BP4 Monday Oct. 24, 2016

Let $z = f(x, y) = 4x^2 + 9y^2$ and $\bar{r}(t) = 3\sin 4t\bar{i} + 2\cos 4t\bar{j}$.

1. Show that $\bar{r}$ lies on a level curve of z.
2. Give the equation of the tangent plane to the graph of z at (0,0) and (1,2).
3. Suppose an ant is tracing out $\bar{r}$ in time t.
   (a) What is the ant's speed as it traces out this curve.
   (b) Show that the ant is always moving in a direction orthogonal to ∇z.
   (c) If z gives the temperature at any point (x, y), what is the change in the ant's temperature at $t = \frac{\pi}{8}$.
   (d) What direction should the ant walk at $t = \frac{\pi}{4}$ if it wants to decrease its temperature as fast as possible?