

MATHS 109

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

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

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

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

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

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

we have

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

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

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

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

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

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

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

$$8 \int (\tan x)^6 \sec^2 x \, dx$$

$$\text{let } u = \tan x$$

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

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

$$= \int (u)^6 \cdot du$$

$$= \frac{u^{6+1}}{6+1} \cdot du$$

$$= \frac{u^7}{7} \cdot du$$

$$= \frac{[\tan x]^7}{7} + C$$