PLEASE INCLUDE THIS PAGE WITH YOUR SUBMISSION

NAME:_____Student #_____ GROUP:_____

ENG 1440 Lab # 10 BONUS

A UFO (Unidentified Flying Object) landed in South Winnipeg (near the U of M campus) and was seen taking off carrying three (3) unidentified packages (rumor has it they were Engineering students). The masses of the students are $M_1 = 100\ kg$, $M_2 = 65\ kg$ and $M_3 = 140\ kg$. Their location in the *5 m* radius space craft is shown in Figure 1(b) below.

The message back from the space craft is that the students will be returned if you can replace these forces by a single force and correctly locate its point of application with respect to the origin, *O* in the figure. **(Use g = 9.8 m/sec^2)**

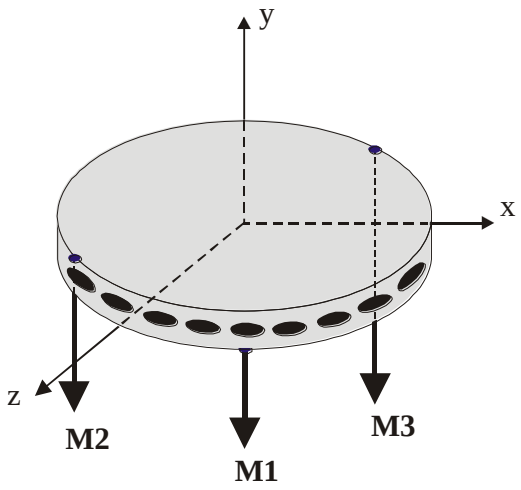

Figure 1(a)

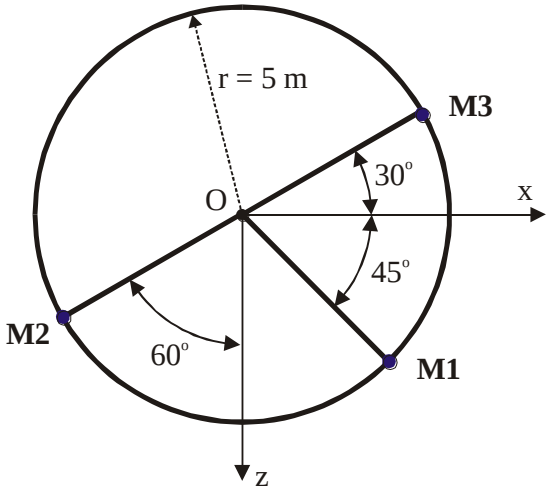

Figure 1(b) - Location of Masses

ANSWER (Provide detailed solution):

PLEASE INCLUDE THIS PAGE WITH YOUR SUBMISSION

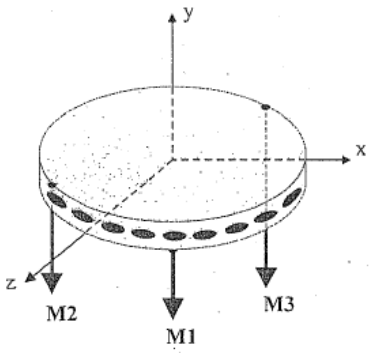

Figure 1(a)

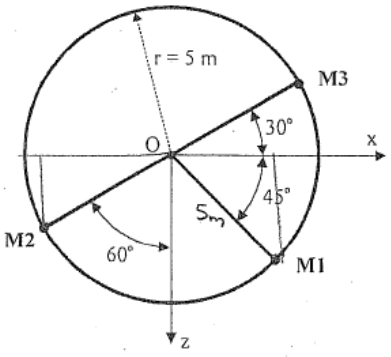

Figure 1(b) - Location of Masses

FORCE	MAGN(N)	$\bar{F}$	$\bar{r}$ (m)	$\bar{M}_o = \bar{r} \times \bar{F}$
M1	980	$-980\bar{j}$	$5\cos45°\bar{i} + 5\sin45°\bar{k}$ $= 3.535\bar{i} + 5.355\bar{k}$	$3.535 \times (-980)\bar{k} + 5.355 \times (-980)(-\bar{i})$ $= -3464.3\bar{k} + 3464.3\bar{i}$
M2	637	$-637\bar{j}$	$-5\sin60°\bar{i} + 5\cos60°\bar{k}$ $= -4.330\bar{i} + 2.5\bar{k}$	$-4.330(-637)\bar{k} + 2.5(-637)(-\bar{i})$ $= 2758.21\bar{k} + 1592.5\bar{i}$
M3	1372	$-1372\bar{j}$	$5\cos30°\bar{i} - 5\sin30°\bar{k}$ $= 4.330\bar{i} - 2.5\bar{k}$	$4.330(-1372)\bar{k} + (-2.5)(-1372)(-\bar{i})$ $= -5940.76\bar{k} - 3430\bar{i}$

$\bar{R} = \Sigma\bar{F} = -2989\bar{j}$ (N) $\quad \Sigma\bar{M}_o = -6646.85\bar{k} + 1626.8\bar{i}$ (

$\therefore \Sigma\bar{M}_o = (x\bar{i} + z\bar{k}) \times \bar{R} = (x\bar{i} + z\bar{k}) \times (-2989\bar{j})$

$1626.8\bar{i} - 6646.85\bar{k} = -2989x\bar{k} - 2989z(-\bar{i})$
$= -2989x\bar{k} + 2989z\bar{i}$

$\therefore 1626.8 = 2989\bar{z} \qquad z = 0.544$ m ◀

$-6646.85 = -2989x \qquad x = 2.22$ m ◀