Homework 1

Monday, September 13, 2021 10:43 AM

Assignment Homework1 due 09/13/2021 at 11:59pm EDT

---

9. **(1 point)** Library/ma122DB/set12/s5_5_77.pg

If f is continuous and $\int_0^{10} f(x)\,dx = -16$, evaluate $\int_0^2 f(5x)\,dx$.

Answer: ______

$u = 5x \Rightarrow \frac{du}{dx} = u' = 5 \Rightarrow du = 5\cdot dx$

$\boxed{dx = \frac{1}{5}du}$

$\begin{cases} u = 0 & \text{when } x = 0 \\ u = 10 & \text{when } x = 2 \end{cases}$

$\Rightarrow \int_0^2 f(5x)\,dx \underset{=}{\overset{u=5x}{=}} \frac{1}{5}\int_0^{10} f(u)\,du = \frac{-16}{5}$

---

10. **(1 point)** Library/Wiley/setAnton_Section_5.3/Anton_5_3_Q16.pg

Evaluate the integral using an appropriate substitution.

$\int x^3\sqrt{x^4-9}\,dx =$ ______ $+C$

Solution: *(Instructor solution preview: show the student solution after due date.)*

$u = x^4 - 9, \quad du = 4x^3\,dx \Rightarrow x^3\,dx = \frac{1}{4}du$

$\Rightarrow \int x^3\sqrt{x^4-9}\,dx = \frac{1}{4}\int u^{\frac{1}{2}}\,du = \frac{1}{4}\frac{u^{\frac{3}{2}}}{\frac{3}{2}} + C$

$= \frac{1}{6}(x^4-9)^{\frac{3}{2}} + C$

---

11. **(1 point)** Library/Valdosta/APEX_Calculus/6.1/APEX_6.1_14.pg

Evaluate the indefinite integral using Substitution. (use C for the constant of integration.)

$\int \frac{9\ln x}{x}\,dx =$ ______

$(\ln x)' = \frac{1}{x}$

$\underline{\underline{u = \ln x}}$

$du = \frac{1}{x}dx$

$9\int u\,du = \frac{9}{2}u^2 + C = \frac{9}{2}(\ln x)^2 + C$

---

12. **(1 point)** Library/Valdosta/APEX_Calculus/6.1/APEX_6.1_24.pg

12. **(1 point)** Library/Valdosta/APEX_Calculus/6.1/APEX_6.1_24.pg

Evaluate the indefinite integral using Substitution. (use C for the constant of integration.)

$\int e^{9x+7}\,dx =$ ____________________

Sol.

$$\int e^{9x+7}\,dx \quad \frac{u=9x+7}{du=9dx} \quad \frac{1}{9}\int e^{u}\,du$$

$$= \frac{1}{9}e^{u}+C = \frac{1}{9}e^{9x+7}$$

13. **(1 point)** Library/Valdosta/APEX_Calculus/6.1/APEX_6.1_30.pg

Evaluate the indefinite integral using Substitution. (use C for the constant of integration.)

$\int 9^{6x}\,dx =$ ____________________

$$\boxed{\int a^{x}\,dx = \frac{a^{x}}{\ln a}+C}$$

$$\frac{u=6x}{du=6dx} \quad \frac{1}{6}\int 9^{u}\,du = \frac{1}{6}\cdot\frac{9^{u}}{\ln 9}+C$$

$$= \frac{1}{6\ln 9}\cdot 9^{6x}+C$$

14. **(1 point)** Library/Valdosta/APEX_Calculus/6.1/APEX_6.1_59.pg

Evaluate the indefinite integral. (use C for the constant of integration.)

$\int \frac{2x-1}{x^2-1x-30}\,dx =$ ____________________

$\Delta = (-1)^2 - 4\cdot 1\cdot(-30) > 0$

$u = x^2-x-30 \Rightarrow du = (2x-1)\,dx$

$$\int \frac{2x-1}{x^2-x-30}\,dx = \int \frac{du}{u} = \ln|u|+C$$

$$= \ln|x^2-x-30|+C$$

15. **(1 point)** Library/ma122DB/set12/s5_5_29.pg

Evaluate the indefinite integral.

$\int 4\sin^5 x\cos x\,dx$

15. **(1 point)** `Library/ma122DB/set12/s5_5_29.pg`

Evaluate the indefinite integral.

$$\int 4\sin^5 x\cos x\,dx$$

Answer: ______________ $+C$

$u = \sin x \Rightarrow du = \cos x\,dx$

$\Rightarrow \int 4\sin^5 x \cos x\,dx = 4\int u^5 \, du$

$= 4 \cdot \frac{u^6}{6} + C = \frac{2(\sin x)^6}{3} + C$

16. **(1 point)** `Library/Wiley/setAnton_Section_7.1/Anton_7_1_Q5.pg`

Evaluate the integral by any method.

$\int \frac{\sin(8x)}{2+\cos(8x)}\,dx =$ ______________ $+C$

Solution: *(Instructor solution preview: show the student solution after due date.)*

let $u = 2+\cos(8x) \Rightarrow du = -\sin(8x)\cdot 8 \cdot dx$

$\Rightarrow \sin(8x)\,dx = \frac{-1}{8}\,du$

$\Rightarrow \int \frac{\sin(8x)}{2+\cos(8x)}\,dx \overset{u=2+\cos(8x)}{=} \frac{-1}{8}\int \frac{1}{u}\,du$

$= -\frac{1}{8}\ln|u| + C = -\frac{1}{8}\ln(2+\cos 8x) + C$

SOLUTION

For $u = 2+\cos(8x)$ we have $-\frac{1}{8}du = \sin(8x)\,dx$ hence;

$$\int \frac{\sin(8x)}{2+\cos(8x)}\,dx = -\frac{1}{8}\int \frac{1}{u}\,du = -\frac{1}{8}\ln(|u|)+C = -\frac{1}{8}\ln(|2+\cos(8x)|)+C$$

17. **(1 point)** `Library/Wiley/setAnton_Section_5.3/Anton_5_3_Q20.pg`

Evaluate the integral using an appropriate substitution.

$\int \sec^2(9x)\,dx =$ ______________ $+C$

$(\tan x)' = \sec^2 x$

Solution: *(Instructor solution preview: show the student solution after due date.)*

$u = 9x, \quad du = 9\,dx$

$$\Rightarrow \int \sec^2(9x)\,dx = \frac{1}{9}\int \sec^2 u\,du = \frac{1}{9}\tan u + C$$

$$= \frac{1}{9}\tan(9x) + C$$

.

---

18. **(1 point)** Library/Utah/AP_Calculus_I/set8_Exponentials_and_Logarithms/1220s8p5.pg
Evaluate the indefinite integral

$\int x^4 \sin(x^5)\,dx =$ ______________ $+C$.

Hint: Use substitution.

$u = x^5, \quad du = 5x^4\,dx \Rightarrow x^4\,dx = \frac{1}{5}du$

$$\Rightarrow \int x^4 \sin(x^5)\,dx \underline{\underline{\;u=x^5\;}} \frac{1}{5}\int \sin(u)\,du$$

$$= -\frac{1}{5}\cos(u) + C = -\frac{1}{5}\cos(x^5) + C$$

---

19. **(1 point)** Library/UMN/calculusStewartET/s_7_2_prob05.pg
Evaluate

$$\int \tan^7 x \sec^2 x\,dx.$$

Answer: ______________

$(\tan x)' = \sec^2 x$

$(\sec x)' = \sec x \tan x$

$\tan^6 \sec x\, d \sec x$

Let $u = \tan x$. Then $du = \sec^2 x\,dx$

$$\Rightarrow \int \tan^7 x \sec^2 x\,dx = \int u^7\,du = \frac{u^8}{8} + C$$

$$= \frac{1}{8}(\tan x)^8 + C$$

.

---

20. **(1 point)** Library/UMN/calculusStewartCCC/s_5_5_24.pg
Evaluate the indefinite integral

20. **(1 point)** `Library/UMN/calculusStewartCCC/s_5_5_24.pg`
Evaluate the indefinite integral

$$\int \frac{\sin(\ln x)}{x}\,dx.$$

Answer: ______________

$u = \ln x, \quad du = \frac{1}{x}\,dx$

$\Rightarrow \int \frac{\sin(\ln x)\,dx}{x} = \int \sin(u)\,du$

$= -\cos(u) + C = -\cos(\ln x) + C$

.

19. **(1 point)** `Library/UMN/calculusStewartET/s_7_2_prob05.pg`
Evaluate

$$\int \tan^7 x \sec^2 x\,dx.$$

Answer: ______________

21. **(1 point)** `Library/UCSB/Stewart5_7_2/Stewart5_7_2_21.pg`

Evaluate the integral

$$\int 2\sec^2(x)\tan(x)\,dx$$

Let $u = \tan x \Rightarrow du = \sec^2 x\,dx$

$\Rightarrow \int 2\sec^2 x \tan x\,dx = 2\int u\,du$

$= u^2 + C = \underline{(\tan x)^2 + C}$

Method 2: $u = \sec x \Rightarrow du = \sec x \tan x\,dx$

$\Rightarrow \int 2\sec^2 x \tan x\,dx = 2\int u\,du$

$= u^2 + C = \underline{(\sec x)^2 + C}$ $\quad \tan^2 x + 1 = \sec^2 x$

22. **(1 point)** `Library/UCSB/Stewart5_5_5/Stewart5_5_5_4.pg`

Evaluate the following integral by making the given substitution:

$$\int \frac{-8\sin(\sqrt{x})}{\sqrt{x}}\,dx, \quad u=\sqrt{x} = x^{\frac{1}{2}}$$

Note: Any arbitrary constants used must be an upper-case "C".

$$du = \frac{1}{2} x^{-\frac{1}{2}} dx = \frac{1}{2}\frac{dx}{\sqrt{x}}$$

$$\Rightarrow \frac{dx}{\sqrt{x}} = 2\,du$$

$$\Rightarrow \int \frac{-8\sin(\sqrt{x})}{\sqrt{x}} dx \xrightarrow{u=\sqrt{x}} (-8)(2)\int \sin(u)\,du$$

$$= 16\cos u + C = 16\cos(\sqrt{x}) + C$$

23. **(1 point)** `Library/Michigan/Chap7Sec1/Q59.pg`

$x^{\frac{1}{3}}$

$x^{-\frac{2}{3}}$

Use the Fundamental Theorem of Calculus to find
$\int_1^8 \frac{\sin(\sqrt[3]{x})}{\sqrt[3]{x^2}}\,dx =$ ______________

Solution: *(Instructor solution preview: show the student solution after due date.)*

Let $u = x^{\frac{1}{3}} \Rightarrow du = \frac{1}{3} x^{-\frac{2}{3}} dx = \frac{1}{3}\frac{dx}{\sqrt[3]{x^2}}$

$$\Rightarrow \frac{dx}{\sqrt[3]{x^2}} = 3\,du$$

$$\Rightarrow \int_1^8 \frac{\sin(\sqrt[3]{x})\,dx}{\sqrt[3]{x^2}} = 3\int_{x=1}^{x=8} \sin(u)\,du$$

$$= -3\cos(u)\Big|_{x=1}^{8} = -3\cos(x^{\frac{1}{3}})\Big|_1^8$$

$$= -3[\cos(2) - \cos 1]$$

$$= 3(\cos 1 - \cos 2)$$

24. **(1 point)** `Library/ma122DB/set13/s6_5_1.pg`
Find the average value of $f(x) = x^3$ on the interval $[3,4]$.

Answer: ____________________

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION

Average value = $\frac{1}{4-3}\int_3^4 x^3\,dx = \left[\frac{x^4}{4}\right]_3^4 = \left(\frac{4^4}{4} - \frac{3^4}{4}\right) = \frac{175}{4}$

Correct Answers:

- `(4^(3+1)- (3^(3+1)))/((3+1)*(4-(3)))`

25. **(1 point)** `Library/Wiley/setAnton_Section_5.8/Anton_5_8_Q8.pg`
Find the average value of the function $f(x) = 6e^x$ on the interval $[-8, \ln 2]$.

$f_{\text{ave}} =$ ____________________

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION

$$f_{\text{ave}} = \frac{6}{\ln 2 + 8}\int_{-8}^{\ln 2} e^x\,dx = \frac{6}{\ln 2 + 8}\left[e^x\right]_{-8}^{\ln 2} = \frac{6}{\ln 2 + 8}(2 - e^{-8})$$

Correct Answers:

- `6/[ln(2)+8]*[2-e^(-8)]`