AP Classroom U-Substitution Practice (Unit 5 Lessons 1-4)

1) $\int_0^1 \left(x^3+x\right)\left(x^4+2x^2+9\right)^{\frac{1}{2}}dx =$

(A) $\frac{1}{6}$

(B) $\frac{2}{3}$

(C) $4\sqrt{3}-\frac{9}{2}$

(D) $16\sqrt{3}-18$

2) $\int \frac{3x^2+4x+1}{3x^3+6x^2+3x+5}dx =$

(A) $-\frac{9x^2+12x+3}{\left(3x^3+6x^2+3x+5\right)^2}+C$

(B) $\frac{x^3+2x^2+x}{\frac{3}{4}x^4+2x^3+\frac{3}{2}x^2+5x}+C$

(C) $\frac{1}{3}\ln\left|3x^3+6x^2+3x+5\right|+C$

(D) $\ln\left|3x^3+6x^2+3x+5\right|+C$

3) $\int \frac{12x^2}{2x+1}\,dx =$

(A) $2x^3 \ln|2x+1| + C$

(B) $4x^3 \ln|2x+1| + C$

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

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

4) $\int_3^5 \frac{2x^2+x+4}{x-1}\,dx =$

(A) $\frac{139}{9} - 23$

(B) $\frac{\frac{695}{6} - \frac{69}{2}}{\frac{15}{2} - \frac{3}{2}}$

(C) $22 + 7\left(\ln 4 - \ln 2\right)$

(D) $24 + 8\left(\ln 4 - \ln 2\right)$

5) Using the substitution $u = 4x - 3$, $\int x(4x-3)^{10}dx$ is equivalent to which of the following?

(A) $\int u^{10}du$

(B) $\frac{1}{4}\int u^{10}du$

(C) $\frac{1}{4}\int (u^{11}+3u^{10})du$

(D) $\frac{1}{16}\int (u^{11}+3u^{10})du$

6) Which of the following are equivalent to $\int_0^5 \frac{3x+11}{x+2}dx$?

I. $\frac{\int_0^5 (3x+11)dx}{\int_0^5 (x+2)dx}$

II. $\int_0^5 \left(3+\frac{5}{x+2}\right)dx$

III. $\int_2^7 \left(3+\frac{5}{u}\right)du$

(A) I only

(B) II only

(C) III only

(D) II and III only

7) Which of the following is equivalent to $\int_1^2 \frac{x^7 - 4x^3 + 6}{x^2} dx$?

(A) $\int_1^2 (x^5 - 4x + 6) dx$

(B) $\int_1^2 (x^5 - 4x^3 + 6) dx$

(C) $\int_1^2 (x^5 - 4x + 6x^{-2}) dx$

(D) $\int_1^2 (x^7 - 4x^3 + 6x^{-2}) dx$

8) Which of the following is equivalent to $\int (2x^3 + 1)^2 dx$?

(A) $\int (4x^6 + 4x^3 + 1) dx$

(B) $\int (2x^3 + 1) dx \cdot \int (2x^3 + 1) dx$

(C) $\int u^2 du$, where $u = 2x^3 + 1$

(D) $\frac{1}{6x^2} \int u^2 du$, where $u = 2x^3 + 1$

9) Which of the following is equivalent to $\int \cos(4x)\sin^5(4x)dx$?

(A) $\frac{1}{4}\int \cos u du \cdot \frac{1}{4}\int \sin^5 u du$, where $u = 4x$

(B) $\int \cos(4x)dx \cdot \int \sin^5(4x)dx$

(C) $\frac{1}{4}\int u^5 du$, where $u = \sin(4x)$

(D) $\int u^5 du$, where $u = \sin(4x)$

10) Which of the following is equivalent to $\int_1^{e^6} \frac{1}{x(2+\ln x)}dx$?

(A) $\int_2^8 \frac{1}{u}du$

(B) $\int_1^{e^6} \frac{1}{u}du$

(C) $\frac{1}{\int_1^{e^6} x(2+\ln x)dx}$

(D) $\int_1^{e^6} \frac{1}{x}dx \cdot \int_1^{e^6} \frac{1}{2+\ln x}dx$

11) $\int e^x \sin(6e^x + 3)dx =$

(A) $-e^x \cos(6e^x + 3) + C$

(B) $-6\cos(6e^x + 3) + C$

(C) $-\frac{1}{6}\cos(6e^x + 3) + C$

(D) $\frac{1}{6}\cos(6e^x + 3) + C$

12) What are all solutions to the differential equation $\frac{dy}{dx} = \frac{1}{x(\ln 2)}$?

(A) $y = \frac{\ln x}{\ln 2} + C$

(B) $y = \frac{x^{(1-\ln 2)}}{(1-\ln 2)} + C$

(C) $y = \frac{-1}{x^2(\ln 2)} + C$

(D) $y = e^{x(\ln 2)} + C$

13) What is the general solution to the differential equation $\frac{dy}{dx} = \frac{\cos x e^{\sin x}}{\cos y}$?

(A) $y = \arcsin\left(e^{\sin x}\right) + C$

(B) $y = \arcsin\left(e^{\sin x} + C\right)$

(C) $y = \sin x + \arcsin\left(C\right)$

(D) $y = \arcsin\left(\sin x e^{-\cos x} + C\right)$

14) What is the general solution to the differential equation $\frac{dy}{dx} = \frac{x\cos\left(x^2\right)}{4y}$ for $y > 0$?

(A) $y = \frac{1}{2}\sqrt{\sin\left(x^2\right)} + C$

(B) $y = \sqrt{\frac{1}{4}\sin\left(x^2\right) + C}$

(C) $y = \frac{1}{8}\sin\left(x^2\right) + C$

(D) $y = Ce^{\frac{1}{8}\sin\left(x^2\right)}$

15) Which of the following is the solution to the differential equation $\frac{dy}{dx} = (x-2)(y-2)$ for $y > 2$ with the initial condition $y(4) = 5$?

(A) $y = 4 + e^{\left(\frac{x^2}{2} - 2x\right)}$

(B) $y = 2 + 3e^{\left(\frac{x^2}{2} - 2x\right)}$

(C) $y = \frac{4 + \sqrt{16 + 4(x^2 - 4x + 5)}}{2}$

(D) $y = \frac{-x^2 + 4x + 5}{\left(1 - \frac{x^2}{2} + 2x\right)}$

16) $\int \frac{1}{\sqrt{9 - x^2}} dx =$

(A) $\ln\left(\sqrt{9 - x^2}\right) + C$

(B) $\frac{1}{3}\sin^{-1}\left(\frac{x}{3}\right) + C$

(C) $3\sin^{-1}\left(\frac{x}{3}\right) + C$

(D) $\sin^{-1}\left(\frac{x}{3}\right) + C$

17) $\int \frac{4}{x^2+4x+8}dx =$

(A) $4\ln\left|x^2+4x+8\right|+C$

(B) $\tan^{-1}\left(\frac{x+2}{2}\right)+C$

(C) $4\tan^{-1}(x+2)+C$

(D) $2\tan^{-1}\left(\frac{x+2}{2}\right)+C$

18) $\int \frac{8}{\sqrt{12-x^2-4x}}dx =$

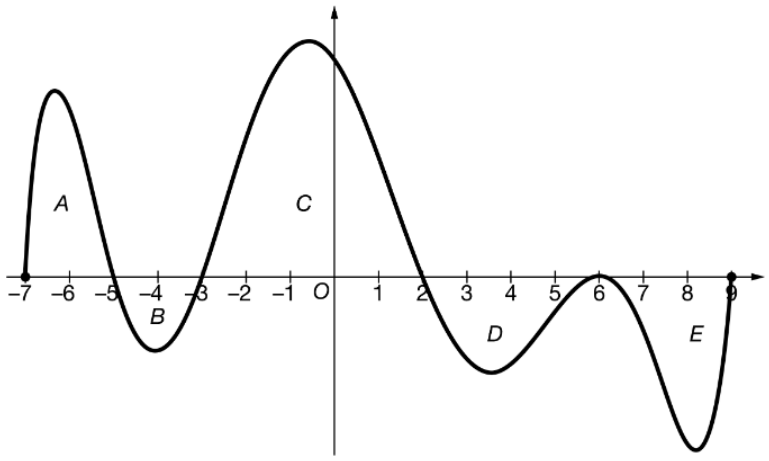
(A) $16\sqrt{12-x^2-4x}+C$

(B) $2\sin^{-1}\left(\frac{x+2}{4}\right)+C$

(C) $8\sin^{-1}\left(\frac{x-2}{4}\right)+C$

(D) $8\sin^{-1}\left(\frac{x+2}{4}\right)+C$

19) Open Ended



Graph of f

The figure above shows the graph of the continuous function f. The regions A, B, C, D, and E have areas 5, 2, 16, 5, and 6, respectively.

Find the value of $\int_{-7}^{-5} f(2x+16)dx$.