HL_04_25_22

7.1 The Substitution Rule

Question 5

Evaluate this integral using u-substitution

$$\int \frac{2x^4}{6-x^5}dx$$

Make a u-substitution then take the derivative

$$\begin{aligned} u &= 6 - x^5 \\ du &= -5x^4 dx \\ dx &= -\frac{du}{5x^4} \end{aligned}$$

Replace your $6 - x^5$ and your dx

$$\int \frac{2x^4}{u}\left(-\frac{du}{5x^4}\right)$$

Notice that the x^4's cancel out. The $-\frac{2}{5}$ is factored out.

$$-\frac{2}{5}\int \frac{1}{u}du = -\frac{2}{5}ln|u| = -\frac{2}{5}ln|6 - x^5| + C$$

Do not forget to add C when evaluating indefinite integrals.

Question 5

Use substitution to evaluate the indefinite integral.

$$\int \left(x^4 - 3x^2\right)\left(x^5 - 5x^3 + 4\right)^{\frac{1}{5}} dx$$

$$\int \left(x^4 - 3x^2\right)\left(x^5 - 5x^3 + 4\right)^{\frac{1}{5}} dx = \square$$

Lets perform u-substitution. Let $u = x^5 - 5x^3 + 4$

$$du = (5x^4 - 15x^2)dx$$
$$dx = \frac{du}{5x^4 - 15x^2}$$

Replace

$$\int \frac{(x^4 - 3x^2)u^{1/5}}{5x^4 - 15x^2} du$$

Factor out the 5 in the denominator and push to the front

$$\frac{1}{5} \int \frac{(x^4 - 3x^2)u^{1/5}}{x^4 - 3x^2} du$$

Cancel out the factors of x

$$\frac{1}{5} \int u^{1/5} du = \frac{1}{5} \frac{u^{6/5}}{6/5} = \frac{1}{5} \frac{5}{6} u^{6/5} = \frac{u^{6/5}}{6} = \frac{(x^5 - 5x^3 + 4)^{6}}{6}$$

Question 5

Use substitution to evaluate the indefinite integral.

$$\int (\sin^7 x) \cos x \, dx$$

$\int (\sin^7 x) \cos x \, dx = \square$

Let $u = sinx$

$$du = cosxdx$$

$$dx = \frac{du}{cosx}$$

Replace

$$\int u^7 cos(x)(\frac{du}{cosx})$$

Notice the $cos(x)$ cancels out

$$\int u^7 du = \frac{sin(x)^8}{8} + C$$

Problem 10

Evaluate the integral $\int \frac{4}{(4x-1)\ln(4x-1)}\, dx$.

$\int \frac{4}{(4x-1)\ln(4x-1)}\, dx = \square$

Let $u = ln(4x-1)$

$$du = \frac{4}{4x-1}dx$$
$$dx = \frac{4x-1}{4}du$$

Replace and cancel out

$$\int \frac{4}{4x-1}\frac{1}{u}\frac{4x-1}{4}du$$
$$= \int \frac{1}{u}du = ln|ln(4x-1)| + C$$

Problem 13

Use substitution to evaluate the definite integral.

$$\int_{\ln 5}^{\ln 9} \frac{e^x}{\left(e^x+1\right)^2}dx$$

$\int_{\ln 5}^{\ln 9} \frac{e^x}{\left(e^x+1\right)^2}dx = \square$ (Type an exact answer.)

Let $u = e^x + 1$

$$dx = \frac{du}{e^x}$$
$$= \int_{ln5}^{ln9} \frac{e^x}{u^2}\frac{du}{e^x}$$
$$= \int_{ln5}^{ln9} u^{-2}du$$
$$= -\frac{1}{e^x+1}\Bigg|_{ln5}^{ln9}$$

$$-\left(\frac{1}{10}-\frac{1}{6}\right)$$