

Chapter 4 – AP Calculus AB

Name: _____

Antiderivative and Integral EXTRA PRACTICE**Directions:**

Answer each question without the use of a graphing calculator. A graphing calculator is allowed for problem #33 only.

For problems #1 to #9, find the antiderivative.

1. $f(x) = -4x + 21$

(A) $2x^2 - 21x + C$

(B) $-2x^2 + 21x + C$

(C) $-2x + 21 + C$

(D) $2x - 21 + C$

(E) $-2x^2 + C$

2. $f(x) = e^{-3x}$

(A) $-\frac{10}{3}e^{-3x} + C$

(B) $-e^{-3x} + C$

(C) $-\frac{10}{3}e^{-3x+1} + C$

(D) $-\frac{1}{.3x+1}e^{-.3x+1} + C$

(E) $-\frac{1}{.3x}e^{-.3x} + C$

3. $f(x) = 2.5\sqrt{x}$

(A) $\frac{5}{2}x^{\frac{3}{2}} + C$

(B) $\frac{2}{3}x^{\frac{3}{2}} + C$

(C) $\frac{5}{3}x^{\frac{3}{2}} + C$

(D) $-5x^{-\frac{1}{2}} + C$

(E) $-\frac{5}{2}x^{-\frac{1}{2}} + C$

4. $f(x) = \sqrt{e} - \pi^2 + \ln 16$

(A) $(\sqrt{e} - \pi^2 + \ln 16)x + C$

(B) $\frac{2}{3}e^{\frac{3}{2}} - \frac{1}{3}\pi^3 + \frac{1}{16} + C$

(C) 8

(D) C

(E) 0

5. $f(x) = \cos 2x$

(A) $\sin 2x + C$

(B) $2\sin 2x + C$

(C) $.5\sin 2x + C$

(D) $-.5\cos 2x + C$

(E) $-2\cos 2x + C$

6. $f(x) = -5\sqrt[3]{x^8}$

(A) $-3x^{\frac{5}{3}} + C$

(B) $-\frac{5}{3}x^{\frac{5}{3}} + C$

(C) $-\frac{15}{8}x^{\frac{8}{3}} + C$

(D) $-\frac{15}{11}x^{\frac{11}{3}} + C$

(E) $-\frac{5}{3}x^3 + C$

7. $f(x) = \pi^x$

(A) $\frac{1}{x+1}\pi^{x+1} + C$

(B) $\frac{1}{\ln \pi}\pi^x + C$

(C) $(\ln \pi)\pi^x + C$

(D) $(\ln \pi)\pi^{x+1} + C$

(E) $\frac{1}{\ln x+1}\pi^{\ln x+1} + C$

8. $f(x) = \frac{1}{\sqrt{1-x^2}}$

(A) $\arccos x + C$

(B) $\arcsin x + C$

(C) $\arctan x + C$

(D) $\arcsin(x^2) + C$

(E) $\arctan(x^2) + C$

9. $f(x) = \frac{1}{1+x^2}$

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

(B) $\frac{1}{1+x^2}\ln|1+x^2| + C$

(C) $\frac{1}{2x}\ln|1+x^2| + C$

(D) $\arctan x + C$

(E) $\arcsin x + C$

For problems #10 to #15, find the indefinite integrals.

10. $\int .5\sec^2 x \, dx$

- (A) $\cos x \sin x + C$
- (B) $.5\cos x \sin x + C$
- (C) $.5\cos^2 x \sin x + C$
- (D) $\cos^2 x \sin x + C$
- (E) $.5\tan x + C$

11. $\int \sin(e-x) \, dx$

- (A) $\sin(e-x) + C$
 - (B) $-\sin(-x) + C$
 - (C) $\cos(e-x) + C$
 - (D) $-\cos(e-x) + C$
 - (E) $-\cos(-x) + C$
-

12. $\int \frac{x^4 + x^3 + x^2 + x + 1}{x^2} \, dx$

- (A) $\frac{1}{3}x^3 + \frac{1}{2}x^2 + x + \ln x - x^{-1} + C$
- (B) $\frac{1}{3}x^3 + \frac{1}{2}x^2 + x + \ln x + C$
- (C) $\frac{\frac{1}{5}x^5 + \frac{1}{4}x^4 + \frac{1}{3}x^3 + \frac{1}{2}x^2 + x}{\frac{1}{3}x^3} + C$
- (D) $\frac{x^5 + x^4 + x^3 + x^2 + x}{x^3} + C$
- (E) $\frac{x^5 + x^4 + x^3 + x^2 + x}{\frac{1}{2}x} + C$

13. $\int x^2(x+2)^2 \, dx$

- (A) $\frac{1}{6}x^3(x+2)^3 + C$
 - (B) $\frac{1}{12}x^3(x+2)^3 + C$
 - (C) $\frac{1}{5}x^5 + x^4 + \frac{4}{3}x^3 + C$
 - (D) $\frac{1}{5}x^5 + \frac{1}{4}x^4 + \frac{2}{3}x^3 + C$
 - (E) $\frac{1}{2}x(x+2)^3 + C$
-

14. $\int \sqrt{8x+36} \, dx$

- (A) $\frac{1}{2}(8x+36)^{\frac{3}{2}} + C$
- (B) $\frac{1}{12}(8x+36)^{\frac{2}{3}} + C$
- (C) $\frac{1}{12}(8x+36)^{\frac{3}{2}} + C$
- (D) $\frac{1}{2}(8x+36)^{\frac{2}{3}} + C$
- (E) $\frac{3}{40}(8x+36)^{\frac{5}{3}} + C$

15. $\int \frac{1}{2x} \, dx$ (two possible answers)

- (A) $\frac{1}{2x} \ln x + C$
 - (B) $\frac{1}{2x} \ln 2x + C$
 - (C) $2 \ln x + C$
 - (D) $\frac{1}{2} \ln x + C$
 - (E) $\frac{1}{2} \ln 2x + C$
-

For problems #16 to #19, evaluate the definite integrals.

16. $\int_1^2 4x^3 dx$

- (A) 15
 - (B) 13.5
 - (C) 14
 - (D) 14.5
 - (E) 15
-

17. $\int_1^4 \frac{2}{x} dx$

- (A) $2\ln 2 + 1$
 - (B) $4\ln 2$
 - (C) $2\ln 2$
 - (D) $\ln 2 + 2$
 - (E) $\ln 2$
-

18. $\int_{\ln 5}^5 e^x dx$

- (A) $e^5 - 5$
 - (B) 0
 - (C) -4
 - (D) $5 - \ln 5$
 - (E) $e^5 - 1$
-

19. $\int_{-\frac{5\pi}{6}}^{\frac{7\pi}{12}} \sin 2x dx$

- (A) $\frac{\sqrt{3}-1}{2}$
 - (B) $\frac{\sqrt{3}-1}{4}$
 - (C) $\frac{\sqrt{3}+1}{2}$
 - (D) $\frac{\sqrt{3}-1}{4}$
 - (E) $\frac{\sqrt{3}+1}{4}$
-

For problems #20 to #28, find the definite integrals by u -substitution.

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

- (A) $\frac{1}{3} \sin^3 x + C$
 - (B) $\frac{1}{2x} \sin^2 x + C$
 - (C) $\frac{1}{2} \sin^4 x + C$
 - (D) $\frac{1}{2x} \sin^4 x + C$
 - (E) $\frac{1}{4} \sin^4 x + C$
-

21. $\int 8x^2 5^{(1-x^3)} dx$

- (A) $\frac{-1}{3 \ln 5} 5^{(1-x^3)} + C$
 - (B) $\frac{-8}{3x^2} 5^{(1-x^3)} + C$
 - (C) $\frac{-8}{3 \ln 5} 5^{(1-x^3)} + C$
 - (D) $\frac{8}{3x^2} 5^{(x^3)} + C$
 - (E) $\frac{8}{x^2} 5^{(x^3)} + C$
-

22. $\int \frac{3x}{2+6x^2} dx$

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

23. $\int \frac{2 \sin x}{1 + \cos^2 x} dx$

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

24. $\int \frac{dx}{x(\ln x)^6}$

- (A) $5(\ln(\ln x))^{-5} + C$
- (B) $\frac{1}{5}(\ln(\ln x))^5 + C$
- (C) $-\frac{1}{5}(\ln(\ln x))^{-5} + C$
- (D) $-\frac{1}{5}(\ln x)^{-5} + C$
- (E) $\frac{1}{5}(\ln x)^5 + C$

25. $\int \frac{x}{\sqrt{1-x^2}} dx$

- (A) $(1-x^2)^{-\frac{1}{2}} + C$
- (B) $-(1-x^2)^{\frac{1}{2}} + C$
- (C) $\arcsin(1-x^2) + C$
- (D) $-\arcsin(-x^2) + C$
- (E) $-\arcsin(x) + C$

26. $\int \frac{6x}{\sqrt{1-x^4}} dx$

- (A) $3\arcsin(x^5) + C$
 - (B) $4\arcsin(x^5) + C$
 - (C) $6\arcsin(x^2) + C$
 - (D) $2\arcsin(x^2) + C$
 - (E) $3\arcsin(x^2) + C$
-

27. $\int \cot x \, dx$

- (A) $x \tan|\ln x| + C$
- (B) $\tan|\ln x| + C$
- (C) $\ln|\sin x| + C$
- (D) $\ln|\cos x| + C$
- (E) $\ln|\tan x| + C$

28. $\int \frac{\sin \sqrt{x}}{\sqrt{x}} \, dx$

- (A) $-2\sqrt{x} \sin \sqrt{x} + C$
- (B) $-2 \sin \sqrt{x} + C$
- (C) $-2 \cos \sqrt{x} + C$
- (D) $-\frac{1}{15} \cos \sqrt{x} + C$
- (E) $-\frac{15}{2} \cos \sqrt{x} + C$

29. The rate of change of a function is the equation $3x^2 + 2$. If the function contains the point $(-1, 2)$, then what is the equation of the function?

- (A) $x^3 + 2x + 5$
 - (B) $x^3 - 2x + 1$
 - (C) $3x^2 - 1$
 - (D) $3x^2 + x$
 - (E) $6x + 8$
-

30. $\frac{d}{dx} \left(\int_1^{x^2} \cos(\sqrt{t}) dt \right) =$

- (A) $-2x \cos \sqrt{x}$
- (B) $-\cos \sqrt{x}$
- (C) $2x \cos x$
- (D) $-2x \cos x$
- (E) $\cos \sqrt{x}$

31. If $g(x) = \int_{x^2}^e \frac{1}{3t^2 + 1} dt$, then $g'(x) =$

- (A) $\frac{-1}{3x^2 + 1}$
- (B) $\frac{2x}{3x^2 + 1}$
- (C) $\frac{-1}{3x^4 + 1}$
- (D) $\frac{-2x}{3x^4 + 1}$
- (E) $\frac{-12x^3}{3x^4 + 1}$

32. If $f(x) = \int_1^x \frac{1}{t^2 - 4} dt$, then the domain of f is

- (A) $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$
 - (B) $(0, 2) \cup (2, \infty)$
 - (C) $[1, 2) \cup (2, \infty)$
 - (D) $(-2, 2)$
 - (E) $[1, 2)$
-

CALCULATOR REQUIRED

33. If $g(x) = \int_1^x \cos(t^2) dt$ for $-1 \leq x \leq e$, then $g(x)$ decreases on the interval

- (A) $-1 \leq x \leq 2.171$
- (B) $2.171 \leq x \leq e$
- (C) $-1 \leq x \leq 1.253$
- (D) $0 \leq x \leq 1.253$
- (E) $1.253 \leq x \leq 2.171$

34. If $g(x) = \int_x^4 e^{\sqrt{t}} dt$, then $g'(4) =$

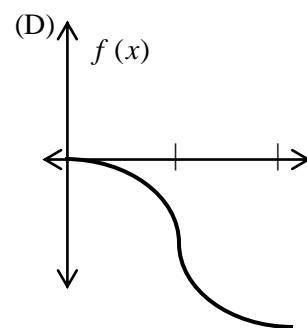
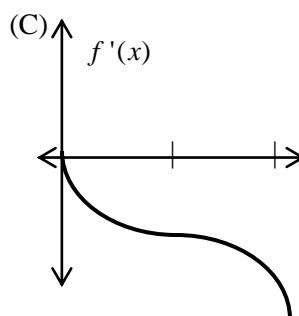
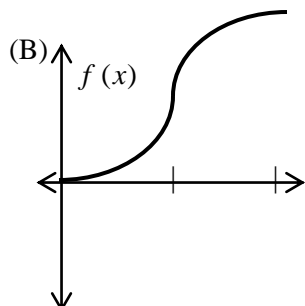
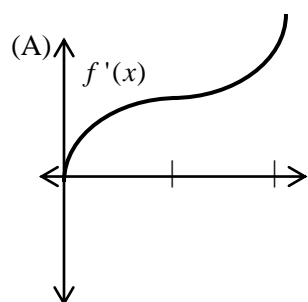
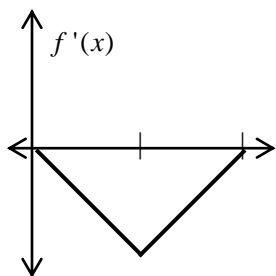
- (A) 0
- (B) e^2
- (C) $-e^2$
- (D) -1
- (E) $\frac{e^2}{4}$

35. If $u = 3x - 1$, then $\int_1^2 \sqrt{3x-1} dx$ may be written as

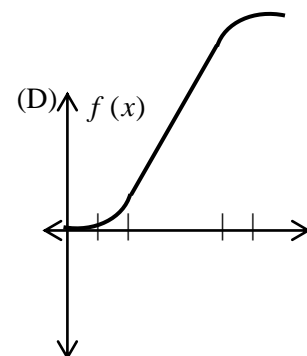
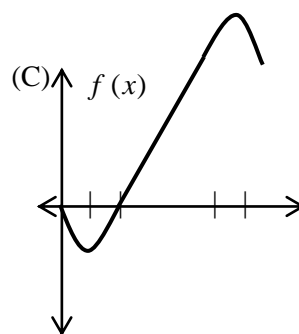
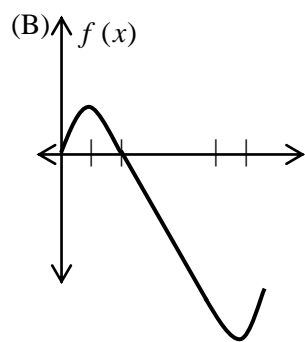
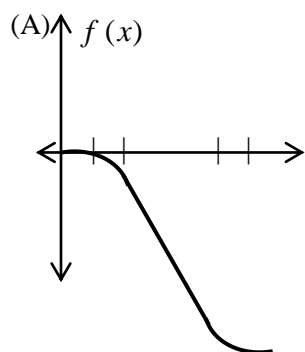
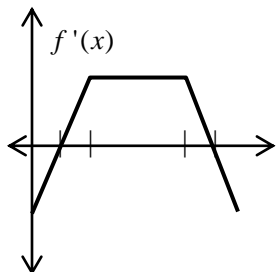
- (A) $\frac{1}{3} \int_1^2 \sqrt{u} du$
 - (B) $\frac{1}{3} \int_2^5 \sqrt{u} du$
 - (C) $\int_1^2 \sqrt{u} du$
 - (D) $\int_2^5 \sqrt{u} du$
 - (E) $-\frac{1}{3} \int_1^2 \sqrt{u} du$
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For problems #36 to #39, the graph of $f'(x)$ is shown. If $f(0) = 0$, then choose the correct graph of $f(x)$.

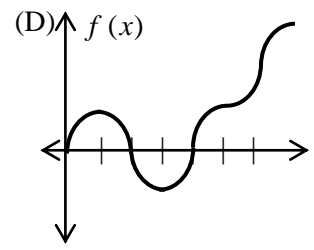
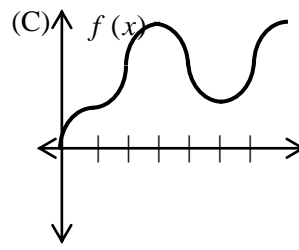
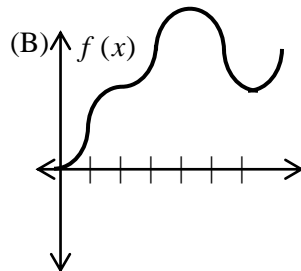
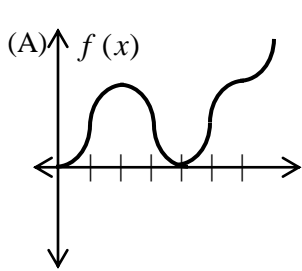
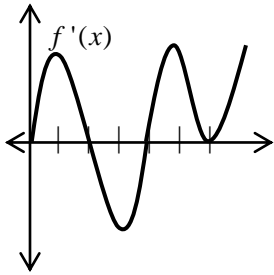
36.



37.



38.



ANSWERS:

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|------|-----------|------|------|
| 1 B | 11 C | 21 C | 31 D |
| 2 A | 12 A | 22 B | 32 D |
| 3 C | 13 C | 23 D | 33 E |
| 4 A | 14 C | 24 D | 34 C |
| 5 C | 15 D or E | 25 B | 35 B |
| 6 D | 16 E | 26 E | 36 D |
| 7 B | 17 B | 27 C | 37 C |
| 8 B | 18 A | 28 C | 38 A |
| 9 D | 19 E | 29 A | |
| 10 E | 20 E | 30 C | |