1. Find an equation for the line tangent to the curve $x = \sec t$, $y = \tan t$, $-\frac{\pi}{2} < t < \frac{\pi}{2}$ at the point where $t = \frac{\pi}{4}$.

Find $\frac{dy}{dx}$:

$\frac{dx}{dt} = \sec t \tan t$, $\frac{dy}{dt} = \sec^2 t$

$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{\sec^2 t}{\sec t \tan t} = \frac{\sec t}{\tan t}$

Find slope of tangent line:

$\left.\frac{dy}{dx}\right|_{t=\frac{\pi}{4}} = \frac{\sec \frac{\pi}{4}}{\tan \frac{\pi}{4}} = \frac{\sqrt{2}}{1} = \sqrt{2}$

Find point where $t = \frac{\pi}{4}$:

$x = \sec \frac{\pi}{4} = \sqrt{2}$, $y = \tan \frac{\pi}{4} = 1$

$(\sqrt{2}, 1)$

Tangent line:

$$y - 1 = \sqrt{2}(x - \sqrt{2})$$

2. Find the length of the curve $x = r\cos t$, $y = r \sin t$, $0 \le t \le 2\pi$ (using the arc length formula). What have you just done?

$\frac{dx}{dt} = -r\sin t$, $\frac{dy}{dt} = r\cos t$

$$L = \int_0^{2\pi} \sqrt{(-r\sin t)^2 + (r\cos t)^2}\, dt$$

$$= \int_0^{2\pi} \sqrt{r^2(\sin^2 t + \cos^2 t)}\, dt \quad (\sin^2 t + \cos^2 t = 1)$$

$$= \int_0^{2\pi} r\, dt$$

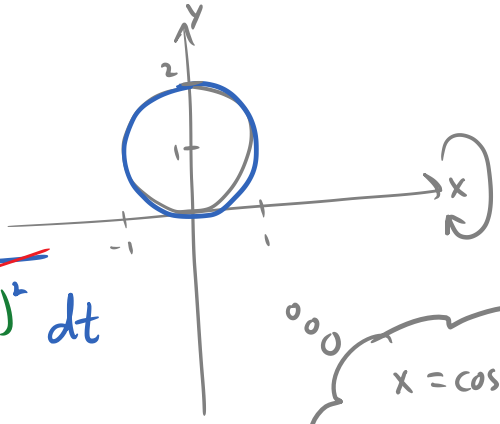
$$= [rt]_0^{2\pi}$$

$$= 2\pi r$$

I just found the formula for the circumference of a circle with radius r.

(And what have YOU done lately?)

3. Find the area of the surface generated by revolving $x = \cos t$, $y = 1 + \sin t$, $0 \le t \le 2\pi$ about the x-axis.



$\frac{dx}{dt} = -\sin t$, $\frac{dy}{dt} = \cos t$

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

$$= 2\pi \int_0^{2\pi} (1+\sin t)\, dt$$

$$= 2\pi \left[t - \cos t \right]_0^{2\pi}$$

$$= 2\pi \left[(2\pi - \cos 2\pi) - (0 - \cos 0) \right]$$

$$= \boxed{4\pi^2}$$

$x = \cos t$, $y - 1 = \sin t$

$x^2 + (y-1)^2 = \cos^2 t + \sin^2 t$

$x^2 + (y-1)^2 = 1$

Q: April says May is a liar. May says June is a liar. June says April and May are both liars. If only one person is telling the truth, who is it?