

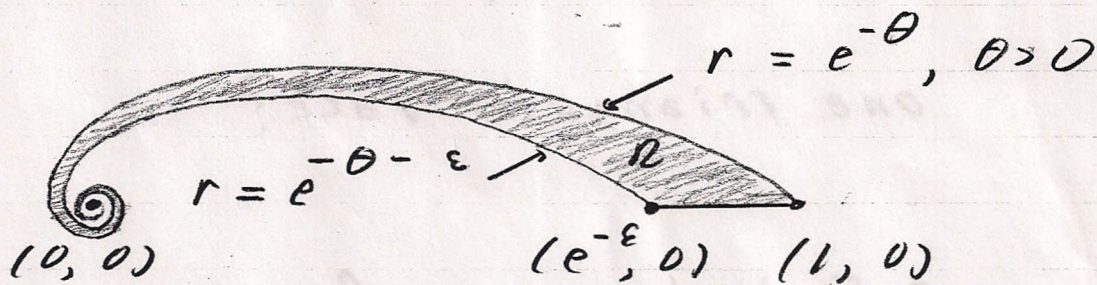
1. We have parametric curve $x(t) = \frac{t}{2} + \sin t$,
 $y(t) = \sin t$.

a) Find equation of tangent line at $(x(\frac{\pi}{3}), y(\frac{\pi}{3}))$.

b) For what t in $0 \leq t < 2\pi$ is the tangent line at $(x(t), y(t))$ vertical?

c) Sketch the curve for $0 \leq t < 2\pi$.

2. Find the area of the region R :



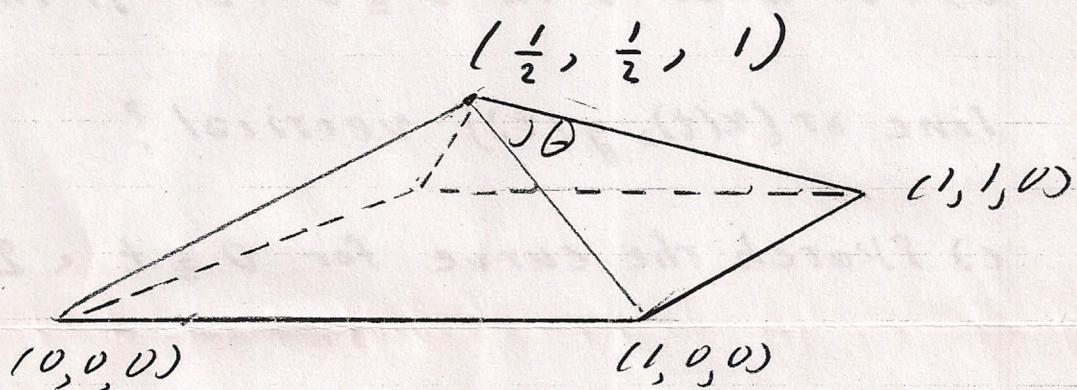
ϵ is a positive constant.

3. The parametric line $\underline{r}(t) = t\underline{a} - \underline{b}$

represents displacement of a particle

from the origin. \underline{a} , \underline{b} are given vectors, and $\underline{a} \neq 0$. What is the smallest distance of the particle from the origin?

4. See here this pyramid:



What is $\cos \theta$? What is the area of one triangular face?

5. Find the vector function $\underline{r}(t)$ that represents uniform circular motion, of period 2π , centered about origin, with axis of rotation $\underline{\omega} =$

$$\left(\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right), \text{ and } \underline{r}(0) = (1, -1, 1)$$