

Record your answers to the multiple choice problems by placing an  $\times$  through one letter for each problem on this page. There are 22 multiple choice questions worth 6 points each. You start with 18 points.

You may not use a calculator.

1.  a  b  c  d  e

12.  a  b  c  d  e

2.  a  b  c  d  e

13.  a  b  c  d  e

3.  a  b  c  d  e

14.  a  b  c  d  e

4.  a  b  c  d  e

15.  a  b  c  d  e

5.  a  b  c  d  e

16.  a  b  c  d  e

6.  a  b  c  d  e

17.  a  b  c  d  e

7.  a  b  c  d  e

18.  a  b  c  d  e

8.  a  b  c  d  e

19.  a  b  c  d  e

9.  a  b  c  d  e

20.  a  b  c  d  e

10.  a  b  c  d  e

21.  a  b  c  d  e

11.  a  b  c  d  e

22.  a  b  c  d  e

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1.  a  b  c  d  e12.  a  b  c  d  e2.  a  b  c  d  e13.  a  b  c  d  e3.  a  b  c  d  e14.  a  b  c  d  e4.  a  b  c  d  e15.  a  b  c  d  e5.  a  b  c  d  e16.  a  b  c  d  e6.  a  b  c  d  e17.  a  b  c  d  e7.  a  b  c  d  e18.  a  b  c  d  e8.  a  b  c  d  e19.  a  b  c  d  e9.  a  b  c  d  e20.  a  b  c  d  e10.  a  b  c  d  e21.  a  b  c  d  e11.  a  b  c  d  e22.  a  b  c  d  e

1. Evaluate the series  $\sum_{n=0}^{\infty} \frac{1}{2^n n!}$ .

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

2. Evaluate  $\int_0^{\pi/2} x \cos(3x) dx$ .

- (a)  $-\frac{\pi}{6} + \frac{1}{3}$                       (b)  $-\frac{\pi}{2} + \frac{1}{3}$                       (c)  $-\frac{2\pi}{3} + \frac{1}{6}$                       (d)  $-\frac{\pi}{6} - \frac{1}{9}$                       (e)  $-\frac{\pi}{2} - \frac{1}{9}$

3. Calculate  $\int_3^5 \frac{1}{x^2 \sqrt{x^2 - 9}} dx$ .

- (a)  $\frac{3}{45}$                       (b)  $\frac{4}{45}$                       (c)  $\frac{8}{45}$                       (d)  $\frac{1}{45}$                       (e)  $\frac{2}{45}$

4. Determine the Taylor series of  $\sin(x)$  centered at  $\pi/2$ .

(a)  $\sum_{n=0}^{\infty} (-1)^n \frac{(x - \pi/2)^{2n+1}}{(2n + 1)!}$                       (b)  $\sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n + 1)!}$                       (c)  $\sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!}$

(d)  $\sum_{n=0}^{\infty} (-1)^n \frac{(x - \pi/2)^{2n}}{(2n)!}$                       (e)  $\sum_{n=0}^{\infty} \frac{(x - \pi/2)^{2n+1}}{(2n + 1)!}$

5. Determine how many terms are needed to approximate  $\sum_{n=1}^{\infty} (-1)^n \frac{\cos^2(n)}{n^2 + 1}$  with an error less than 0.0001.

- (a) 5000                      (b) 50                      (c) 10000                      (d) 500                      (e) 100

6. Find the length of the curve  $x = 1 + \frac{1}{t}$ ,  $y = 1 - \frac{1}{t}$ ,  $1 \leq t \leq 2$ .

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

7. The function  $f(x) = x^3 + 2x - 1$  is one-to-one. Find  $(f^{-1})'(2)$ .

- (a)  $\frac{1}{2}$             (b)  $\frac{1}{14}$             (c)  $\frac{1}{3}$             (d)  $\frac{1}{6}$             (e)  $\frac{1}{5}$

8. Evaluate the series  $\sum_{n=0}^{\infty} \frac{2^{2n}}{\pi^n}$ .

- (a)  $\frac{\pi}{\pi - 4}$             (b)  $\frac{1}{4 - \pi}$             (c) *diverges*            (d)  $\frac{4}{4 - \pi}$             (e)  $\frac{4}{4\pi - 1}$

9. Compute  $\int_0^1 \frac{2^x \ln(2)}{(2^x + 1)} dx$ .

- (a)  $\ln(2)$             (b)  $\ln(3)/2$             (c)  $2 \ln(2)$             (d)  $\ln(3/2)$             (e)  $3 \ln(2)$

10. Evaluate  $\int_0^{\infty} e^{-\sqrt{x}} dx$ .

- (a)  $4$             (b)  $1$             (c)  $2$             (d)  $3$             (e) *diverges*

11. Compute  $\int_0^{\pi/4} \tan^4(x) \sec^4(x) dx$ .

- (a)  $\frac{12}{35}$             (b)  $\frac{1}{7}$             (c)  $\frac{29}{35}$             (d)  $\frac{1}{5}$             (e)  $\frac{17}{35}$

12. Find the Cartesian coordinates  $(x, y)$  of the points where the polar curves  $r = 1 + \cos(\theta)$  and  $r = \sin(\theta)$  intersect.

(a)  $(0, 0)$

(b)  $(0, 0), (0, 1)$

(c)  $(0, 0), (0, 1), (0, -1)$

(d)  $(0, 0), \left(\frac{\sqrt{2}}{2}, 1 + \frac{\sqrt{2}}{2}\right), \left(\frac{\sqrt{2}}{2}, 1 - \frac{\sqrt{2}}{2}\right)$

(e)  $(0, 0), \left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right), \left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

13. Evaluate  $\int \frac{x^2 + 2x - 1}{x^3 - x} dx$ .

(a)  $\ln|x(x-1)/(x+1)| + C$

(b)  $\ln|x/(x^2 - 1)| + C$

(c)  $(x^2 + 2x - 1) \ln|x(x^2 - 1)| + C$

(d)  $(1/3) \ln|x^3 - x| + 2 \ln|x^2 - 1| + C$

(e)  $\ln|x| + \ln|x^3 - x| + C$

14. Estimate the error of approximating  $\sum_{n=1}^{\infty} \frac{1}{n^2}$  using the partial sum  $1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16}$ .

(a)  $\frac{1}{4}$

(b)  $\frac{1}{16}$

(c)  $\frac{\pi^2}{6}$

(d)  $\frac{1}{5}$

(e)  $\frac{1}{25}$

15. The function  $y = f(x)$  satisfies the differential equation  $y' = y^2 + 1$  with the initial condition  $f(1) = 0$ . Find  $f(1 + \pi/4)$ .

(a) 1

(b)  $1/\sqrt{2}$

(c)  $1 + (\pi/4)^2$

(d)  $1 + \pi/4$

(e) 0

16. Calculate  $\lim_{x \rightarrow 0^+} (\cos(2x))^{1/x^2}$ .

(a)  $e$

(b) 0

(c) 1

(d)  $e^3$

(e)  $1/e^2$

17. Find the slope of the line tangent to the curve  $x = t - t^3$ ,  $y = t + t^4$  at the point  $(0, 2)$ .

(a)  $(1 + 4t^3)/(1 - 3t^2)$       (b)  $-5/2$       (c)  $5$

(d)  $1 + 4t^3$       (e)  $-4/3$

18. Find the centroid of the region bounded by  $y = \cos x$ ,  $y = 0$ ,  $x = -\pi/2$ ,  $x = \pi/2$ .

(a)  $(0, \pi/4)$       (b)  $(0, 1/4)$       (c)  $(0, \pi/8)$       (d)  $(0, 1/2)$       (e)  $(0, 1/3)$

19. Determine the interval of convergence of  $\sum_{n=1}^{\infty} \frac{(-1)^n(x+1)^{2n}}{(2n)^n}$ .

(a)  $(-\sqrt{2} - 1, \sqrt{2} - 1)$       (b)  $[-\sqrt{2} - 1, \sqrt{2} - 1)$       (c)  $(-\sqrt{2} - 1, \sqrt{2} - 1]$

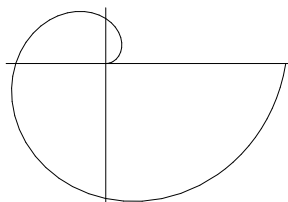
(d)  $(-\infty, \infty)$       (e)  $\{-1\}$

20. Find a power series representation for  $\frac{1}{(1+x)^4}$ .

(a)  $\sum_{n=0}^{\infty} (-1)^n \binom{n+3}{3} x^n$       (b)  $\sum_{n=0}^{\infty} 4^n x^n$       (c)  $\sum_{n=0}^{\infty} \binom{n+2}{2} x^n$

(d)  $\sum_{n=0}^{\infty} (-1)^n \frac{x^n}{4^n}$       (e)  $\sum_{n=0}^{\infty} (-1)^n \frac{4^n}{n!} x^n$

21. Find the area bounded by the spiral  $r = \theta$ ,  $0 \leq \theta \leq 2\pi$ , and the  $x$ -axis.



- (a)  $4\pi^3/3$       (b)  $4\pi$       (c)  $2\pi^2$       (d)  $\pi^3/6$       (e)  $2\pi$

22. Find the area of the surface formed by revolving the graph of  $f(x) = x^2$  on the interval  $0 \leq x \leq \sqrt{2}$  about the  $y$ -axis.

- (a)  $3\pi/2$       (b)  $4\pi$       (c)  $13\pi/3$       (d)  $27\pi/(2\sqrt{2})$       (e)  $2\pi$