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

Solution.

$\int 2x \cdot (4x^2-1)^{-1/2} \cdot dx$

Let $u = 4x^2 - 1$

$\frac{du}{dx} = 8x$

$du = 8x\,dx$

$dx = \frac{du}{8x}$

$\therefore = \int \frac{1}{2x} \cdot u^{-1/2} \cdot \frac{du}{8x}$

$= \frac{1}{4}\int u^{-\frac{1}{2}} \cdot du$

$= \frac{1}{4}\left[\frac{u^{\frac{1}{2}}}{\frac{1}{2}}\right] + C$

$= \frac{1}{4}\left[2u^{\frac{1}{2}}\right] + c$

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

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

Solution.

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

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

$\frac{dx}{du} = \cos u$

but $\sin^2 u + \cos^2 u = 1$

$\cos^2 u = 1 - \sin^2 u$

$\cos^2 u = 1 - x^2$

$\cos u = \sqrt{1-x^2}$

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

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

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

$= \int u \cdot du$

$= \frac{u^2}{2} + c$

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

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

Solution

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

Let $u = \tan x$

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

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

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

$\therefore \int u^6 \cdot du$

$= \left[\frac{u^7}{7}\right] + c$

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