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## Multiple Choice Questions

1. Find  $\int \sin(x) \cos(\cos(x)) dx$

- A.  $\cos(\sin(x)) + C$
- B.  $-\sin(\cos(x)) + C$
- C.  $-\cos(x) \sin(\sin(x)) + C$
- D.  $\sin(x) + \cos(x) + C$
- E.  $\sin^2(x) + \cos^2(x) + C$

2.  $\int x \cos(2x) dx =$ .

- A.  $-\frac{x}{2} \sin(2x) + \frac{1}{4} \cos(2x) + C$
- B.  $\frac{x}{2} \sin(2x) - \frac{1}{4} \cos(2x) + C$
- C.  $\frac{x}{2} \sin(2x) + \frac{1}{4} \cos(2x) + C$
- D.  $-2x \sin(2x) + \cos(2x) + C$
- E.  $-2x \sin(2x) - 4 \cos(2x) + C$

3. Which of the following is the correct form of the partial fraction expansion of

$$\frac{x^2 + 3x - 10}{(x^2 + 4x + 6)(x^2 - 1)(x + 1)} ?$$

- A.  $\frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{C}{x+1} + \frac{Dx+E}{x^2+4x+6}$ .
- B.  $\frac{A}{x+1} + \frac{B}{(x+1)^2} + \frac{C}{x-1} + \frac{Dx+E}{x^2+4x+6}$ .
- C.  $\frac{B}{(x+1)^2} + \frac{C}{x-1} + \frac{Dx+E}{x^2+4x+6}$ .
- D.  $\frac{A}{x+1} + \frac{Bx+C}{x^2-1} + \frac{Dx+E}{x^2+4x+6}$ .
- E.  $\frac{A}{x+1} + \frac{B}{(x+1)^2} + \frac{C}{x-1} + \frac{D}{x^2+4x+6}$ .

4. Use the fact that

$$\frac{13x^2 + 6x - 24}{(3x - 1)(x^2 + 4)} = \frac{6x + 4}{x^2 + 4} - \frac{5}{3x - 1}$$

to evaluate the integral

$$\int \frac{13x^2 + 6x - 24}{(3x - 1)(x^2 + 4)} dx.$$

- A.  $6 \ln|x^2 + 4| - \frac{5}{3} \ln|3x - 1| + C$
- B.  $12 \arctan\left(\frac{x}{2}\right) - \frac{5}{3} \ln|3x - 1| + C$
- C.  $\frac{8}{x+2} - \frac{5}{3} \ln|3x - 1| + 6 \ln|x + 2| + C$
- D.  $3 \ln|x^2 + 4| - \frac{5}{3} \ln|3x - 1| + 2 \arctan\left(\frac{x}{2}\right) + C$
- E.  $4 \ln|x - 2| + 2 \ln|x + 2| - \frac{5}{3} \ln|3x - 1| + C$

5. What is the area of the region enclosed by the curves  $y^2 = x$  and  $y = x$ ?

- A.  $1/2$
- B.  $1/3$
- C.  $1$
- D.  $1/6$
- E.  $3/2$

6. The table below gives values of  $f$ ,  $f'$ ,  $g$ , and  $g'$  for selected values of  $x$ . If

$$\int_0^1 f'(x)g(x)dx = 5,$$

then  $\int_0^1 f(x)g'(x)dx =$

$x$	0	1
$f(x)$	2	4
$f'(x)$	6	-3
$g(x)$	-4	3
$g'(x)$	2	-1

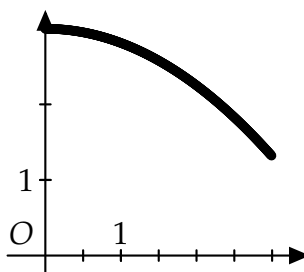
- A. -14
- B. -13
- C. -2
- D. 7
- E. 15

7. Which trigonometric integral is obtained after trigonometric substitution for

$$\int \frac{\sqrt{4-x^2}}{x} dx.$$

- A.  $\int \tan(\theta) d\theta$
- B.  $\frac{1}{2} \int \frac{\sin^2(\theta)}{\cos(\theta)} d\theta$
- C.  $2 \int \frac{\cos^2(\theta)}{\sin(\theta)} d\theta$
- D.  $\int \sin(\theta) d\theta$
- E.  $\int \cos(\theta) d\theta$

8. The graph of the function  $f$  is shown below for  $0 \leq x \leq 3$ . Of the following, which has the smallest value?



- A.  $\int_1^3 f(x) dx$
- B. Left Riemann sum approximation of  $\int_1^3 f(x) dx$  with 6 subintervals of equal length.
- C. Right Riemann sum approximation of  $\int_1^3 f(x) dx$  with 6 subintervals of equal length.
- D. Midpoint sum approximation of  $\int_1^3 f(x) dx$  with 6 subintervals of equal length.
- E. Trapezoidal sum approximation of  $\int_1^3 f(x) dx$  with 6 subintervals of equal length.

9. The function  $f$  is continuous on the closed interval  $[2, 14]$  and has values as shown the table below. Using three subintervals, what is the approximation of  $\int_2^{14} f(x)dx$  found by using the Trapezoid rule?

$x$	2	6	10	14
$f(x)$	12	28	34	30

- A. 249  
B. 296  
C. 332  
D. 368  
E.  $387.\overline{33}$
10. What are all the values of  $p$  for which  $\int_1^{\infty} \frac{1}{x^{2p}} dx$  converges
- A.  $p < -1$   
B.  $p > 0$   
C.  $p > \frac{1}{2}$   
D.  $p > 1$   
E. There are no values of  $p$  for which this integral converges.

## Free Response Questions

11. Find the following definite integral

$$\int_0^{\sqrt[3]{\pi/2}} v^2 \cos(v^3) dv.$$

12. Consider the two curves  $y = x^2 + 2$  and  $y = x + 1$ .

(a) Find the area of the region enclosed by these two curves and the vertical lines  $x = 0$  and  $x = 3$ .

(b) There is a vertical line  $x = a$  for  $0 < a < 3$  so that the area between the two curves between  $x = 0$  and  $x = a$  is exactly  $\frac{3}{2}$ . Write down the cubic equation that you need to solve in order to find  $a$ .



13. Find the following antiderivatives:

(a)  $\int x^2 \sin(x) dx$

(b)  $\int x^5 \sqrt[3]{x^3 + 1} dx$

14. Find the following integrals

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

(b)  $\int_0^8 x^{-2/3} dx.$

15. Compute the integral

$$\int \sin^3(x) dx.$$

Hint: Note that  $\sin^3(x) = \sin^2(x) \sin(x)$  and use a trigonometric identity followed by substitution.

16. A table of values for a continuous function  $f$  is shown below. If four equal subintervals of  $[0, 2]$  are used, what is the Simpson's rule approximation for  $\int_0^2 f(x) dx$ .

$x$	0.0	0.5	1.0	1.5	2.0
$f(x)$	2	8	6	12	10