Arc Length in parametric form

Left-to-right

$a \le x \le b \Rightarrow \frac{dx}{dt} \ge 0$

$\alpha \le t \le \beta$

$x = f(t)$, $y = g(t)$

$$L = \int_a^b ds = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

$1 + \left(\frac{dy}{dx}\right)^2$

$$\frac{dy}{dt} = \frac{dy}{dx} \cdot \frac{dx}{dt} \Longrightarrow$$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} \Rightarrow 1 + \left(\frac{\frac{dy}{dt}}{\frac{dx}{dt}}\right)^2$$

$$= \left(\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2\right) \cdot \frac{1}{\left(\frac{dx}{dt}\right)^2}$$

"Arc length increment"

$$ds = \left(\sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\right) \sqrt{\frac{1}{\left(\frac{dx}{dt}\right)^2}}\, dx$$

$$= \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, \frac{dt}{dx}\, dx$$

$$= \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt = ds \text{ for parametrics.}$$

$$= \sqrt{(x')^2 + (y')^2}\, dt$$

$$\boxed{\sin^2\theta + \cos^2\theta = 1}$$

$$L = \int_\alpha^\beta \sqrt{(x')^2 + (y')^2}\, dt = \int_\alpha^\beta ds$$

Surface Areas: $x = f(t),\ y = g(t)$

About x-axis: $S = 2\pi \int_a^b y\, ds = 2\pi \int_\alpha^\beta g(t) \sqrt{(f'(t))^2 + (g'(t))^2}\, dt$

About y-axis: $S = 2\pi \int_c^d x\, ds = 2\pi \int_\delta^\gamma f(t) \sqrt{(f'(t))^2 + (g'(t))^2}\, dt$

$y' = ky$

$\frac{y'}{y} = k$

$\ln|y| = kx + C$ $\quad y \geq 0$

$y = e^{kx+C} = e^C e^{kx}$

$y' - ky = 0$

$(D-k)y = 0$

$D = k$

ce^{kt}

$P(t) = P_0 e^{kt}$

$P(0) = 20 \Rightarrow P_0 = 20 \Rightarrow P(t) = 20e^{kt}$

$P(5) = 500 \Rightarrow 20e^{5k} = 500$

$e^{5k} = 25$

$5k = \ln(25)$

$k = \frac{1}{5}\ln 25$

$P(t) = e^{\frac{1}{5}\ln(25)t} = e^{\ln(25^{\frac{1}{5}t})} = 25^{\frac{1}{5}t}$

$P(100) = 20e^{\frac{1}{5}\ln(25)(100)} = 20e^{20\ln(25)} = 20\left(e^{\ln(25)}\right)^{20}$

$= 20(25)^{20}$

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              50400
20*25^20
   1.818989404E29
ln(25)/5
         .643775165
20e^(Ans*100)
   1.818989404E29
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$$\int \frac{dx}{x(\ln(x))^4} \qquad u = \ln x \qquad du = \frac{1}{x}dx$$

$$= \int (\ln(x))^{-4}\left(\frac{1}{x}dx\right) = \int u^{-4}du = \frac{u^{-3}}{-3} + C = -\frac{1}{3}(\ln(x))^{-3} + C$$

$$\int x^2 \ln(\sqrt[5]{x^4})dx = \qquad \ln\left(\sqrt[5]{x^4}\right) = \ln\left(x^{\frac{4}{5}}\right) = \frac{4}{5}\ln(x)$$

$$= \frac{4}{5}\int x^2 \ln(x)\,dx \qquad u = \ln x \quad du = \frac{1}{x}dx \qquad dv = x^2dx \Rightarrow dx = \frac{dv}{x^2} \quad v = \frac{1}{3}x^3$$

etc.

$x = 1 - t^2$, $y = 2t - t^2$

$t^2 = 1 - x$

$t = \pm\sqrt{1-x}$ $\quad y = 2\left(\pm\sqrt{1-x}\right) - (1-x)^2$

$x = \sin(t)$, $y = 1 - \cos t$ Eliminate Parameter.

$\cos t = 1 - y$

$x^2 + (1-y)^2 = 1$ circle, centered

$x^2 + (y-1)^2 = 1$ @ $(h, k) = (0, 1)$

$r = 1$

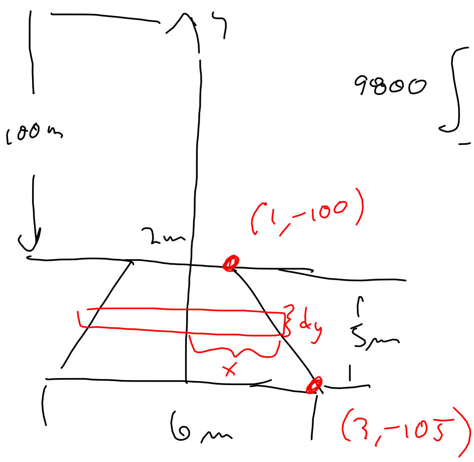
So with Coronavirus hysteria,

let's do ZOOM sessions. I'll be sending you the invites.

We can do ZOOM any time, basically. All you have to do is ask.

Please stay tuned to the D2L, as we work out a plan.

LET'S STICK TO OUR SCHEDULE, BUT FROM LONG-DISTANCE. I DON'T THINK THIS NEEDS TO AFFECT MAT 202 ALL THAT MUCH. WE JUST WON'T BE HERE AS A GROUP, AT LEAST NOT UNTIL ADMINISTRATION GETS ITS HEAD OUT OF ITS ASSETS.



$$9800\int_{-105}^{-100} (-y)\left(2\left(-\frac{2}{5}y - 39\right)\right) dy$$

Area of representative rectangle is $2x\,dy$

Find x as $f(y)$:

$(1,-100)$, $(3,-105)$:

$$m = \frac{-105-(-100)}{3-1} = \frac{-5}{2}$$

$$y = -\frac{5}{2}(x-1) - 100$$

$$-\frac{2}{5}y = x - 1 + \frac{200}{5} = x - 1 + 40 = x + 39$$

$$x = -\frac{2}{5}y - 39$$

$$\frac{dp}{dt}=t^2p+t^2-p-1 = t^2(p+1)-1(p+1) = (p+1)(t^2-1)$$

$$\Rightarrow \frac{\frac{dp}{dt}}{p+1} = t^2-1$$

$$\Rightarrow \frac{dp}{p+1} = (t^2-1)\,dt$$

$$\Rightarrow \int \frac{dp}{p+1} = \int (t^2-1)\,dt$$

* Assuming $p+1 \geq 0$

$\boxed{p \geq -1}$

$$\Rightarrow \ln|p+1| = \frac{1}{3}t^3-t+C$$

*

$$\Rightarrow p+1 = e^{\frac{1}{3}t^3-t+C} = e^C e^{\frac{1}{3}t^3-t} = \hat{C} e^{\frac{1}{3}t^3-t}$$

$$\Rightarrow \boxed{p = \hat{C} e^{\frac{1}{3}t^3-t} - 1} \quad \forall\, \hat{C} > 0.$$