4] $L = \int_0^{.5} \sqrt{\left(\frac{-2t}{1-t^2}\right)^2 + (1)^2}\, dt$

$= \int_0^{.5} \sqrt{\frac{4t^2}{(1-t^2)^2} + 1}\, dt$

$= \int_0^{.5} \sqrt{\frac{4t^2 + (1-t^2)^2}{(1-t^2)^2}}\, dt$

$= \int_0^{.5} \sqrt{\frac{4t^2 + 1 - 2t^2 + t^4}{(1-t^2)^2}}\, dt = \int_0^{.5} \sqrt{\frac{1 + 2t^2 + t^4}{(1-t^2)^2}}\, dt$

$= \int_0^{.5} \sqrt{\frac{(1+t^2)^2}{(1-t^2)^2}}\, dt = \int_0^{.5} \frac{1+t^2}{1-t^2}\, dt$

note $(1-t^2)$ is positive on the interval

$0 \le t \le .5$

now long division

$$\begin{array}{rl} & \quad -1 \\ \cline{2-2} -t^2+1 & \big) \; t^2+0t+1 \\ & \;\; -(t^2 \qquad -1) \\ \cline{2-2} & \qquad\qquad 2 \end{array}$$

$$\frac{t^2+1}{-t^2+1} = -1 + \frac{2}{1-t^2}$$

now decompose $\frac{2}{1-t^2}$

$$\frac{2}{1-t^2} = \frac{A}{1-t} + \frac{B}{1+t}$$

$$2 = A(1+t) + B(1-t)$$

if $t=1$ $\Rightarrow$ $2 = 2A$

$A = 1$

$t=-1$ $\Rightarrow$ $2 = 2B$

$B = 1$

Thus

$$\int_0^{.5} \frac{1+t^2}{1-t^2}\,dt = \int_0^{.5} -1 + \frac{1}{1-t} + \frac{1}{1+t}\,dt$$

$$= -t - \ln(1-t) + \ln(1+t)\Big|_0^{.5}$$

$$= -.5 - \ln(.5) + \ln(1.5) - \left[0 - \ln(1) - \ln(1)\right]$$

$$= -.5 - \ln(.5) + \ln(1.5)$$

$$\approx .5986$$