19/mhsa1/081

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Assignment

① $\int \frac{2x}{\sqrt{4x^2-1}}\,dx$

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

③ $\int (\tan x)^6 \sec^2 x\,dx$

Solution

① $\int \frac{2x}{\sqrt{4x^2-1}}\,dx$

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

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

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

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

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

We have

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

$= \frac{1}{2}\int du$

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

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

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

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

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

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

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

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

③ $\int (\tan x)^6 \sec^2 x\,dx$

let $u = \tan x$

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

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

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

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