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Course: Math 104

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

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

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

We have

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

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

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

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

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

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

$$3) \int (\tan x)^5 \sec^2 x dx$$

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

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

we have

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

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