TMATH 126 Week 5 Workshop

A particle moves along a path in space described by the vector-valued function

$$\vec{r}(t) = \langle 3cost, 3sint, t^2 \rangle, \quad 0 \leq t \leq 2\pi$$

a Describe the motion of the particle in words. What shape does the projection of the path make in the xy-plane?

b Find the tangent vector $\vec{r}\,'(t)$ and compute the arc length of the curve from $t = 0$ to $t = 3\pi$ (set up the integral and evalute with technology)

c Compute the curvature $\kappa(t)$ of the curve. What happens to the curvature as t increases?

d Now let $z = f(x, y) = x^2 + y^2$, and imagine the movement of the particle. What does this look like geometrically.

e Find the tangent plane to the surface $z = f(x, y) = x^2 + y^2$ at the point where $t = 0$.

f Use a linear approximation to estimate the value of $f(x, y) = x^2 + y^2$ near $(x, y) = (2.9, 0.1)$.(use the tangent plane found previously)