rotating C around the y -axis.
- (c) Evaluate the integral in (b).

15. (10pts) Find the centroid of the region bounded by the curves

$$y = \sqrt{x} \quad \text{and} \quad y = x$$

16. (10pts) A vertical dam has a semicircular gate as shown in the figure where the water level is at 2 m below the top of the dam. Find the hydrostatic force against the gate ($\rho = 1000 \text{ kg/m}^3, g = 9.8 \text{ m/s}^2$)

