

$$1. \int \frac{\ln x}{x^2} dx$$

$$2. \int \tan^3 3x \sec 3x dx$$

$$3. x(t) = 2 \cos^3 t, y(t) = 2 \sin^3 t, t = 0 \dots \frac{\pi}{2}$$

$$4. x(t) = t - \sin t, y(t) = 1 - \cos t, t = 0 \dots 2\pi$$

$$1. \int \frac{\ln x}{x^2} dx$$

$$u = \ln x \quad dv = x^{-2}$$

$$du = \frac{1}{x} dx \quad v = -\frac{1}{x}$$

$$uv - \int v du$$

$$\frac{\ln x}{-x} + \int \frac{1}{x} \left(\frac{1}{x}\right) dx$$

$$\frac{-\ln x}{x} - \frac{1}{x} + C$$

$$u = \frac{1}{x^2}$$

$$dv = \ln x dx$$

$$du = d(x^{-2})$$

$$= -2x^{-3}$$

$$= \frac{-2}{x^3} dx$$

works too

$$2. \int \tan^3 3x \sec 3x dx = \text{Max Z}$$

$$\int \frac{\sin^3 3x}{\cos^4 3x} dx \rightarrow \frac{1}{3} \int \frac{\sin x (1 - \cos^2 x)}{\cos^4 x} dx$$

$$\downarrow \quad \begin{array}{l} dv = -\sin x \\ u = \cos x \end{array}$$

$$\frac{1}{3} \int \left(\frac{1}{u^4} - \frac{1}{u^2} \right) du = \frac{1}{3} \left(\frac{u^{-3}}{-3} + u^{-1} \right)$$

(substitute $3x$ in)

$$\frac{1}{3} \left(\frac{1}{-3 \cos^3 x} + \frac{1}{\cos x} \right) \rightarrow \frac{\sec^3 3x}{9} - \frac{\sec 3x}{3} + C$$

Jimmy B.

$$x(t) = 2\cos^3 t \quad y(t) = 2\sin^3 t \quad t = 0 \dots \pi/2$$

$$x'(t) = 6\cos^2 t \cdot -\sin t \quad y'(t) = 6\sin^2 t \cdot \cos t$$

$$x'(t)^2 = 36\cos^4 t \sin^2 t \quad y'(t)^2 = 36\sin^4 t \cos^2 t$$

$\pi/2$

$$\int_0^{\pi/2} \sqrt{36\cos^4 t \sin^2 t + 36\sin^4 t \cos^2 t} dt$$

$$\int \sqrt{36(\cos^4 t \sin^2 t + \sin^4 t \cos^2 t)} dt$$

$$\int \sqrt{36\cos^2 t \sin^2 t (\cos^2 t + \sin^2 t)} dt$$

$$\int \sqrt{36\cos^2 t \sin^2 t} dt$$

$$6 \int \cos t \sin t dt$$

$$6 \left(\frac{-\cos^2 t}{2} \right) \Big|_0^{\pi/2}$$

also

$$3 \int \frac{2 \sin t \cos t dt}{\sin 2t}$$

$$0 \dots \pi/2$$
$$\left[3 \right]$$

$$x(t) = t - \sin t$$

$$x'(t) = 1 - \cos t$$

$$(x'(t))^2 = (\cos t - 1)^2$$

$$y(t) = 1 - \cos t$$

$$y'(t) = \sin t$$

$$(y'(t))^2 = \sin^2 t$$

Done

$$\int_a^b \sqrt{x'(t)^2 + y'(t)^2} dt$$

$$\int_0^{2\pi} \sqrt{(\cos t - 1)^2 + \sin^2 t} dt$$

$$\int \sqrt{\cos^2 t - 2\cos t + 1 + \sin^2 t} dt$$

$$\int \sqrt{(1 - \sin^2 t) - 2\cos t + 1 + \sin^2 t} dt$$

$$\int \sqrt{-2\cos t + 2} dt$$

$$\int \sqrt{4 \left(\frac{1 - \cos t}{2} \right)}$$

$$\int \sqrt{4 \left(\frac{1 - \cos 2\theta}{2} \right)}$$

$$\int \sqrt{4 \sin^2 \frac{t}{2}} \quad \frac{t}{2} = \theta$$

$$t = 2\theta$$

$$dt = 2d\theta$$

$$\int 2 \sin \theta \cdot 2 d\theta$$

$$-4 \cos \theta \Big|_0^{2\pi}$$

$$-4 \cos \frac{t}{2} \Big|_0^{2\pi}$$

$$-4 \cos \pi + 4 \cos 0$$

$$-4(-1) + 4 \cdot 1$$

$$L = 8$$