

$$S = \int_1^2 \frac{2}{x^2} dx$$

$$= \left[ -\frac{2}{x} \right]_1^2 = -(1-2) = 1$$

$$S = \int_0^1 \frac{4}{1+x^2} dx$$

$$x = \tan \theta \quad \left( -\frac{\pi}{2} < \theta < \frac{\pi}{2} \right) \quad x = 0 \quad \theta = 0$$

$$\frac{dx}{d\theta} = \frac{1}{\cos^2 \theta} \quad \text{or}$$

$$\int_0^{\frac{\pi}{4}} \frac{4}{\tan^2 \theta + 1} \cdot \frac{1}{\cos^2 \theta} d\theta$$

$$= \int_0^{\frac{\pi}{4}} \frac{4}{\frac{1}{\cos^2 \theta}} \cdot \frac{1}{\cos^2 \theta} d\theta$$

$$= \int_0^{\frac{\pi}{4}} 4 d\theta = [4\theta]_0^{\frac{\pi}{4}} = \pi$$