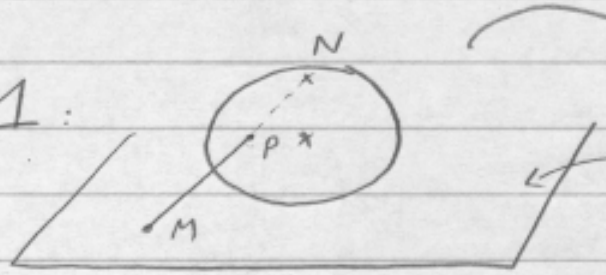
(5) Any chord can be transformed by a rotation into a chord like PQ that will then be transformed into a circular arc joigning the same pts.

#1:



The line $\overleftrightarrow{NP}$ is the set of pts M such that $\overrightarrow{NM} = t\,\overrightarrow{NP}$ for some $t \in \mathbb{R}$.

If $P = \begin{pmatrix} a \\ b \\ c \end{pmatrix}$, $M = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$ one has $\begin{pmatrix} x \\ y \\ z-2 \end{pmatrix} = t \cdot \begin{pmatrix} a \\ b \\ c-2 \end{pmatrix}$. We want $z = 0$, therefore one must have $-2 = t \cdot (c-2)$ and thus $t = \frac{2}{2-c}$. We deduce $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \frac{2}{2-c} \cdot \begin{pmatrix} a \\ b \\ 0 \end{pmatrix}$.

Image of a circle $\ni N$:

such a circle is given by intersecting a plane through N with the sphere.

Thus the projection of such a circle is equal to the line L (intersection of the plane through N with the plane $(z=0)$).