TUTORIAL 1

MA1132: ADVANCED CALCULUS, HILARY 2017

(1) (a) Find the equation of the plane passing through the points $(1, 1, 3)$, $(0, 0, -2)$, and $(2, 2, 1)$.
   (b) Find parametric equations describing the curve of intersection of this plane with the surface given by $z = x^2 + y^2$.
   (c) What type of geometric object is the curve you found in b)?

(2) Show that the graph of the vector-valued function

$$\vec{r}(t) = t \cos t \vec{i} + t \sin t \vec{j} + t \vec{k}$$

lies on the double-cone $x^2 + y^2 = z^2$.

(3) Consider the surface given parametrically in terms of parameters $u, v \in [0, 2\pi)$ by

$$\begin{cases} x = (2 + \cos v) \cos u \\ y = (2 + \cos v) \sin u \\ z = \sin v. \end{cases}$$

   (a) The intersection of this surface with the plane $y = 0$ is a union of two curves. Describe what these two curves are by finding (non-parametric) equations for them in a form which makes the geometric interpretation of these two curves clear.
   (b) Now consider the intersection of the same surface with the plane $z = 0$ and find non-parametric equations for the curves in this intersection, and describe the objects you find.