1. Find a parametric representation of the curve:

$$x^2 + y^2 = 36 \text{ and } z = \frac{1}{\pi}\arctan\left(\frac{x}{y}\right).$$

i.e. find a representation in the form: $x = x(t); y = y(t), z = z(t)$.

2. Find what kind of curves are given by the following representations and draw (schematically) the curves:
   (i) $\underline{r}(t) = (2t - 5, -3t + 1, 4)$;
   (ii) $\underline{r}(t) = (0, -\cos(t), 3\sin(t))$

3. Find the equations of the tangent (straight line) and the normal plane to the curve given by the following parametric representation:

$$x = 2 + 3t^4; y = 2t + t^3, z = t \text{ at the point } t = 1.$$

4. The equations of motion of a point particle in space are given by:

   (i) $\underline{x}(t) = 2t^3 - 3$; $\underline{y}(t) = -3t^3$; $\underline{z}(t) = 4t^3 - 1$.
   (ii) $\underline{x}(t) = a\sin(\omega t)$; $\underline{y}(t) = a\cos(\omega t)$; $\underline{z}(t) = t$

In each case, calculate the velocity vector $\underline{v}$ and the acceleration vector $\underline{a}$. Also calculate the absolute values of these vectors. What are the curves along which the particle moves?
(*find these values for an arbitrary* ***t****, with* ***a*** *and* $\boldsymbol{\omega}$ *being fixed parameters*)