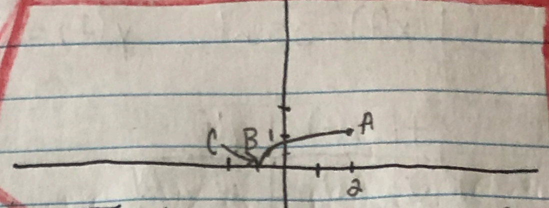
$e^{-t} = 3e^{-2t} - 1$

3. $x(t) = 3e^{-2t} - 1 \quad y(t) = e^{-t}, \quad t \geq 0$

t	$x(t)$	$y(t)$
0	2	1 → A
1	$\frac{3}{e^2} - 1$	$\frac{1}{e}$
2	$\frac{3}{e^4} - 1$	$\frac{1}{e^2}$



Starts @ (2,1) & moves left towards (-1,0), but never makes contact w/ it.

$L = \lim_{r\to\infty} \int_0^r \sqrt{(3e^{-2t}(-2))^2 + (-e^{-t})^2}\, dt$

$L = \lim_{r\to\infty} \int_0^r \sqrt{(-6e^{-2t})^2 + e^{-2t}}\, dt$

$L = \lim_{r\to\infty} \int_0^r \sqrt{36e^{-4t} + e^{-2t}}\, dt = \lim_{r\to\infty} \int_0^r \sqrt{e^{-2t}(36e^2+1)}\, dt$

$L = \lim_{r\to\infty} \int_0^r e^{-t}\sqrt{36e^2+1} = \sqrt{36e^2+1} \lim_{r\to\infty} \int_0^r e^{-t} =$

$L = \sqrt{36e^2+1}\left(-e^{-t}\right)\Big|_0^r = \sqrt{36e^2+1}\left(\underset{0}{-e^{-r}} + \underset{1}{e^0}\right) = \boxed{\sqrt{36e^2+1}}$

4. $y = x$

$\tan\theta = 1$

$y = r\sin\theta$

$x = r\cos\theta$

$\boxed{\theta = \frac{\pi}{4}, \frac{5\pi}{4}}$

$\frac{\cancel{r}\sin\theta}{\cancel{r}} = \frac{\cancel{r}\cos\theta}{\cancel{r}}$

$\boxed{\tan\theta = 1}$

5. $3x^2 + 2y^2 = 1 \qquad x = r\cos\theta \qquad r^2(\cos^2\theta + 2) = 1$

$y = r\sin\theta \qquad r^2 = \frac{1}{\cos^2\theta + 2}$

$3(r\cos\theta)^2 + 2(r\sin\theta)^2 = 1$

$\boxed{r = \sqrt{\frac{1}{\cos^2\theta + 2}}}$

$3r^2\cos^2\theta + 2r^2\sin^2\theta = 1$

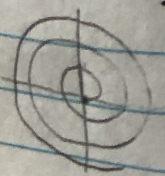
$r^2(3\cos^2\theta + 2\sin^2\theta) = 1$

$r^2(3\cos^2\theta + 2 - 2\cos^2\theta) = 1$

6. $r = \csc\theta = \frac{1}{\sin\theta} \longrightarrow r\sin\theta = 1 \qquad \boxed{y = 1}$

$r\sin\theta = y$

7. $r = \theta^2$



$\sqrt{x^2+y^2} = \left(\arctan\left(\frac{y}{x}\right)\right)^2 \qquad \boxed{x^2 + y^2 = \left(\arctan\frac{y}{x}\right)^4}$