THE UNIVERSITY OF MANITOBA

Date : Monday, December 14, 2009 | **Page No : 1 of 6**
Department & Course No : ENG 1440 | **Time : 9 a.m.**
Paper No : 234 Sections 1-2, D01 | **Duration : 2 Hours**
Examination : Introduction to Statics | **Examiners : Dr. M. J. Frye, Dr. D. Polyzois**
Place : Frank Kennedy Gold Gym | **Seats: 1 - 227**

PRINT STUDENT NAME IN FULL

STUDENT SIGNATURE

STUDENT NUMBER

SECTION and INSTRUCTOR

Problem	Marks
1	
2	
3	
4	
TOTAL	30

Notes:

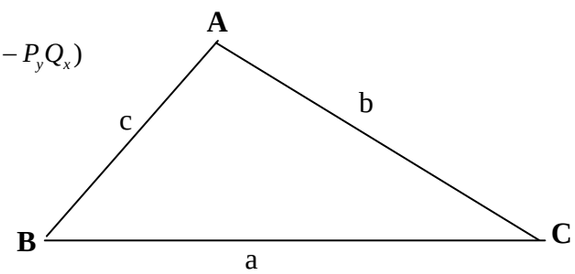
- **CLOSED BOOK. Textbooks, notes, problems NOT permitted.**
- **Calculators are permitted.**
- **All questions are of equal value.**
- **STRAIGHT EDGE IS REQUIRED.**
- **Wherever necessary a FBD must be drawn!!!!**

DO ANY 3 (THREE) questions in the answer booklets provided:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\vec{V} = \vec{P}\ x\ \vec{Q} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ P_x & P_y & P_z \\ Q_x & Q_y & Q_z \end{vmatrix} = \hat{i}(P_yQ_z - P_zQ_y) - \hat{j}(P_xQ_z - P_zQ_x) + \hat{k}(P_xQ_y - P_yQ_x)$$



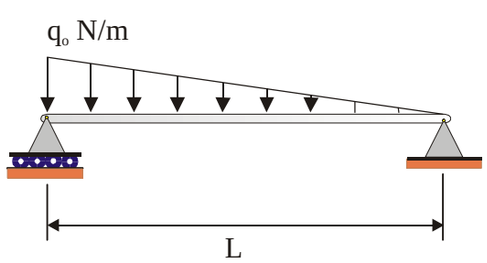
$$V = \left|\vec{V}\right| = \sqrt{V_x^2 + V_y^2 + V_z^2}$$

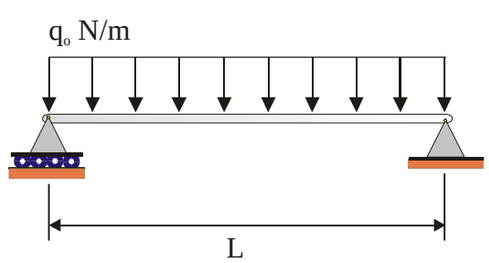
$$\cos\theta_x = \frac{V_x}{V},\ \cos\theta_y = \frac{V_y}{V},\ \cos\theta_z = \frac{V_z}{V}$$

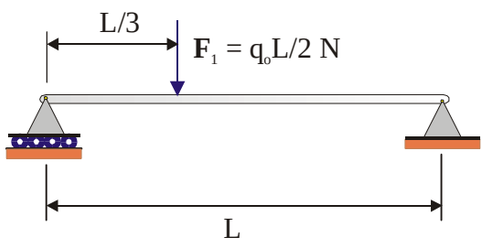
$$\vec{M} = \vec{r}\ x\ \vec{F}$$

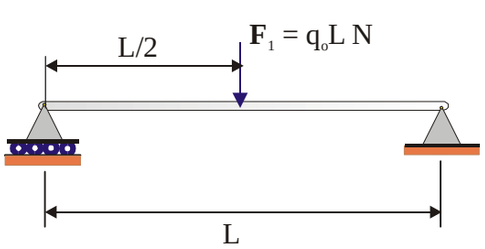
$$M_{OL} = \vec{\lambda}_{OL} \bullet \vec{M}_O$$

$$\vec{P} \bullet \vec{Q} = P_xQ_x + P_yQ_y + P_zQ_z$$





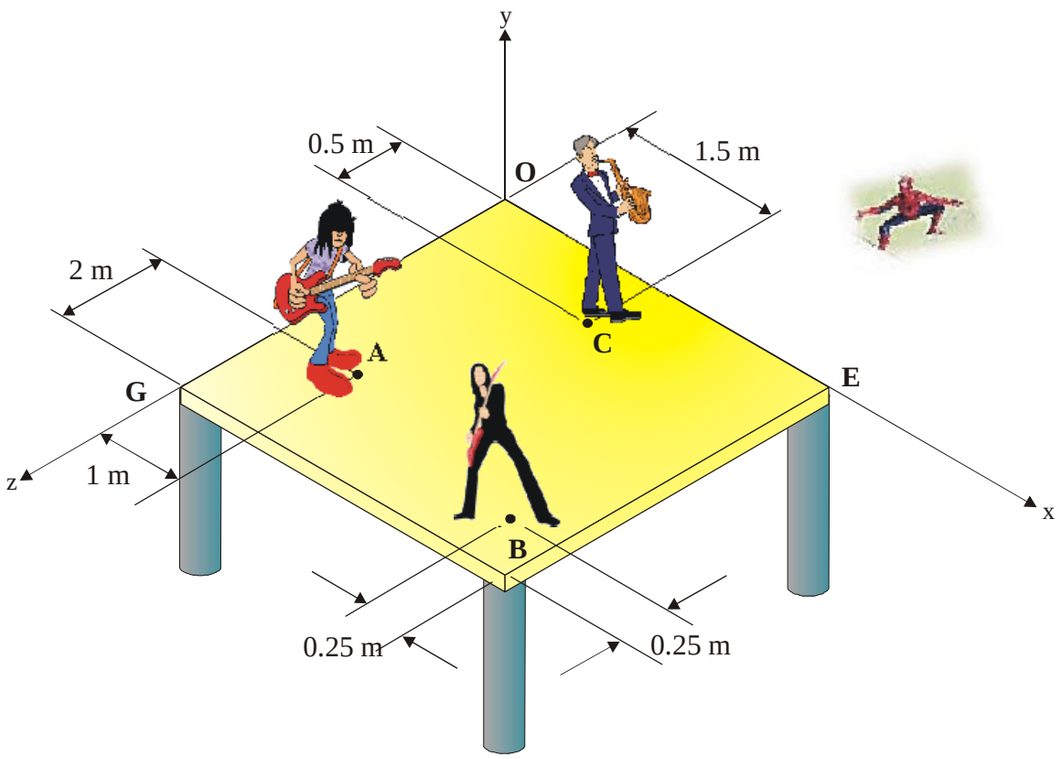




Question 1

Three musicians are standing on a *5 m x 5 m* stage. The weights of the musicians at points *A*, *B*, and *C* are *1 kN*, *1.2 kN* and *1.4 kN*, respectively. Spiderman who weighs *1.3 kN* leaps onto the stage.

Determine where spiderman should stand if the other musicians remain in the positions shown and the line of action of the resultant of the four weights is to pass through the center of the stage.



THE UNIVERSITY OF MANITOBA

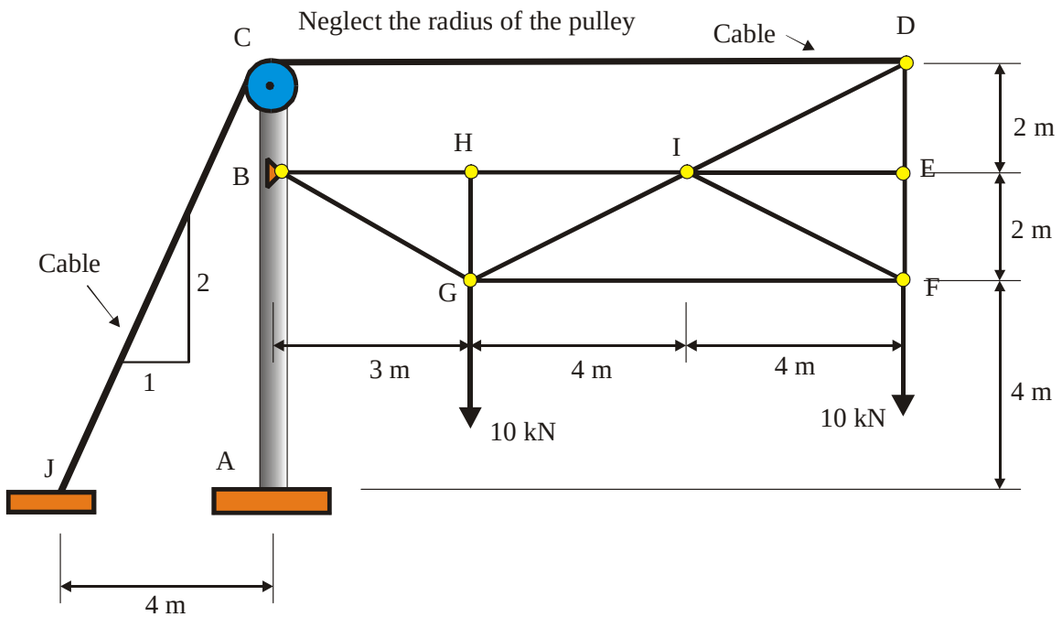
Date : Monday, December 14, 2009 | **Page No : 3 of 6**
Department & Course No : ENG 1440 | **Time : 9 a.m.**
Paper No : 234 Sections 1-2, D01 | **Duration : 2 Hours**
Examination : Introduction to Statics | **Examiners : Dr. M. J. Frye**
Dr. D. Polyzois
Place : Frank Kennedy Gold Gym | **Seats: 1 - 227**

Question 2

The truss shown in the figure below is attached to a pole by a pin support at *B*. A cable is attached to the truss at *D* and it passes over a smooth pulley attached to the pole at *C*. The cable is attached to the ground at *J*. The pole has a fixed support at *A*. The truss supports two *10 kN* loads applied at *G* and *F* respectively. (**You may neglect the radius of the pulley.**)

Determine:

a) The tension in the cable and the reaction at B,
b) The reactions at *A*, and
c) The force in each member of the truss and state whether it is in tension or compression. (**Indicate your results on the figure provided on Page 6.**)



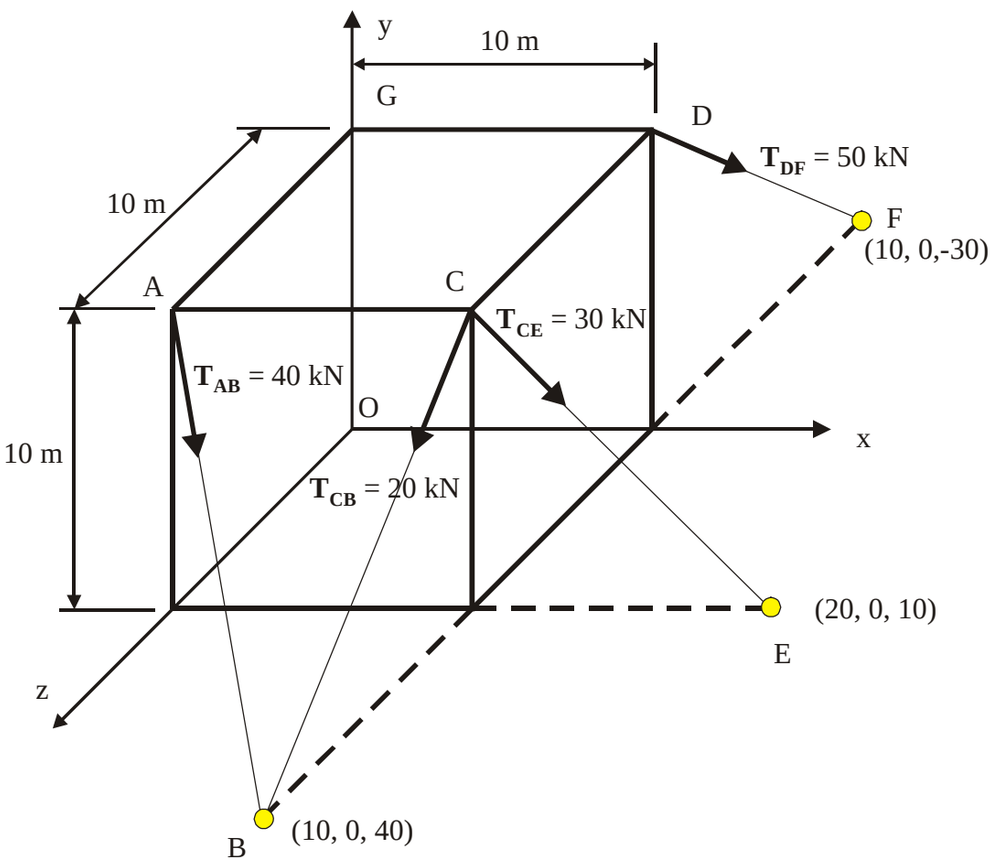
THE UNIVERSITY OF MANITOBA

Date : Monday, December 14, 2009 | **Page No : 4 of 6**
Department & Course No : ENG 1440 | **Time : 9 a.m.**
Paper No : 234 Sections 1-2, D01 | **Duration : 2 Hours**
Examination : Introduction to Statics | **Examiners : Dr. M. J. Frye**
Dr. D. Polyzois
Place : Frank Kennedy Gold Gym | **Seats: 1 - 227**

Question 3

Four forces (***T*$_{AB}$**, ***T*$_{CB}$**, ***T*$_{CE}$**, and ***T*$_{DF}$**) are shown acting at the corners of a box. Determine:

a) The total moment that the four forces have about the Line *AB*, and
b) The angle between the forces ***T*$_{CB}$** and ***T*$_{CE}$**.



THE UNIVERSITY OF MANITOBA

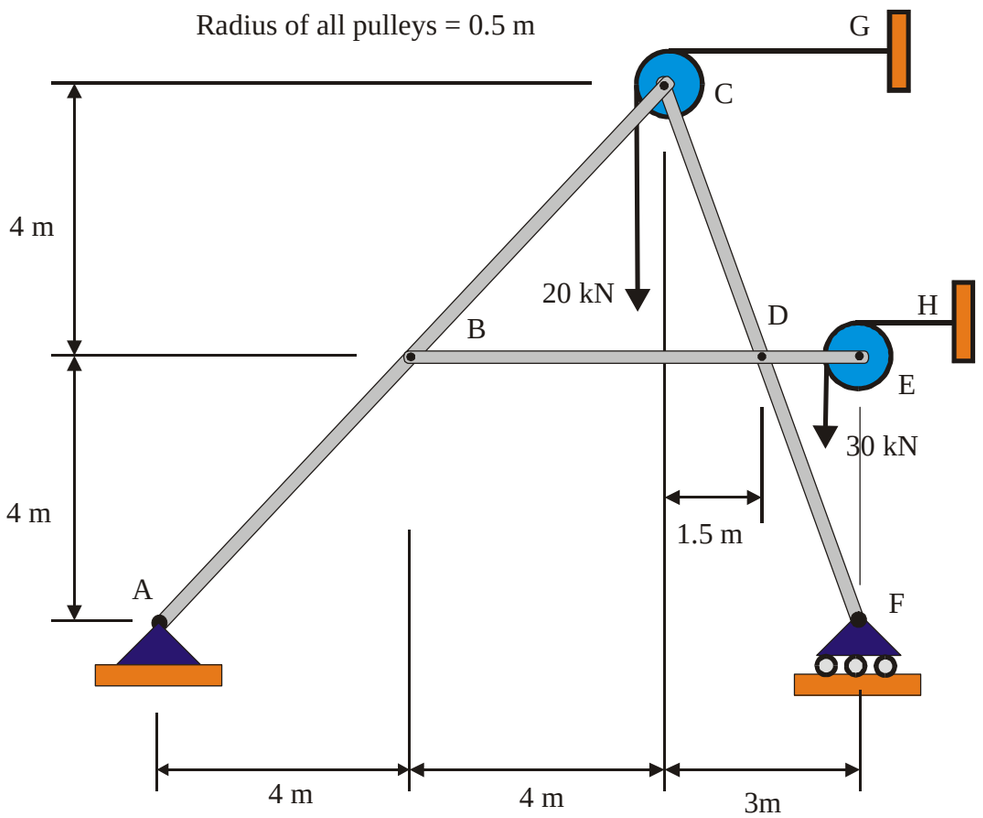
Date : Monday, December 14, 2009 | **Page No : 5 of 6**
Department & Course No : ENG 1440 | **Time : 9 a.m.**
Paper No : 234 Sections 1-2, D01 | **Duration : 2 Hours**
Examination : Introduction to Statics | **Examiners : Dr. M. J. Frye**
Dr. D. Polyzois
Place : Frank Kennedy Gold Gym | **Seats: 1 - 227**

Question4

The frame shown has three members (*Member ABC, Member BDE and Member CDF*) pinned together at points *B*, *C* and *D*. Smooth pulleys having a radius of *0.5 m* are attached to the frame at *C* and *E*. Cables supporting a *20 kN* load and a *30 kN* load are attached back to external supports at *G* and *H*. The frame has a pin support at *A* and a roller support at *F*.

Determine:

a) The external reactions at *A* and *F*, and
b) The forces acting on each member of the frames and on the pulleys at *C* and *E*.



THE UNIVERSITY OF MANITOBA

Date : Monday, December 14, 2009 | **Page No : 6 of 6**
Department & Course No : ENG 1440 | **Time : 9 a.m.**
Paper No : 234 Sections 1-2, D01 | **Duration : 2 Hours**
Examination : Introduction to Statics | **Examiners : Dr. M. J. Frye**
Dr. D. Polyzois
Place : Frank Kennedy Gold Gym | **Seats: 1 - 227**

Question 2 – Results Page

NAME: _____ STUDENT NO. _____