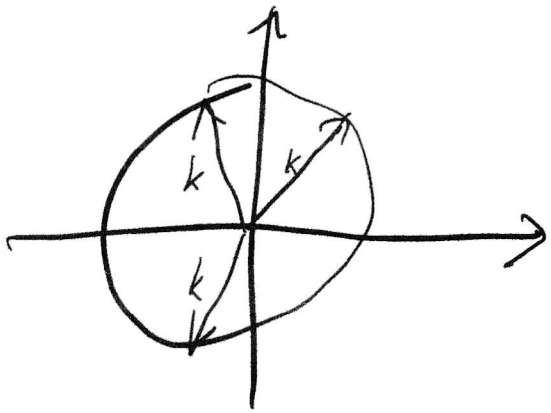
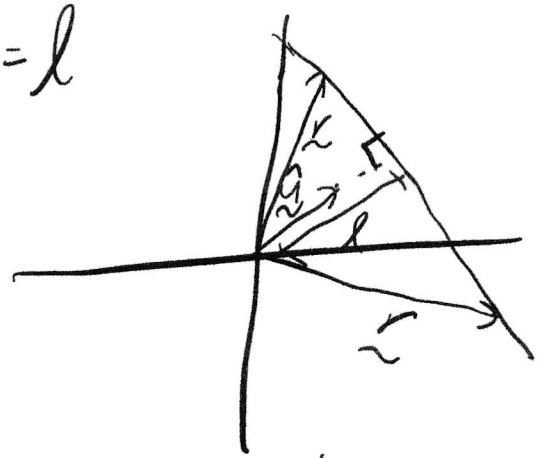
(i) $|\underset{\sim}{r}| = k$



centred at O

∴ The surface is a sphere of radius k in the same number of dimensions as $\underset{\sim}{r}$ (e.g. a circle in 2D, a sphere in 3D, etc.)

(ii) $\underset{\sim}{r} \cdot \hat{\underset{\sim}{q}} = l$



∴ The surface is a line in 2D, a plane in 3D, etc. which is a distance l from the origin at its closest point, is perpendicular to $\hat{\underset{\sim}{q}}$, and passing through the same quadrant as $\hat{\underset{\sim}{q}}$.

(iii) $\underset{\sim}{r} \cdot \hat{\underset{\sim}{q}} = m|\underset{\sim}{r}|$

$\underset{\sim}{r} \cdot \hat{\underset{\sim}{q}} = |\underset{\sim}{r}||\hat{\underset{\sim}{q}}|\cos\theta$

$= |\underset{\sim}{r}|\cos\theta$

$\therefore |\underset{\sim}{r}|\cos\theta = m|\underset{\sim}{r}|$

$\Rightarrow m = \cos\theta$

why.

∴ The surface is two points in 2D, two circles in 3D, etc. where the angle θ between $\underset{\sim}{r}$ and $\hat{\underset{\sim}{q}}$ is $\cos^{-1}(m)$.