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COURSE: MATH 104
ASSIGNMENT

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

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

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

Solution.

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

$$\text{Let } u = 4x^2 - 1$$

$$\left(\frac{u-1}{4}\right)^{1/2} = x$$

$$2x = \left(\frac{u-1}{4}\right)^{1/2} \Rightarrow \frac{(u-1)^{1/2}}{2}$$

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

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

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

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

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

$$= \frac{2}{4} \left[(4x^2-1)^{1/2} \right] + C$$

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

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

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

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

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

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

$$= \int u du$$

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

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

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

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

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

$$\int u^6 \cdot \frac{\sec^2 x}{\sec^2 x} \cdot \frac{du}{\sec^2 x}$$

$$= \frac{u^7}{7} + C$$

$$\int (\tan x)^6 \sec^2 x dx = \frac{(\tan x)^7}{7} + C.$$