



A tractor pulls a tree with force F . Find the resulting moment formed by the force about O . Express the moment in cartesian form.

$$\vec{r} = d_1 \hat{k}$$

$$\vec{F} = \frac{F}{\sqrt{d_1^2 + d_2^2 + d_3^2}} (d_3 \hat{i} + d_2 \hat{j} - d_1 \hat{k})$$

$$F_x = F \cdot \frac{d_3}{\sqrt{d_1^2 + d_2^2 + d_3^2}}$$

$$F_y = F \cdot \frac{d_2}{\sqrt{d_1^2 + d_2^2 + d_3^2}}$$

$$F_z = -F \cdot \frac{d_1}{\sqrt{d_1^2 + d_2^2 + d_3^2}}$$

$$\vec{M} = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & d_1 \\ F_x & F_y & F_z \end{vmatrix}$$

$$\Rightarrow \vec{M} = -d_1 F_y \hat{i} + d_1 F_x \hat{j}$$