MATH 104 ASSIGNMENT

IDOVICTOR YVONNE UYAIABASI
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1. $\int \frac{2x}{\sqrt{4x^2-1}}\,dx = \frac{1}{2}\sqrt{4x-1} + C$

Solution

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

$$u = (4x^2-1)^{1/2}$$
$$u^2 = 4x^2-1$$
$$u^2+1 = 4x^2$$

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

$$\therefore x = \left(\frac{u^2+1}{4}\right)^{1/2}$$

$$\frac{dx}{du} = \frac{\cancel{udu}\,1}{\cancel{4}\,2}\left(\frac{u^2+1}{4}\right)^{-1/2} \cdot \frac{u}{2}$$

$$dx = \frac{u\,du}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$$

$$2\int \left(\frac{u^2+1}{4}\right)^{1/2} \cdot \frac{1}{u} \cdot \frac{u\,du}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$$

$$\frac{2}{4}\cancel{\int \left(\frac{u^2+1}{4}\right)^{1/2} \cdot \frac{1}{u} \cdot \frac{u\,du}{4}\left(u^2+1\right.}$$

$$\frac{2}{4}\int \frac{u}{u}\,du$$

$$\frac{2}{4}\int du = \frac{1}{2}[u] + C$$

$$\therefore \int \frac{2x}{(4x^2-1)^{1/2}}\,dx = \frac{\sqrt{4x^2-1}}{2} + C$$

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

Solution.

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

$\int \sin^{-1}x \cdot (\sqrt{1^2-x^2})^{-1/2}\,dx$

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

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

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

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

$\int u\,du$

$\frac{u^2}{2} + C$

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

3. $\int (\tan x)^6 \sec^2 x\,dx \Rightarrow$ $u = \tan x$, $du = \sec^2 x\,dx$, $u^6\,du = u^7/7$

Solution.

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

$u = \tan x$

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

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

$\int u^6\,du$

$\left[\frac{u^7}{7}\right] + C = \frac{(\tan x)^7}{7} + C$