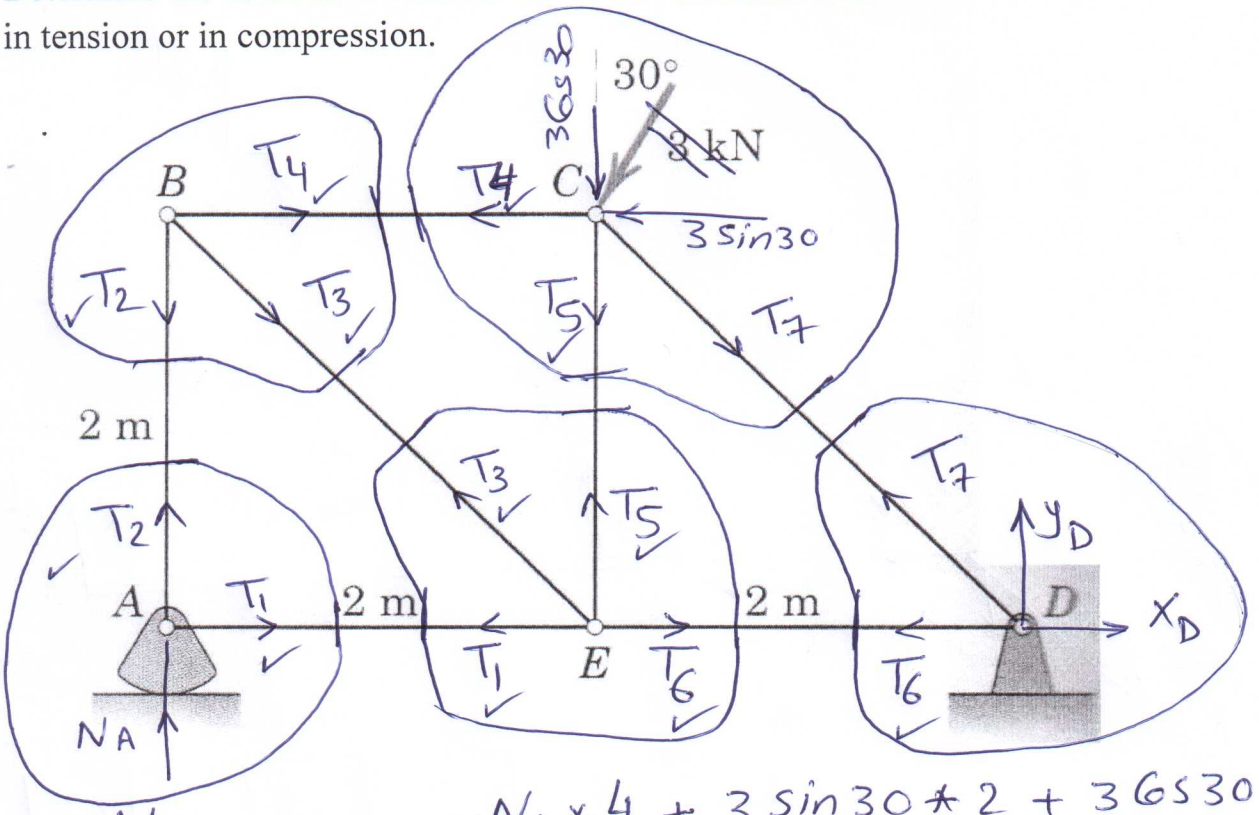
Question Four: (10 marks)

Determine the force in each member of the truss and state if the members are in tension or in compression.



$(+\circlearrowleft)\ \Sigma M_D = 0$ $\quad -N_A * 4 + 3\sin 30 * 2 + 3\cos 30 * 2 =$

$N_A = 2.05\ KN$

$\xrightarrow{+}\ \Sigma F_x = 0$ $\quad X_D - 3\sin 30 = 0$

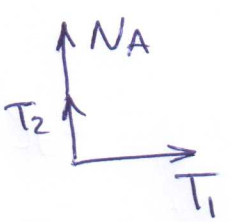
$X_D = 1.5\ KN$

$+\uparrow\ \Sigma F_y = 0$ $\quad N_A + Y_D - 3\cos 30 = 0$

$Y_D = 3\cos 30 - N_A = 0.55\ KN$

KN	N_A	X_D	Y_D	T_1	T_2	T_3	T_4	T_5	T_6	T_7
	2.05	1.5	0.55	0	-2.05	$2.05\sqrt{2}$	-2.05	-2.05	2.05	-0.
					Comp	T.	Comp.	Comp	Tension	

for joint (A)

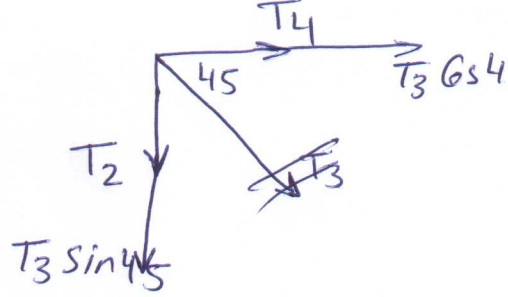


$\xrightarrow{+}\ \Sigma F_x = 0$ $\quad \therefore T_1 = 0$

$+\uparrow\ \Sigma F_y = 0$ $\quad T_2 + N_A = 0$

$T_2 = -2.05\ KN$

for joint (B)



$+\downarrow \Sigma F_y = 0 \qquad T_2 + T_3 \sin 45 = 0$

$$T_3 = \frac{-T_2}{\sin 45}$$

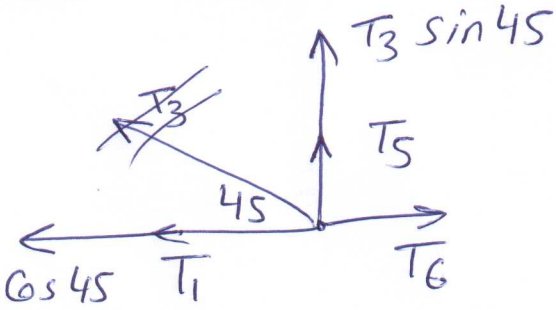
$$= +2.05\sqrt{2}$$

$\pm\rightarrow \Sigma F_x = 0 \qquad T_4 + T_3 \cos 45 = 0$

$$T_4 = -T_3 \cos 45 = -2.05\sqrt{2} * \frac{1}{\sqrt{2}}$$

$$= -2.05 \text{ Newton}$$

for joint (E)



$\pm\rightarrow \Sigma F_x = 0$

$$T_6 - T_1 - T_3 \cos 45 = 0$$

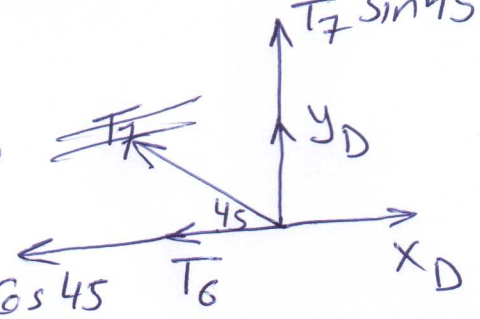
$$T_6 = T_1 + T_3 \cos 45 = 0 + 2.05\sqrt{2} * \frac{1}{\sqrt{2}} = 2.05 \text{ New}$$

$+\uparrow \Sigma F_y = 0 \qquad T_5 + T_3 \sin 45 = 0$

$$T_5 = -T_3 \sin 45 = -2.05\sqrt{2} * \frac{1}{\sqrt{2}}$$

$$= -2.05 \text{ Newton}$$

for joint (D)



$\pm\rightarrow \Sigma F_x = 0 \qquad x_D - T_6 - T_7 \cos 45 = 0$

$$T_7 = \frac{x_D - T_6}{\cos 45}$$

$$= \frac{1.5 - 2.05}{\frac{1}{\sqrt{2}}} = -0.55\sqrt{2} \text{ Newton}$$

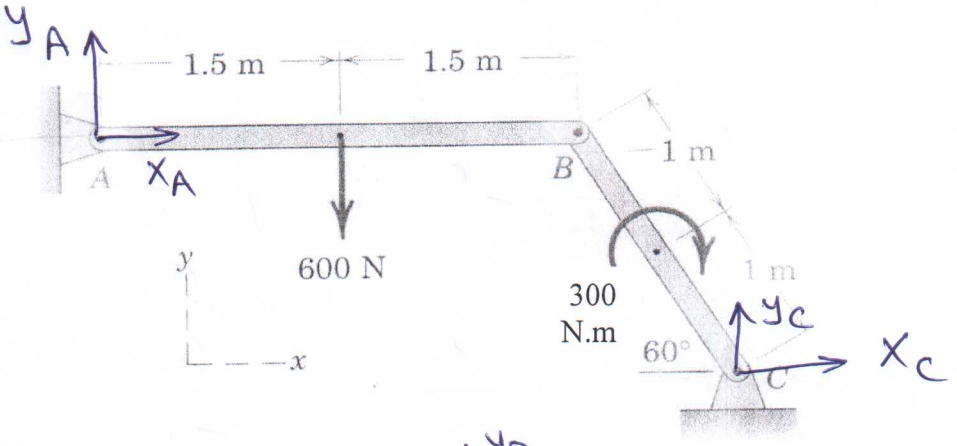
for check

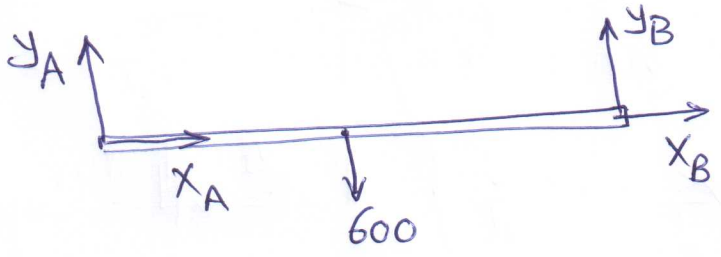
$$\uparrow \Sigma F_y = y_D + T_7 \sin 45 = 0.55 - 0.55\sqrt{2} * \frac{1}{\sqrt{2}}$$

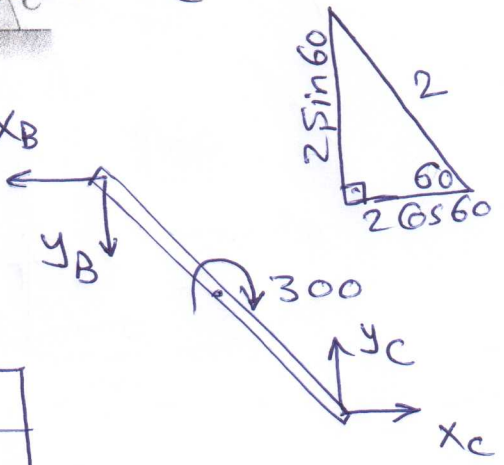
$$= 0 \simeq \text{O.K.}$$

Question Five: (10 marks)

For the shown frame, determine the magnitude of reactions at pins A, B, and C.







	X_A	Y_A	X_B	Y_B	X_C	Y_C
N	0	300	0	300	0	300

for member AB

$(+\circlearrowleft) \Sigma M_A = 0 \quad -600 * 1.5 + Y_B * 3 = 0$

$Y_B = 300$ Newton

$+\uparrow \Sigma F_y = 0 \quad Y_A - 600 + Y_B = 0$

$Y_A = 600 - Y_B = 300$ Newton

$\xrightarrow{+} \Sigma F_x = 0 \quad X_A + X_B = 0 \longrightarrow (1)$

for member BC

$(+\circlearrowleft) \Sigma M_C = 0 \quad -300 + Y_B * 2\,Cos60 + X_B * 2\,Sin60 = 0$

$X_B = \dfrac{300 - 300 * 2\,Cos60}{2\,Sin60} = 0$

sub. in (1) $\therefore X_A = 0$

$\xrightarrow{+} \Sigma F_x = 0 \qquad -X_B + X_C = 0$

$\therefore X_B = X_C = 0$

$+\uparrow \Sigma F_y = 0 \qquad -Y_B + Y_C = 0$

$Y_C = Y_B = 300$ Newton

* use the whole frame for check *

$(+\circlearrowleft) \Sigma M_C = -300 + 600 * (1.5 + 2\cos 60)$

$- X_A * 2 \sin 60 - Y_A (3 + 2\cos 60) = 0$

$\xrightarrow{+} \Sigma F_x = X_A + X_C = 0$

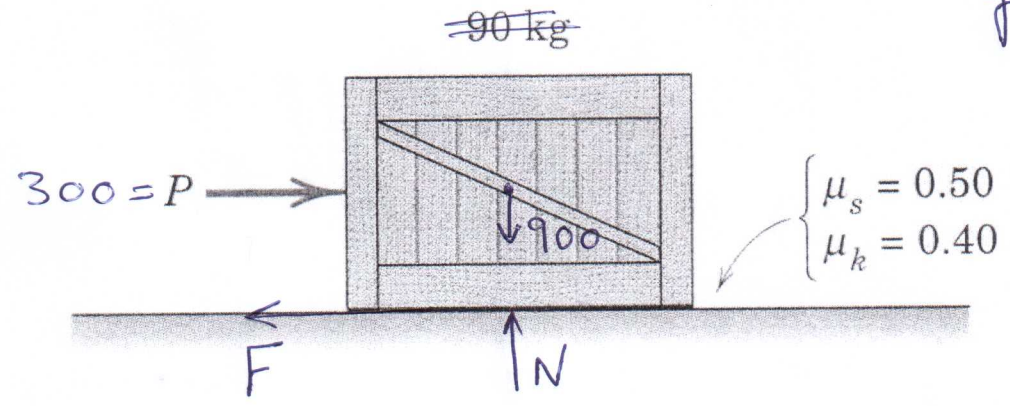
$+\uparrow \Sigma F_y = Y_A - 600 + Y_C = 300 - 600 + 300 = 0$

$\therefore$ O.K.

Question Six: (10 marks)

The force P = 300 N is applied to 90 kg crate, which was stationary before the force is applied. Will the crate move?

$g = 10\ m/s^2$



$\xrightarrow{+}\ \Sigma F_x = 0$ $\quad 300 - F = 0$

$F = 300$ Newton

$+\uparrow \Sigma F_y = 0$ $\quad N - 900 = 0$

$N = 900$ Newton

$F < \mu_s N$

$300 < 0.5 * 900 = 450$

no slipping

The crate won't move.