THE UNIVERSITY OF CALGARY
Schulich School of Engineering

ENGG 202 – Engineering Statics
First Midterm Exam
February 10, 2011 (Thursday)
18:40 – 20:00 (80 minutes)

1. The examination is closed textbook
2. There are 6 short answer questions and 2 comprehensive questions. Answer all questions directly on the question sheets. For the short answer questions, write your answer in the space provided, only the answer will be marked.
3. Only the SSE sanctioned, non-programmable, scientific calculator is permitted.
4. Free body diagrams are required on all comprehensive equilibrium questions to obtain full marks.

DO NOT OPEN THE EXAM BOOKLET UNTIL INSTRUCTED TO DO SO

Student's Last name: _____

Student's First name: _____

Lecture Section (Circle One):

L01	Tu Th	13:00	Lissel
L02	Tu Th	11:00	Grozic/Lissel
L03	Tu Th	09:30	Grozic

Student ID#: _____

USEFUL FORMULAE:

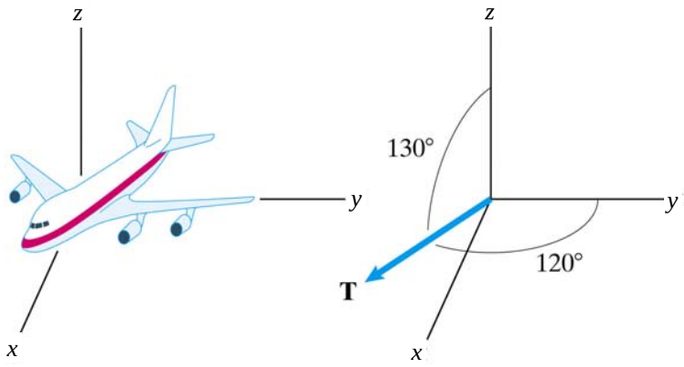
Sine Law: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Cosine Law: $c^2 = a^2 + b^2 - 2ab\cos C$

Question	Maximum mark	Mark
1 – 6	15	
7	15	
8	15	
Total	45	

All figures modified from:
"Engineering Mechanics, Statics", 5th Edition in SI Edition, Bedford and Fowler, Prentice Hall, 2008.

Q1. The airplane's engines exert a total thrust force **T** with a magnitude of of 200 kN. The angle between **T** and the *y* axis is 120°, and the angle between **T** and the *z* axis is 130°. The *x* component of **T** is positive.
(a) What is the angle between **T** and the *x* axis?
(b) Express **T** in Cartesian vector format.



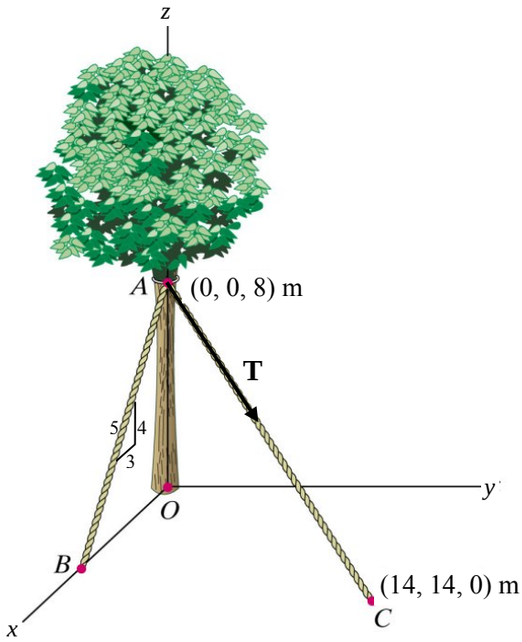
ANSWER: angle = _____ degrees /1.5 marks

T = _____ kN /1.5 marks

Q2. **A** = 20**i** + 10**j** – 15**k** N, and **B** = -1**i** – 3**j** + 4**k** m.
If **A** × **B** = **C**, what is **A**•**C**?

ANSWER: _____ /1 mark

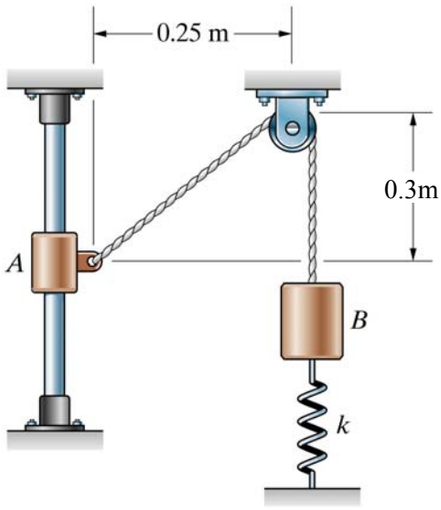
Q3. The tension in cable AC is 1000 N. Determine the magnitudes of the components of **T** that are parallel and perpendicular to line AB.



ANSWER: $T_{// AB}$ = _____ N /2 marks

$T_{\llcorner AB}$ = _____ N /1 mark

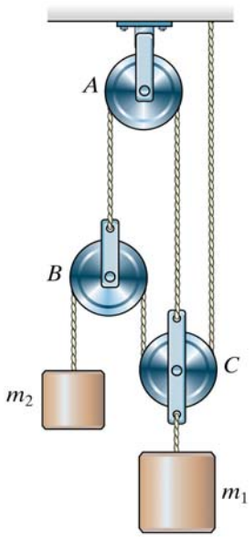
Q4. Collar A slides on the smooth vertical bar. Draw the FBD(s) that would be required to determine the spring constant *k*. Do NOT perform any calculations. Given: m_A = 20 kg, m_B = 10 kg and when the system is in the equilibrium position shown the change in length in the spring is 0.2 m.



ANSWER (draw in the space below):

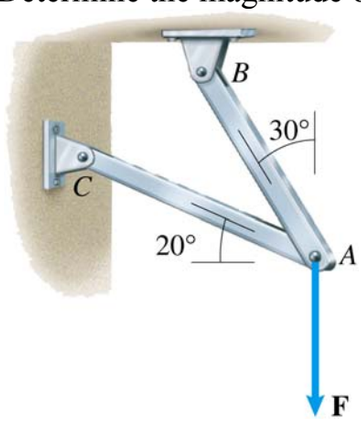
/3 marks

Q5. The mass m_1 = 50 kg. Neglecting the masses of the pulleys, determine the value of the mass m_2 necessary for the system to be in equilibrium.



ANSWER: _____ kg /2 marks

Q6. The length of the bar AB is 350 mm. The moments about points B and C due to the vertical force **F** are M_B = -1.75 kN·m and M_C = -4.20 kN·m. Determine the magnitude of the force **F** and the length of bar AC.

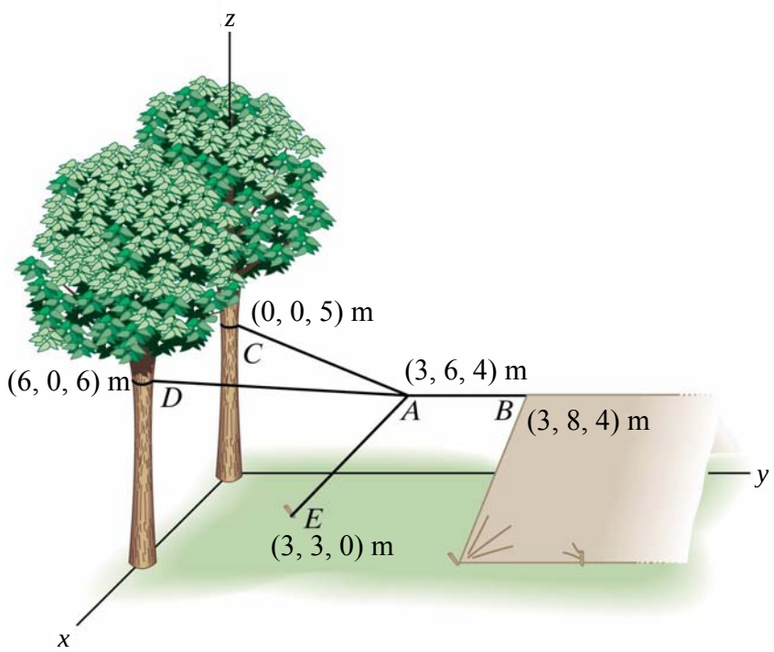


ANSWER: F = _____kN /1.5 marks

Length of AC = _____ mm /1.5 marks

Q7. The tent is supported by an assembly of four ropes. To support the tent, the tension in the rope AB, parallel to the *y* axis, must be 400 N. What are the magnitudes of the forces in the ropes AC, AD, and AE?

/15 marks



Q8. A cable extends from point C to point E. It exerts a 75 N force **T** on the plate at C that is directed along the line from C to E. Points A, B, and E lie in the *x*-*z* plane.
Determine the moment of the force **T** about the straight line that passes through the hinges A and B. Express your answer in Cartesian vector format.

/15 marks