THE UNIVERSITY OF MANITOBA **1440 Introduction to Statics**
Faculty of Engineering **October 13, 2009 Term Test # 1**

Dr. M. J. Frye and Dr. D. Polyzois

There are three (3) questions.
All questions are of equal value (10 marks each).
CLOSED BOOK: textbooks, notes, problems, etc., are not permitted.
Calculators are permitted.

Wherever necessary a FBD must be drawn.

STRAIGHT EDGE IS REQUIRED.
UNDERLINE YOUR ANSWERS.

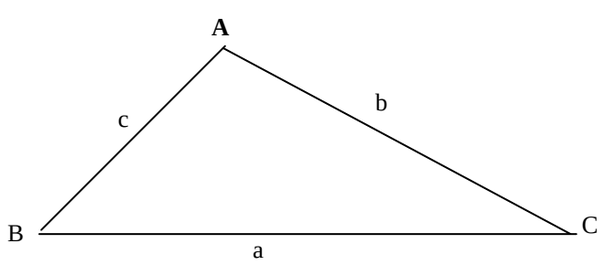
Answer all questions in the answer booklets provided:
Indicate the Following on the Front of your Answer Booklets

Name : _____

Student Number : _____

Group# (Dr. Polyzois class only) _____

Distance Education Students: Indicate that you are in the Distance Ed. Class



$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$b^2 = a^2 + c^2 - 2ac\cos B$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$g = 9.8\ m/sec^2$

QUESTION 1

A large truck is stuck on the centerline of Fermor Avenue as shown. A single tow truck is brought in but it cannot move the large truck as shown in Figure1(a). A force of *45 kN* directed along the centerline of Fermor is required to move the large truck. A second tow truck is brought in. The two tow trucks are now attached as shown in Figure 1(b).

Determine the magnitude of the tension in each of the tow cables *AB* and *AC* when the large truck begins to move.

a) By means of a graphical solution (state the scale that you use),
b) By means of a trigonometric solution applying the sine and/or cosine rules, and
c) By rectangular components.

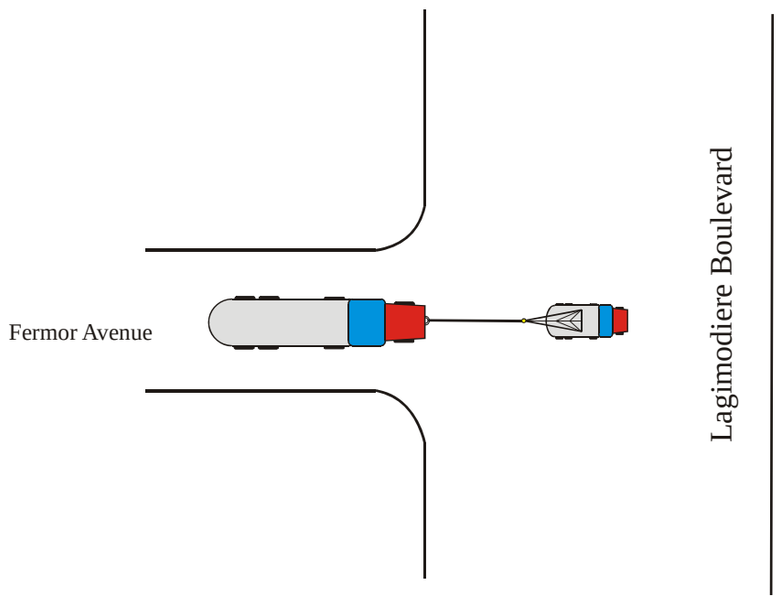


Figure 1(a)

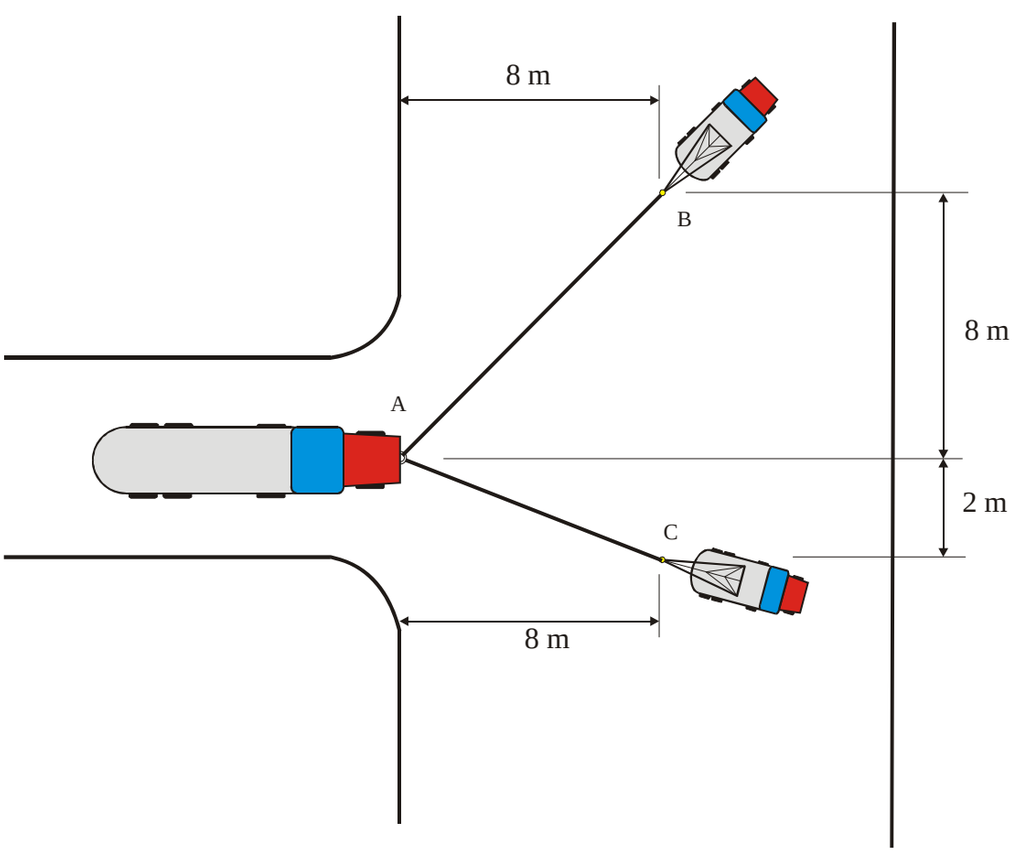


Figure 1(b)

QUESTION 2

A Free Body Diagram (FBD) of a truss joint in equilibrium is given in the Figure 2 below. Determine the magnitudes and the directions of forces $\boldsymbol{F_1}$ and $\boldsymbol{F_2}$.

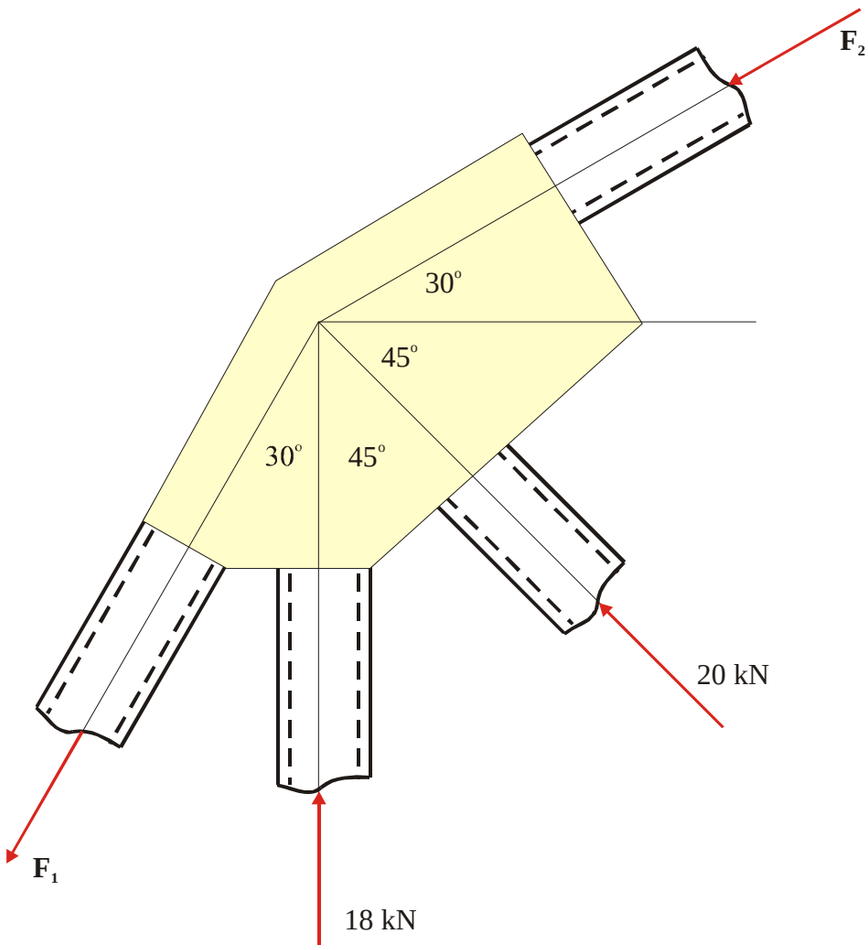


Figure 2

QUESTION 3

Two cranes are used to lift two masses, *M1* and *M2* using a set of five cables (*AC*, *AB*, *BD*,*AE* and *BF*) attached as shown in the figure. Cable *AB* is horizontal.

What would be the maximum combined mass *(M1 + M2)* that the two cranes can lift if the maximum force that any one of the five cables can carry is *100 kN*?

Use g = 9.8 m/sec^2

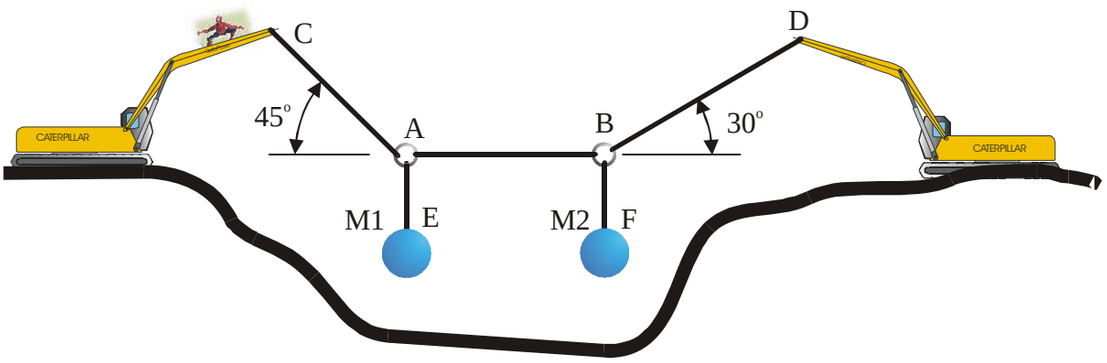
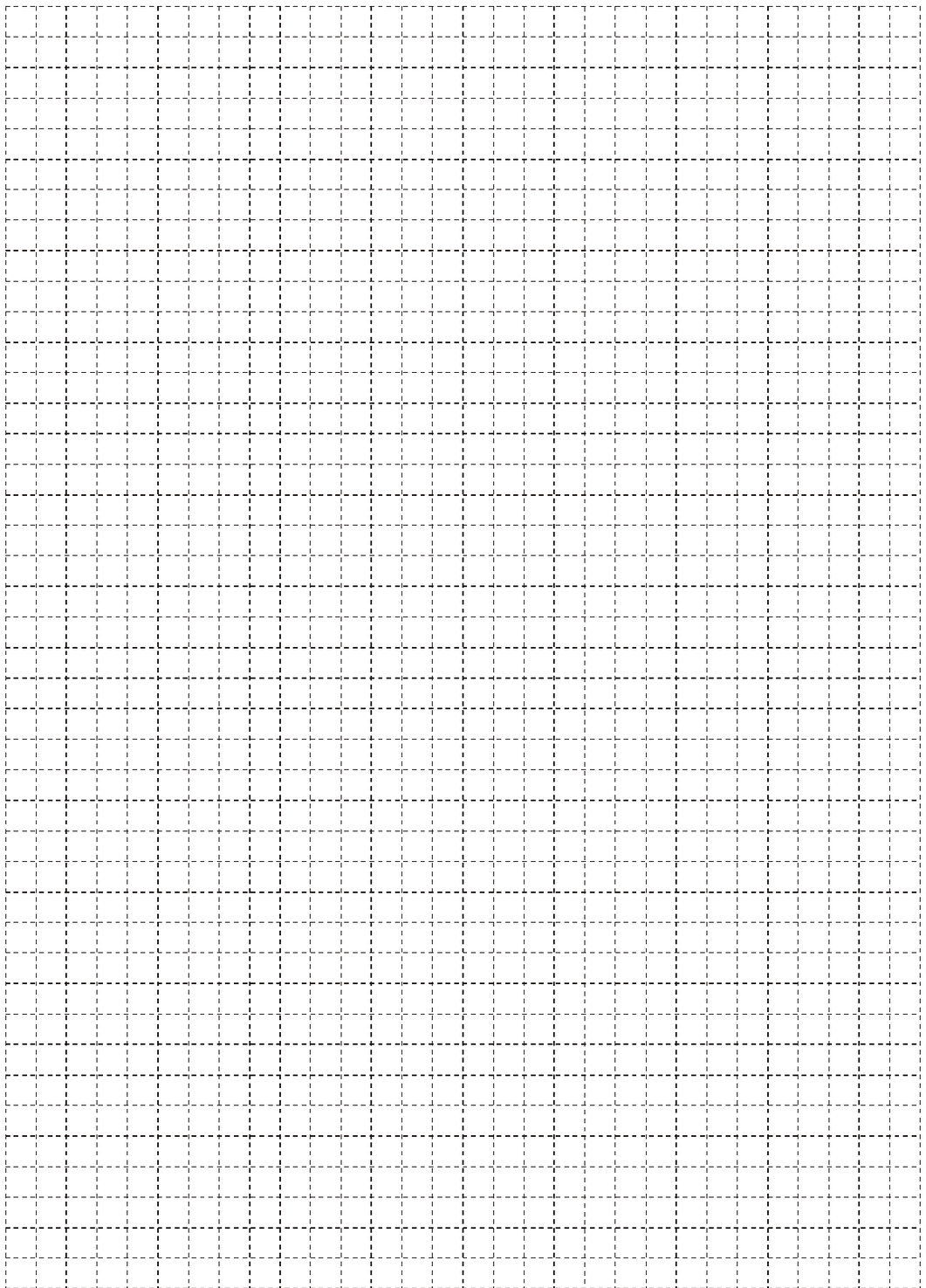



Figure 3