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MAT 104 Assignment

① $\int \frac{2x}{\sqrt{4x^2-1}}\,dx = \frac{1}{2}\sqrt{4x^2-1}+c$

Soln:

$$\int \frac{2x}{\sqrt{4x^2-1}}\,dx$$

$$\int 2x(4x^2-1)^{-\frac{1}{2}}\,dx$$

$$2\int x(4x^2-1)^{-\frac{1}{2}}\,dx$$

Let $u = 4x^2-1$

$$2\int x\, u^{-\frac{1}{2}}\,dx$$

$$\frac{du}{dx} = 8x$$

$$\frac{du}{8x} = \frac{dx\,8x}{8x} \qquad dx = \frac{du}{8x}$$

$$2\int x\, u^{-\frac{1}{2}} \cdot \frac{du}{8x}$$

$$= 2\times\frac{1}{8}\int x \cdot u^{-\frac{1}{2}} \cdot \frac{du}{x}$$

$$\frac{2}{8}\int u^{-\frac{1}{2}}\,du$$

$$\frac{1}{4}\int u^{-\frac{1}{2}}\,du$$

$$\frac{\frac{1}{4}u^{\frac{1}{2}}}{\frac{1}{2}} = \frac{\frac{1}{4}(4x^2-1)^{\frac{1}{2}}}{\frac{1}{2}}$$

$$= \frac{\sqrt{4x^2-1}}{2}+C$$

(2) $\int \frac{\sin^{-1}x}{\sqrt{1-x^2}}\,dx = \frac{(\sin^{-1}x)^2}{2} + C$

Soln.

Let $u = \sin^{-1}x$

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

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

$$dx = du\,(\sqrt{1-x^2})$$

$$\int u \frac{1}{\sqrt{1-x^2}}\,du\,(\sqrt{1-x^2})$$

$$\int u\,du$$

$$\frac{u^{1+1}}{1+1} = \frac{u^2}{2}$$

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

(3) $\int (\tan x)^6 \sec^2 x \, dx = \frac{(\tan x)^7}{7} + C$

Sol

Let $u = \tan x$

$\int u^6 \sec^2 x \, dx$

$\frac{du}{dx} = \sec^2 x$

$\frac{du}{\sec^2 x} = \frac{dx \, \sec^2 x}{\sec^2 x}$

$dx = \frac{du}{\sec^2 x}$

$\int u^6 \sec^2 x \, dx$

$\int u^6 \frac{\sec^2 x}{\sec^2 x} \frac{du}{\sec^2 x}$

$\int u^6 \, du \Rightarrow \frac{u^{6+1}}{6+1} = \frac{u^7}{7}$

$= \frac{(\tan x)^7}{7} + C$ //