

Record your answers to the multiple choice problems by placing an  $\times$  through one letter for each problem on this page. There are 12 multiple choice questions worth 7 points each. You start with 16 points.

**You may not use a calculator.**

1.  a  b  c  d  e2.  a  b  c  d  e3.  a  b  c  d  e4.  a  b  c  d  e5.  a  b  c  d  e6.  a  b  c  d  e7.  a  b  c  d  e8.  a  b  c  d  e9.  a  b  c  d  e10.  a  b  c  d  e11.  a  b  c  d  e12.  a  b  c  d  e

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1.  a  b  c  d  e

2.  a  b  c  d  e

3.  a  b  c  d  e

4.  a  b  c  d  e

5.  a  b  c  d  e

6.  a  b  c  d  e

7.  a  b  c  d  e

8.  a  b  c  d  e

9.  a  b  c  d  e

10.  a  b  c  d  e

11.  a  b  c  d  e

12.  a  b  c  d  e

1. 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)  $3e/400$       (b)  $e/400$       (c)  $e/200$       (d)  $5e/800$       (e)  $3e/800$

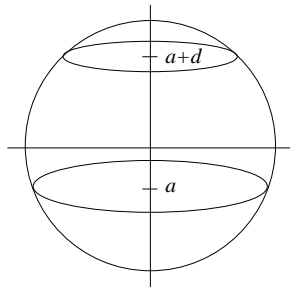
2. Use partial fractions to evaluate  $\int \frac{5x}{x^3 + 2x^2 + x + 2} dx$ .

- (a)  $\tan^{-1}(x) + \ln \left[ \frac{x^2 + 1}{(x + 2)^2} \right]$       (b)  $\ln \left[ \frac{x^5}{x^3 + 2x^2 + x + 2} \right]$   
(c)  $\tan^{-1}(x/2) + \ln(x + 1)^2(x + 2)$       (d)  $\tan^{-1}(x) + \ln[(x^2 + 1)(x + 2)^2]$   
(e)  $\tan^{-1}(x/2) + \ln \left[ \frac{(x + 1)^2}{x + 2} \right]$

3. Determine whether the integral  $\int_1^\infty \frac{\cos(x) + 1}{\sqrt{x^4 + 1/x^4}} dx$  converges.

- (a) *diverges*      (b) *converges*      (c) *insufficient information*  
(d) *indeterminate*      (e) *undefined*

4. 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  $1$ ).



- (a)  $\pi(\arcsin(a + d) - \arcsin(a))$                       (b)  $\pi \frac{a + d}{a}$
- (c)  $2\pi \arccos(d)$     (d)  $2\pi d$
- (e)  $2\pi \arcsin(d)$
5. 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.

- (a)  $20(1 + e^{-10t})$                       (b)  $100(1 + e^{t/20})$                       (c)  $100(1 + e^{t/10})$
- (d)  $200(1 - e^{-t/20})$                       (e)  $10(1 + e^{-t/5})$

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

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

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

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

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

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

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

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

(d)  $\frac{A}{x + 2} + \frac{B}{x + 2} + C$       (e)  $\frac{A}{x + 2} + \frac{Bx + C}{(x + 2)^2}$

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

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

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

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

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

(a)  $\int_1^a 1 + \frac{1}{x^2} dx$

(b)  $\int_1^a \sqrt{1 + \frac{1}{x}} dx$

(c)  $\int_1^a \sqrt{1 + \ln(x)} dx$

(d)  $\int_1^a \frac{\sqrt{x^2 + 1}}{x} dx$

(e)  $\int_1^a x + \frac{1}{x} dx$