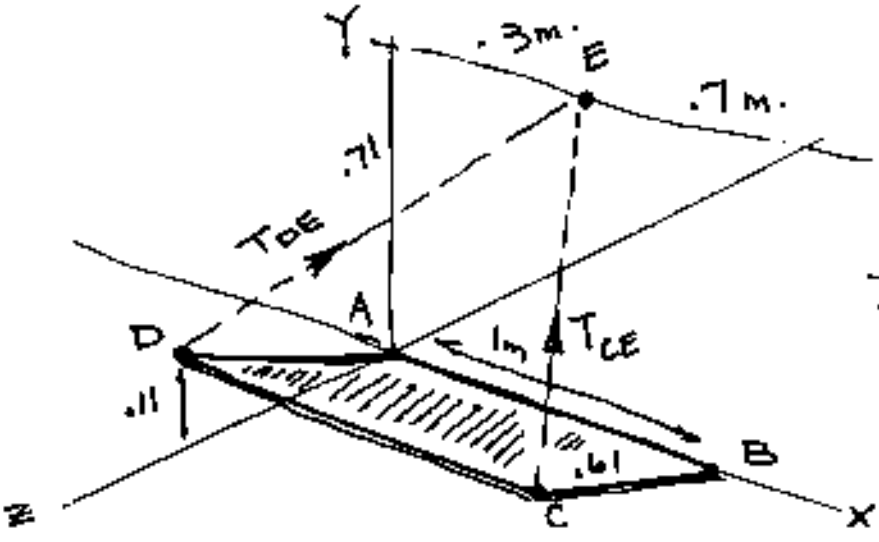
Lid on Storage Bin

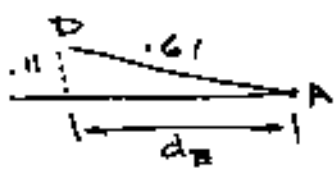
MECH 234 | HW 3.47
MILANO | p. 101



Lid = 0.61m × 1.00 m.
AB fixed on X-axis
$T_{DE} = T_{CE} = 66$ N.
Line of Action for T_{DE} is thru pt. D.
? M_A due to $\vec{F}_D$

The Force on D is the Tension, $\vec{T}_{DE}$ = Space Vector

$$M_A = (\vec{AD}) \times (\vec{T}_{DE})$$

$\vec{AD}$ = 

$d_z = \sqrt{(.61)^2 - (.11)^2} = 0.6$ m.

$\therefore \boxed{\vec{AD} = .11\hat{j} + .6\hat{k}}$

Since $\vec{T}_{DE}$ = Space Vector, Need Unit Vector to find Force Components:

$$\vec{DE} = +.3\hat{i} + (.71 - .11)\hat{j} - .6\hat{k}$$

$$|DE| = \sqrt{.3^2 + .6^2 + .6^2} = 0.9$$

$$\vec{T}_{DE} = \frac{.3}{.9}(66^N)\hat{i} + \frac{.6}{.9}(66^N)\hat{j} + \frac{.6}{.9}(66^N)\hat{k}$$

$$= 22\hat{i} + 44\hat{j} - 44\hat{k}$$

$$M_A = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & .11 & .6 \\ 22 & 44 & -44 \end{vmatrix}$$

$$= \hat{i}[.11(44) - .6(44)] = -31.24\hat{i}$$
$$- \hat{j}[0 - .6(22)] = +13.2\hat{j}$$
$$+ \hat{k}[0 - .11(22)] = -2.42\hat{k}$$

$$\therefore M_A = \underbrace{-31.24\hat{i}}_{M_x} \underbrace{+13.2\hat{j}}_{M_y} \underbrace{-2.42\hat{k}}_{M_z} = 34 \text{ N-m.}$$

TORQUE or TWIST