

AOS Senior AP Calculus BC, Spring 2024

AP Test Review, Exam 1

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ACADEMIES OF LOUDOUN

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Student Signature

Class

Date

Print Name:

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1. Using the substitution $u = 2x^2 + 1$, the integral $\int_2^4 2x (2x^2 + 1)^3 dx$ is equal to which of the following?

(a) $\frac{1}{4} \int_9^{33} u^3 du$

(b) $2 \int_9^{33} u^3 du$

(c) $\frac{1}{2} \int_9^{33} u^3 du$

(d) $2 \int_9^{33} u^3 du$

(e) $\frac{1}{2} \int_9^{33} u^3 du$

2. Let f be the function given by

$$f(x) = \begin{cases} 2x + 3b & \text{if } x \leq 2 \\ 3ax^2 & \text{if } x > 2 \end{cases}$$

What are all values of a and b for which f is differentiable at $x = 2$?

(a) $a = \frac{1}{6} \quad b = \frac{-1}{3}$

(b) $a = \frac{-1}{6} \quad b = \frac{-2}{3}$

(c) $a = \frac{1}{3} \quad b = \frac{-2}{3}$

(d) $a = \frac{-1}{6} \quad b = \frac{1}{3}$

(e) $a = \frac{1}{6} \quad b = \frac{-2}{3}$

3. Evaluate

$$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2 + \sin(4x)} =$$

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

(b) π

(c) 0

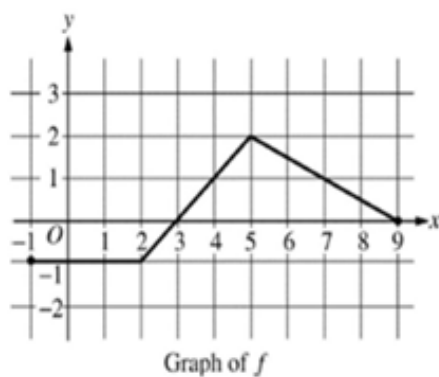
(d) -1

(e) 1

4. The function g is continuous on the closed interval $[2, 10]$. If $\int_9^1 g(x) dx = 25$ and $\int_1^5 \frac{g(x)}{2} dx = -12$, then

$$\int_5^9 g(x) dx =$$

- (a) 49
 - (b) -1
 - (c) 1
 - (d) -13
 - (e) 13
5. The graph of a piecewise linear function f is given.



What is the value of $\int_1^7 (4f(x) - 1) dx$?

- (a) 8
 - (b) 7.5
 - (c) 9.5
 - (d) 10
 - (e) 9
6. Evaluate

$$\lim_{h \rightarrow 0} \frac{\sec(3(x+h)) - \sec(3x)}{h}$$

- (a) $9 \tan^2(3x)$
- (b) $3 \tan^2(3x)$
- (c) $3 \sec^2(3x)$
- (d) $3 \sec(3x) \tan(3x)$
- (e) $3 \sec(x) \tan(x)$

7. Evaluate

$$\int_1^{\infty} x e^{-(x^2-1)} dx$$

- (a) $\frac{1}{e}$
- (b) $\frac{1}{2}$
- (c) divergent
- (d) 2
- (e) $\frac{1}{2e}$

8. Integrate

$$\int x^3 e^{2x} dx$$

- (a) $\frac{1}{8} e^{2x} (4x^3 - 6x^2 + 6x - 3) + C$
- (b) $\frac{1}{4} e^{2x} (4x^3 + 6x^2 + 6x + 3) + C$
- (c) $\frac{1}{8} e^{2x} (2x^3 - 3x^2 + 6x - 3) + C$
- (d) $\frac{1}{8} e^{2x} (4x^3 + 6x^2 - x + 3) + C$
- (e) $\frac{1}{4} e^{2x} (4x^3 - 6x^2 + 6x - 3) + C$

9. Evaluate

$$\int \frac{2x}{x^2 + 9} dx =$$

- (a) $\frac{1}{2} \ln(x^2 + 9) + C$
- (b) $\frac{1}{x^2 + 9} + C$
- (c) $\ln(x^2 + 9) + C$
- (d) $\frac{2}{(x^2 + 9)} + C$
- (e) $\frac{x}{3} \arctan\left(\frac{x}{3}\right) + C$

10. If f is the function defined

$$f(x) = \begin{cases} x^2 & \text{for } x < 3 \\ \frac{1}{3} & \text{for } x \geq 3 \end{cases}$$

then $\int_{-2}^4 f(x)dx$ is

(a) $\frac{-28}{3}$

(b) $\frac{28}{3}$

(c) 12

(d) 13

(e) $\frac{20}{3}$

11. Evaluate

$$\int \frac{1}{x^2 - 16x + 80} dx =$$

(a) $\frac{1}{4} \arctan\left(\frac{x-8}{4}\right) + C$

(b) $\frac{x}{6} \arctan\left|\frac{x-8}{6}\right| + C$

(c) $2 \ln|x-20| - 4 \ln|+4| + C$

(d) $\frac{1}{\ln|x^2 - 16x + 80|} + c$

(e) $\frac{1}{6} \arctan\left(\frac{x-8}{6}\right) + C$

12. Evaluate

$$\int \frac{9x+1}{(2x+1)(x-3)} dx$$

(a) $\ln|2x+1| + \ln|x-3| + C$

(b) $\frac{1}{2} \ln|2x+1| - 2 \ln|x-3| + C$

(c) $4 \ln|2x+1| - 2 \ln|x-3| + C$

(d) $2 \ln|2x+1| - 4 \ln|x-3| + C$

(e) $\frac{1}{2} \ln|2x+1| + 4 \ln|x-3| + C$

13. Evaluate

$$\int_0^3 \frac{x^2 + 5x + 6}{x + 2} dx =$$

- (a) $\frac{15}{2} + 2 \ln 2$
- (b) $\frac{17}{2} - 2 \ln 2$
- (c) $\frac{15}{2}$
- (d) $\frac{27}{2}$
- (e) $4 + 2 \ln 2$

14. Evaluate

$$\lim_{x \rightarrow e} \frac{\ln x - 1}{x - e}$$

- (a) $\frac{1}{e}$
- (b) $2e$
- (c) 1
- (d) $\frac{2}{e}$
- (e) e

15. Evaluate

$$\int \frac{\cos(\sqrt{x} + 1)}{\sqrt{x}} dx =$$

- (a) $2 \sin(\sqrt{x} + 1) + C$
- (b) $\cos(\sqrt{x} + 1) + C$
- (c) $\ln |\cos(\sqrt{x} + 1)| + C$
- (d) $\ln |\sin(\sqrt{x} + 1)| + C$
- (e) $\frac{1}{2} \sin(\sqrt{x} + 1) + C$

16. If the function f is continuous for all real numbers and if $f(x) = \frac{x^2 - 25}{x - 5}$ when $x \neq 5$, then $f(5) =$

- (a) 5
- (b) 10
- (c) -10
- (d) 25
- (e) -5

KEY

1. C
2. E
3. C
4. B
5. A
6. D
7. B
8. A
9. C
10. C
11. A
12. E
13. D
14. A
15. A
16. B