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MAJ 104

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

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

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

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

$$dy/dx = 4x (4x^2-1)^{-1/2}$$

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

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

$$\int \frac{2x}{u} \cdot \frac{(4x^2-1)^{1/2} du}{4x} \Rightarrow \int \frac{2x}{u} \cdot \frac{(4x^2-1)^{1/2} du}{\cancel{4x}}$$

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

$$\int \frac{1}{\cancel{(4x^2-1)^{1/2}}} \cdot \frac{\cancel{(4x^2-1)^{1/2}} du}{2}$$

$$= \frac{1}{2} \int du \quad \frac{1}{2} u + C$$

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

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

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

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

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

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

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

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

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

$$u = \tan x$$

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

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

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

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