

**Vectors Q22 (3/7/23)**

Show that the shortest distance from the point  $\underline{p}$  to the plane

$$\underline{r} \cdot \underline{n} = d \quad \text{is} \quad \frac{|d - \underline{p} \cdot \underline{n}|}{|\underline{n}|}$$

**Solution**

$$(\underline{p} + \lambda \underline{n}) \cdot \underline{n} = d \Rightarrow \underline{p} \cdot \underline{n} + \lambda |\underline{n}|^2 = d$$

$$\Rightarrow \lambda = \frac{d - \underline{p} \cdot \underline{n}}{|\underline{n}|^2}$$

$$\text{So shortest distance} = |\lambda| |\underline{n}| = \frac{|d - \underline{p} \cdot \underline{n}|}{|\underline{n}|}$$