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Integrate the following:

(i) $\int \frac{2x}{\sqrt{4x^2-1}}\,dx$ (ii) $\int \frac{\sin^{-1}x}{\sqrt{1-x^2}}\,dx$ (iii) $\int (\tan x)^5 \sec^2 x\,dx$

Solution

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

let $u = \sqrt{4x^2-1} = (4x^2-1)^{1/2}$

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

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

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

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

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

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

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

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

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

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

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

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

Let $u = \tan x$

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

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

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