

THE UNIVERSITY OF CALGARY
Schulich School of Engineering

ENGG 202 – Engineering Statics
First Midterm Exam
February 23, 2015 (Monday)
19:00 – 20:30 (90 minutes)

1. The examination is closed textbook
2. There are 4 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. You may write on the back of the page.
3. Only the SSE sanctioned, non-programmable, scientific calculators are permitted.
4. **Free body diagrams are required** on all long-answer **equilibrium** questions to obtain full marks. Diagrams must be separate from the given figure.

DO NOT OPEN THE EXAM BOOKLET
UNTIL INSTRUCTED TO DO SO

Student's Last name: _____

Student's First name: _____

Lecture Section (Circle One):

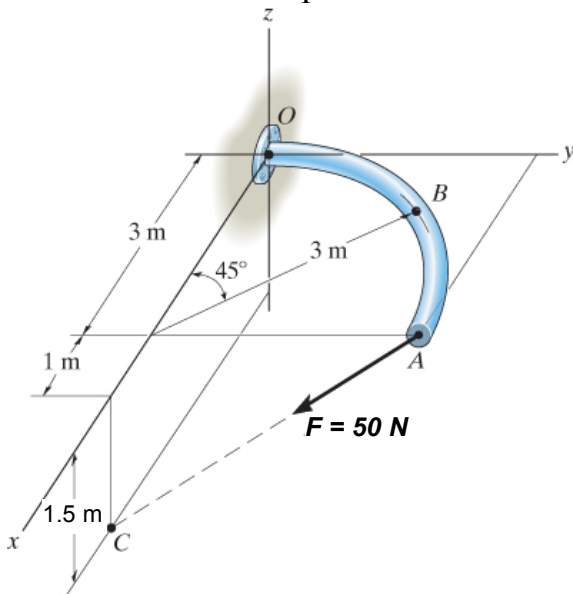
Student ID#: _____

USEFUL FORMULAE:

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

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

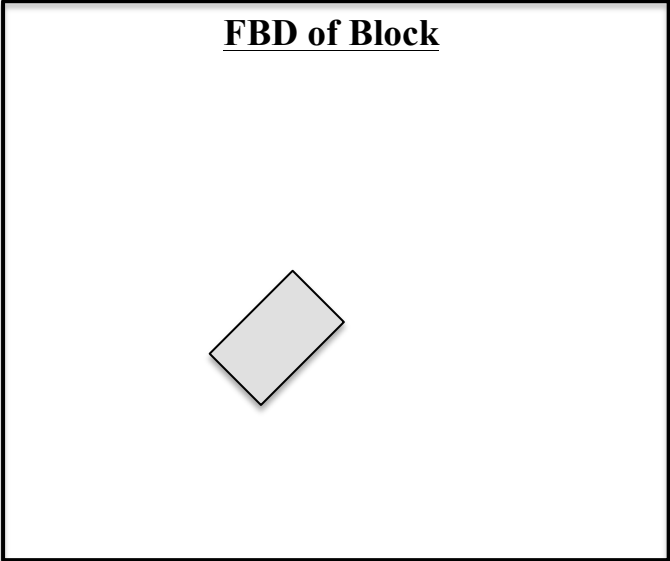
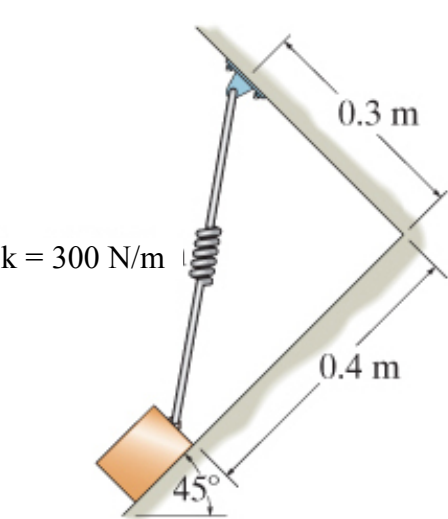
- Q1.** The curved rod lies in the xy plane and has a radius of 3 m. The force \mathbf{F} , acts at its end on point A as shown. Determine the:
- angle between the lines AC and AO.
 - magnitude of the component of the force that acts parallel to the line that connects points A and O.



ANSWER: (a) angle $\theta_{AO-AC} = \underline{\hspace{2cm}}^\circ$ /1.5 marks

 (b) $F_{\parallel OA} = \underline{\hspace{2cm}}$ N /1 mark

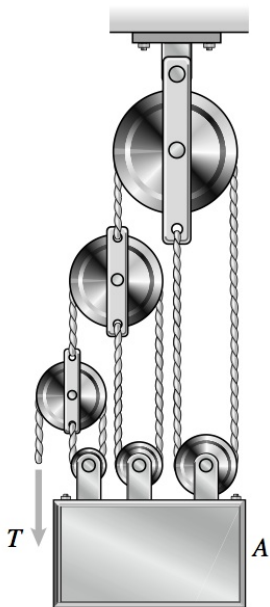
- Q2.** The block has a mass of 10 kg and rests on the smooth plane.
- Draw the free body diagram of the block in the space given.
 - Determine the unstretched length of the spring in mm.



ANSWER: (a) FBD of block (use box above) /1.5 marks

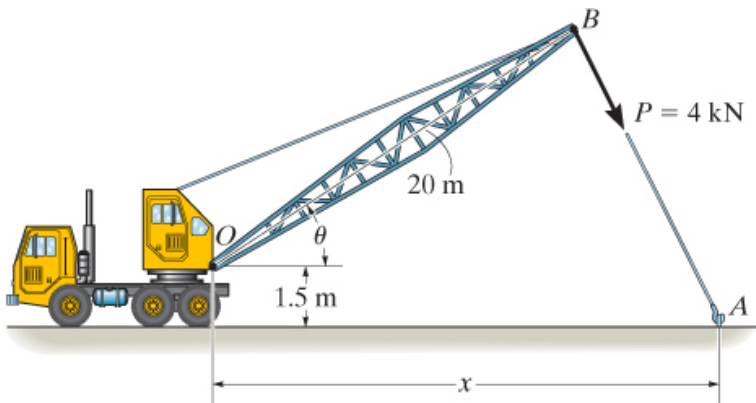
 (b) $L_{\text{unstretched}} = \underline{\hspace{2cm}}$ mm /1.5 marks

Q3. The mass of the suspended object A is m_A and the masses of the pulleys are negligible. Determine the force T necessary for the system to be in equilibrium.



ANSWER: $T =$ _____ N /2 marks

- Q4.** The towline exerts a force $P = 4\text{ kN}$ at the end of a 20 m long crane boom. If $\theta = 20^\circ$, determine:
- a) the placement x of the hook at A so that this force creates a maximum moment about point O.
 - b) the magnitude and direction of the moment about O created by the force P.

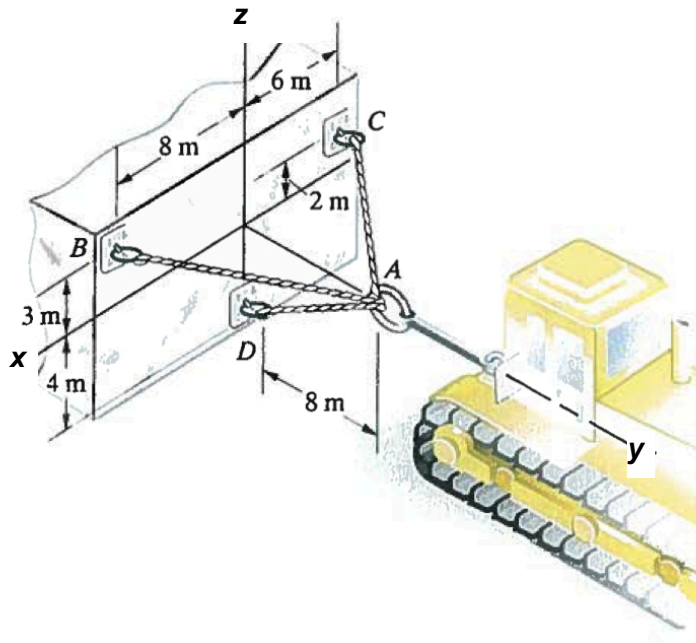


ANSWER: (a) $x =$ _____ m /1.5 marks

(b) $M_o =$ _____ kNm /1 mark

Q5. The bulldozer exerts a force $\mathbf{F} = 3000 \text{ N}$ at A, directed along the positive y-axis. If the system is in equilibrium, what are the magnitudes of the tensions in cables AB, AC, and AD?

/10 marks



Q6. The bar CB is located in the xz plane. An applied force \mathbf{F} , located at point A, has a magnitude of $F = 120\text{N}$. The angle from \mathbf{F} to the xy plane is $\theta = 65^\circ$, and the angle $\alpha = 20^\circ$ is to a line parallel to the y axis. Determine the magnitude and direction (state your answer with magnitude and directional angles θ_x , θ_y , θ_z) of the moment created by \mathbf{F} around the axis CB.

/10 marks

