Calculus II. Quiz 3. Name Key Time

Show all work on this page for full and/or partial credit. Put a box around your final answers in each part.

1. Find the average value of the function $f(x) = \dfrac{x+3}{\sqrt{x}}$ on the interval $[1, 9]$.

$$\boxed{\boxed{\frac{1}{9-1}}\boxed{\int_1^9 \frac{x+3}{\sqrt{x}}\,dx}} = \frac{1}{8}\int_1^9 \frac{x}{x^{1/2}} + \frac{3}{x^{1/2}}\,dx$$

$$= \frac{1}{8}\int_1^9 \left(x^{1/2} + 3x^{-1/2}\right)dx$$

$$= \frac{1}{8}\left[\frac{2x^{3/2}}{3} + 3(2)x^{1/2}\right]_1^9$$

$$= \frac{1}{8}\left(18 + 18 - \left(\frac{2}{3} + 6\right)\right) = \frac{1}{8}\left(30 - \frac{2}{3}\right) = \boxed{\frac{11}{3}}$$

2. Evaluate the definite integral. You must show the steps of integration by parts. $\displaystyle\int_1^2 x^4 \ln(x)\,dx$

$$\begin{bmatrix} \boxed{u = \ln x} & \boxed{dv = x^4\,dx} \\ du = \frac{1}{x}dx & v = \frac{x^5}{5} \end{bmatrix} = \boxed{\boxed{\frac{x^5}{5}}\boxed{\ln x}}_1^2 - \boxed{\int_1^2 \frac{1}{x}\cdot\frac{x^5}{5}\,dx}$$

$\frac{x^4}{5}$

$$= \left[\frac{x^5}{5}\ln x\right]_1^2 - \left[\frac{x^5}{25}\right]_1^2 \qquad \approx 3.1961$$

$$= \frac{32}{5}\ln 2 - 0 - \left(\frac{32}{25} - \frac{1}{25}\right) = \boxed{\frac{32}{5}\ln 2 - \frac{31}{25}}$$

3. Find the indefinite integral. You must show the steps of integration by parts. $\displaystyle\int e^{3x}\sin(4x)\,dx$

$$\begin{bmatrix} \boxed{u = \sin 4x} & \boxed{dv = e^{3x}dx} \\ du = 4\cos 4x & v = \frac{1}{3}e^{3x} \end{bmatrix} = \boxed{\frac{1}{3}e^{3x}}\boxed{\sin 4x} - \boxed{\int \frac{4}{3}e^{3x}\cos 4x}$$

max)

$$\begin{bmatrix} u = \cos 4x & dv = e^{3x} \\ du = -4\sin 4x & v = \frac{1}{3}e^{3x} \end{bmatrix} = \frac{1}{3}e^{3x}\sin 4x - \frac{4}{3}\left(\frac{1}{3}e^{3x}\cos 4x - \int \frac{-4}{3}e^{3x}\sin 4x\right)$$

$$\Rightarrow \frac{9}{9}\int e^{3x}\sin 4x\,dx = \frac{1}{3}e^{3x}\sin 4x - \frac{4}{9}e^{3x}\cos 4x - \frac{16}{9}\int e^{3x}\sin 4x\,dx$$

$$\Rightarrow \frac{25}{9}\int e^{3x}\sin 4x\,dx = \frac{1}{3}e^{3x}\sin 4x - \frac{4}{9}e^{3x}\cos 4x$$

$$\Rightarrow \int e^{3x}\sin 4x\,dx = \boxed{\frac{9}{25}\left(\frac{e^{3x}}{3}\sin 4x - \frac{4e^{3x}}{9}\cos 4x\right) + c} = \boxed{\frac{3e^{3x}}{25}\left(\sin 4x - \frac{4}{3}\cos 4x\right) + c}$$