THE UNIVERSITY OF CALGARY
Schulich School of Engineering

ENGG 202 – Engineering Statics
Second Midterm Exam
March 21, 2013 (Thursday)
19:00 – 20:30 (90 minutes)

1. The examination is closed textbook
2. There are 4 short answer questions and 2 long-answer 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 long-answer 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	15:30	Maes
L02	Tu Th	12:30	Grozic
L03	Tu Th	11:00	di Martino
L04	Tu Th	09:30	Lissel

Student ID#: _____

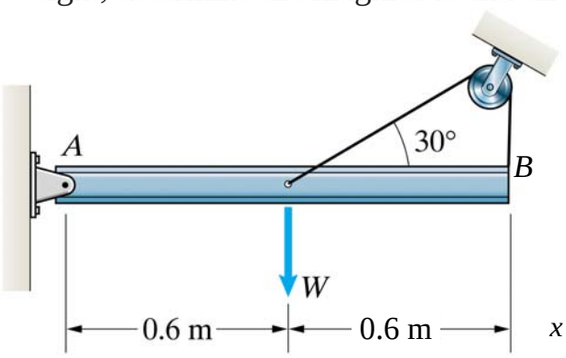
USEFUL FORMULAE:

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 – 4	12	
5	15	
6	10	
Total	37	

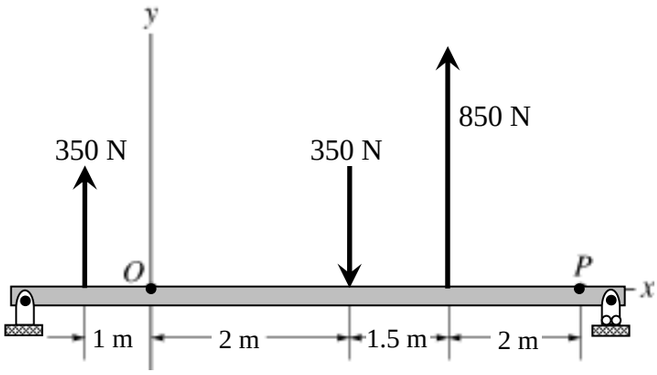
Q1. The cable will safely support a tension of 6 kN for equilibrium of the bar AB. a) determine the largest safe magnitude of the weight, W. b) For this weight, determine the magnitude and direction of the reaction at pin A.



ANSWER: a) Maximum safe W = _____ /1.5 marks

b) Reaction at A = _____ /1.5 marks
magnitude direction

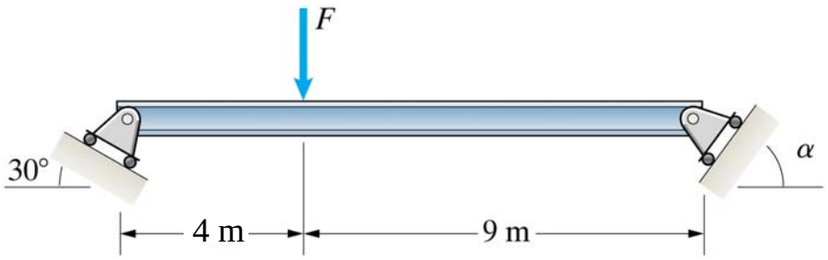
Q2. Replace the force system shown by an equivalent single force resultant and specify its point of application, measured along the *x* axis from point *P*.



ANSWER: Magnitude of F_R = _____ /1 mark

Location measured from P = _____ /2 marks

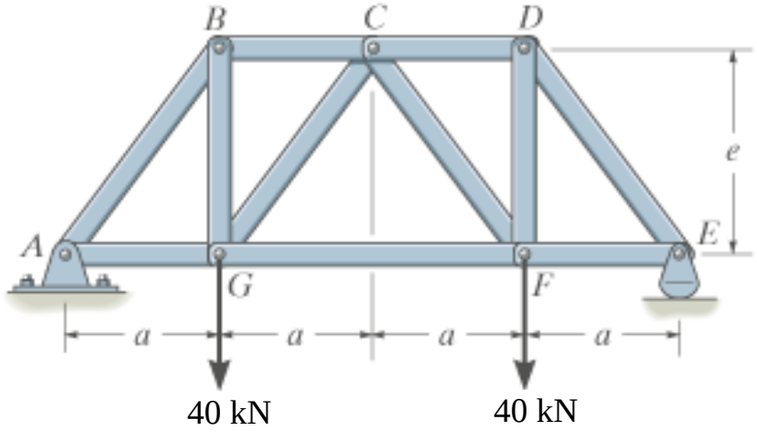
Q3. The horizontal bar has negligible weight and is supported by rollers at each end. Knowing that the bar is a 3-force member, determine the angle α required for equilibrium and draw the FBD of the bar indicating the direction of the three forces acting on the bar. Do NOT solve for the reactions.



ANSWER: a) draw in the space below: /1.5 marks

b) α = _____ /1.5 marks

Q4. Determine the force in members AB, BC and BG of the truss and state whether they are in tension or compression. a = 1.5 m, e = 2 m.

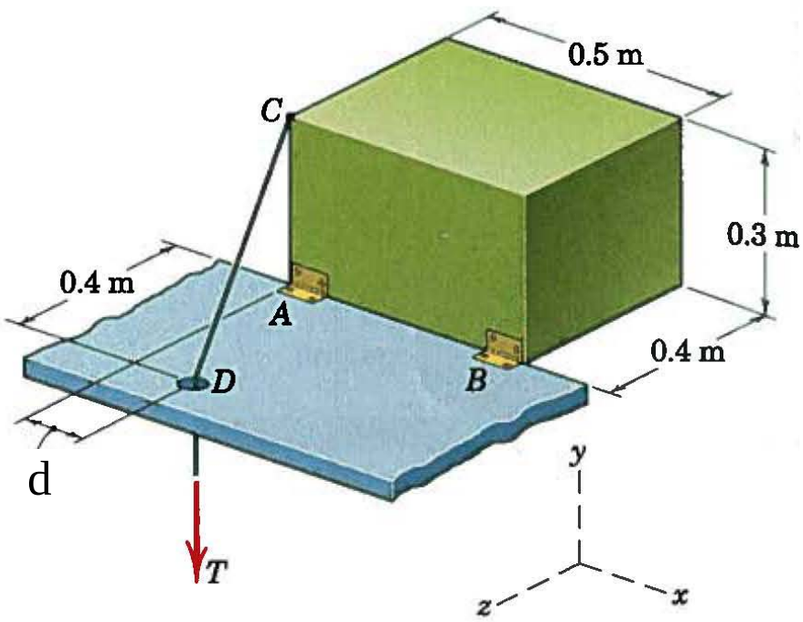


ANSWER: F_{AB} = _____ /1 mark

F_{BC} = _____ /1 mark

F_{BG} = _____ /1 mark

Q5. The 125 kg solid box is homogeneous and its weight acts at its center. The box is held in the equilibrium position shown by the cable CD and is supported by hinges at A and B. The hinge axis AB is parallel to the *x* axis. The hinge at A cannot exert any axial force and neither hinge exerts couples. The friction at D is negligible. Points A, B, and D all lie in an *x*-*z* plane. Knowing that d = 0.125 m, determine the tension, T, required to hold the box in the position shown and the reactions at the hinges A and B. Express your answers in Cartesian vector format. /15 marks



Q6. The L-shaped bar, *ABCD*, is subjected to a couple-moment at D which has a magnitude of M = 3 kNm, a linearly distributed load which has a magnitude of w = 16 kN/m at the left end, and a force F = 5 kN as shown.

(a) Represent the loading shown by an equivalent force-couple system at point A. Indicate magnitude and direction in your answer. /3 marks

(b) Bar *ABCD* is supported in the equilibrium position shown by a pin at *A* and a short link at *B*. Determine the reactions at supports *A* and *B*. Indicate magnitude and direction in your answers. /7 marks