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MTH 104 ASSIGNMENT

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

Sol.

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

$$\frac{du}{dx} = \frac{1}{2}(4x^2-1)^{-\frac{1}{2}} \cdot 8x$$

$$\cancel{dx = \frac{4x}{(4x^2-1)^{\frac{1}{2}}}} \quad \frac{du}{dx} = 4x(4x^2-1)^{-\frac{1}{2}}$$

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

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

We have: $\int \frac{2x}{u} dx \Rightarrow 2\int \frac{x}{\cancel{(4x^2-1)^{\frac{1}{2}}}} \cdot \frac{\cancel{(4x^2-1)^{\frac{1}{2}}}}{4x} du$

$$\frac{2}{4}\int du = \frac{1}{2}[u+c] = \frac{1}{2}(\sqrt{4x^2-1}) + c.$$

$$\therefore \int \frac{2x}{\sqrt{4x^2-1}} dx = \frac{1}{2}(\sqrt{4x^2-1}) + c.$$

2.) $\int \frac{\sin^{-1}(x)}{\sqrt{1-x^2}} dx$

Sol.

$\int \sin^{-1}x \cdot (1+x^2)^{-\frac{1}{2}} dx$

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

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

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

Therefore we have

$\int u \, du = \frac{u^2}{2} + c = \frac{(\sin^{-1}x)^2}{2} + c$

$\therefore \int \frac{\sin^{-1}x}{\sqrt{1-x^2}} = \frac{(\sin^{-1}x)^2}{2} + c$

3.) $\int (\tan x)^6 \sec^2 x \, dx$

Sol.

Let $u = \tan x$

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

$du = \sec^2 x \, dx$

There fore, we have.

$\int u^6 du = \frac{u^7}{7} + c = \frac{(\tan x)^7}{7} + c$

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