

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

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  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. Determine which of the following integrals gives the length of the curve  $y = \cos(x)$ ,  $0 \leq x \leq \pi/2$ .

(a)  $\int_0^{\pi/2} \sqrt{1 + \cos^2(x)} dx$

(b)  $\int_0^{\pi/2} \sqrt{\sin(x)} dx$

(c)  $\int_0^{\pi/2} \sqrt{\cos(x)} dx$

(d)  $\int_0^{\pi/2} \sqrt{1 + \sin^2(x)} dx$

(e)  $\int_0^{\pi/2} \sqrt{\cos^2(x) - \sin^2(x)} dx$

2. Evaluate  $\int \frac{d\theta}{1 - \sin(\theta)}$ .

(a)  $\cot(\theta) - \csc(\theta) + C$

(b)  $\tan(\theta) + \sec(\theta) + C$

(c)  $\ln(\theta + \cos(\theta)) + C$

(d)  $\ln(1 - \cos(\theta)) + \sec(\theta) + C$

(e)  $\cos(\theta) \ln(1 + \sin(\theta)) - \tan(\theta) + C$

3. Find the orthogonal trajectories of the family of hyperbolas defined by  $x^2 - 4y^2 = a^2$ .

(a)  $y = cx^{-4}$

(b)  $x = cy^4$

(c)  $y^2 + 4x^2 = c^2$ .

(d)  $y = cx^{-2}$

(e)  $y^2 - 4x^2 = c^2$ .

4. Use partial fractions to evaluate  $\int \frac{12}{x^3 + 2x^2 - 3x} dx$ .

(a)  $4 \ln |x^3 + 2x^2 - 3x| + C$

(b)  $\ln \left| \frac{(x+1)(x-3)^3}{x^4} \right| + C$

(c)  $\ln \left| \frac{(x-1)^3(x+3)}{x^4} \right| + C$

(d)  $\ln \left| \frac{(x-1)^4(x+3)}{x^3} \right| + C$

(e)  $-12 \frac{3x^2 + 4x^2 - 3x}{(x^3 + 2x^2 - 3x)^2} + C$

5. Evaluate  $\int_1^\infty x^2 e^{-x^3} dx$ .

(a)  $\frac{1}{2}$

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

(c)  $\frac{1}{3}$

(d)  $\frac{1}{2e}$

(e)  $\frac{1}{e}$

6. Determine whether the integral  $\int_0^\infty \frac{dx}{2^x \sqrt{x}}$  converges.

(a) *diverges*

(b) *indeterminate*

(c) *undefined*

(d) *insufficient information*

(e) *converges*

7. Determine which of the following expressions gives the general form of the partial fraction decomposition of  $\frac{x}{(x^4 - 1)^2}$ .

(a)  $\frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{C}{x+1} + \frac{D}{(x+1)^2} + \frac{Ex+F}{(x^2+1)^2}$

(b)  $\frac{A}{(x-1)^2} + \frac{B}{(x+1)^2} + \frac{Cx^2+D}{(x^2+1)^2}$

(c)  $\frac{A}{x-1} + \frac{B}{x+1} + \frac{Cx+D}{(x-1)^2} + \frac{Ex+F}{(x+1)^2} + \frac{Gx+H}{x^2+1} + \frac{Ix^2+J}{(x^2+1)^2}$

(d)  $\frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{C}{x+1} + \frac{D}{(x+1)^2} + \frac{Ex+F}{x^2+1} + \frac{Gx+H}{(x^2+1)^2}$

(e)  $\frac{A}{x^2-1} + \frac{B}{x^2+1} + \frac{Cx+D}{(x^2-1)^2} + \frac{Ex+F}{(x^2+1)^2}$

8. Evaluate  $\int \frac{x}{x^2 + 4x + 5} dx$ .

(a)  $\frac{1}{2(x^2 + 4x + 5)^2} - \frac{1}{2} \tan^{-1} \left( \frac{x+2}{2} \right) + C$       (b)  $\frac{1}{2} \ln(x^2 + 4x + 5) - 2 \tan^{-1}(x+2) + C$

(c)  $\frac{1}{2} \ln(x^2 + 4x + 5) + C$       (d)  $\frac{1}{\sqrt{5}} \tan^{-1} \left( \frac{x+2}{\sqrt{5}} \right) + C$

(e)  $\frac{5-x^2}{(x^2+4x+5)^2} + C$

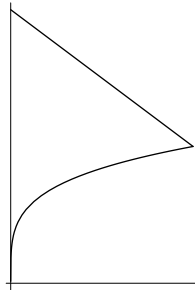
9. Determine the area of the surface obtained by rotating the curve  $y = 1 - \frac{x^2}{2}$ ,  $0 \leq x \leq \sqrt{2}$ , about the  $y$ -axis.

- (a)  $\pi(2\sqrt{3} - 1)$                       (b)  $3\pi/2$                       (c)  $6\pi(\sqrt{2} - 1/2)$   
(d)  $2\pi(\sqrt{3} - 1/3)$                       (e)  $\pi(2\sqrt{2} - 1)$

10. Find an approximation to  $\int_1^3 \frac{1}{x} dx$  using Simpson's rule with 4 subdivisions.

- (a)  $82/15$                       (b)  $16/15$                       (c)  $41/45$                       (d)  $11/15$                       (e)  $62/45$

11. Find the  $y$ -coordinate of the centroid of the region between the curves  $y = 2 - x$  and  $y = x^{1/4}$  for  $0 \leq x \leq 1$ . The area of this region is  $7/10$ .



- (a)  $5/6$                       (b)  $8/7$                       (c)  $7/6$                       (d)  $25/21$                       (e)  $15/14$

12. Determine which function satisfies the differential equation  $y'' + 9y = e^x$ .

- (a)  $y = e^x$                       (b)  $y = \sin(3x)$                       (c)  $y = \cos(3x)$   
(d)  $y = \frac{1}{10}e^x + \sin(3x)$                       (e)  $y = 10e^x + \cos(3x)$