Integration

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Prove the following:

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

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

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

Solution

No1

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

Let $u = 4x^2 - 1$ $\quad du/dx = 8x$, $\quad dx/du = 1/8x$

$$\int \frac{2x}{\sqrt{4x^2-1}}\,dx = \int 2x \cdot u^{-1/2} \cdot \frac{du}{8x}$$

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

$$\int \frac{2x}{\sqrt{4x^2-1}}\,dx = \frac{1}{4}\left[\frac{u^{1/2}}{1/2}\right] + c$$

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

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

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

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

NO2

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

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

Eq

v

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

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

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

$\int u\,du = \frac{u^2}{2} + C$

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

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

NO3

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

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

we have

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

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