

Record your answers to the multiple choice problems by placing an \times through one letter for each problem on this page. There are 8 multiple choice questions worth 6 points each and 4 partial credit problems worth 10 points each. You start with 12 points. On the partial credit problems try to simplify your answer and indicate your final answer clearly. *You must show your work and all important steps to receive credit.*

You may not use a calculator.

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4. a b c d e

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1. Find the centroid of the region bounded by the curves $y = x^2$ and $y = 4$.

- (a) (0, 2.3) (b) (0, 2.4) (c) (0, 2.2) (d) (0, 2.5) (e) (0, 2.1)

2. Evaluate $\int_0^8 \frac{1}{3 + x^{1/3}} dx$.

- (a) $12 \ln(2/3) + 3$ (b) $15/2$ (c) $\ln(3) - 1/2$
(d) $27 \ln(5/3) - 12$ (e) 12

3. Calculate how many years it will take an investment to triple in value if the interest rate is 6% compounded continuously.

- (a) $6 \ln(3)$ (b) $-3 \ln(.06)$ (c) $6 \ln(18)$
(d) $100 \ln(3)/6$ (e) $-100 \ln(.18)$

4. Evaluate the improper integral $\int_{-\infty}^{\infty} \frac{e^x}{1 + e^{2x}} dx$.

- (a) 0 (b) $\pi/2$ (c) ∞ (d) 1 (e) $2 \ln(1 + e^2)$

5. Determine which of the integrals gives the length of the curve $y = \ln(x)$, $1 \leq x \leq a$.

- (a) $\int_1^a x + \frac{1}{x} dx$ (b) $\int_1^a \sqrt{1 + \ln(x)} dx$ (c) $\int_1^a \sqrt{1 + \frac{1}{x}} dx$
(d) $\int_1^a \frac{\sqrt{x^2 + 1}}{x} dx$ (e) $\int_1^a 1 + \frac{1}{x^2} dx$

6. Compute the Error Bound for the Midpoint Rule approximation of $\int_0^1 e^{x^3} dx$ with $n = 10$.
(Choose the answer that gives the best estimate using the standard Error Bound formula.)

- (a) $5e/800$ (b) $3e/400$ (c) $e/200$ (d) $e/400$ (e) $3e/800$

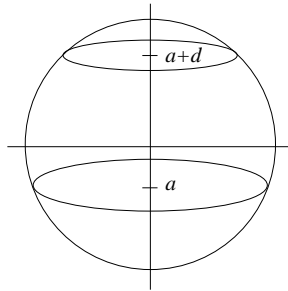
7. Determine which of the following functions is a solution of the differential equation $y'' + y' = 12y$.

- (a) $12t$ (b) $12t - 1$ (c) $6e^t$ (d) e^{-4t} (e) $2e^{2t}$

8. Determine which of the following expressions gives the general form of the partial fraction decomposition of $\frac{x^2}{(x+2)^2}$.

- (a) $\frac{A}{x+2} + \frac{Bx+C}{(x+2)^2}$ (b) $\frac{A}{x+2} + \frac{B}{x+2} + C$ (c) $1 + \frac{A}{x+2} + \frac{Bx}{(x+2)^2}$
(d) $1 + \frac{A}{x+2} + \frac{B}{(x+2)^2}$ (e) $\frac{A}{(x+2)^2} + B$

9. Use partial fractions to evaluate $\int \frac{5x}{x^3 + 2x^2 + x + 2} dx$.
10. Use the *Comparison Theorem* to determine whether the integral $\int_1^\infty \frac{\cos(x) + 1}{\sqrt{x^4 + 1/x^4}} dx$ converges or diverges.
11. The surface obtained by rotating the curve $x = \sqrt{1 - y^2}$ about the y -axis is the unit sphere S . Calculate the area of the part of S that lies between two horizontal planes a distance d apart, that is, between $y = a$ and $y = a + d$ (both a and $a + d$ must lie between -1 and 1).



12. A certain retention pond has a system of pipes that drains water from the pond at a rate proportional to the volume of water in the pond. When the pond contains 100 cubic feet of water, the drainage rate is measured to be 5 cubic feet per second. Suppose the pond is empty and run-off water starts to flow into the pond at a constant rate of 10 cubic feet per second. Determine the volume of water y in the pond after t seconds.