INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)

EGR 1203: ENGINEERING MECHANICS
FINAL EXAMINATION: MAY 2016 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the paper provided. All questions carry equal marks.

Question 1

(a) Calculate $\frac{684\ \mu m}{43\ ms}$ and express the answer in SI units using an appropriate *prefix*.

(5 marks)

(b) The bracket is subjected to the two forces as shown in Figure Q1-(a)

i) Express the vector force in Cartesian format for $\mathbf{F_1}$, and force $\mathbf{F_2}$.

(8 marks)

ii) Find the magnitude and coordinate direction angle for the resultant force.

(12 marks)

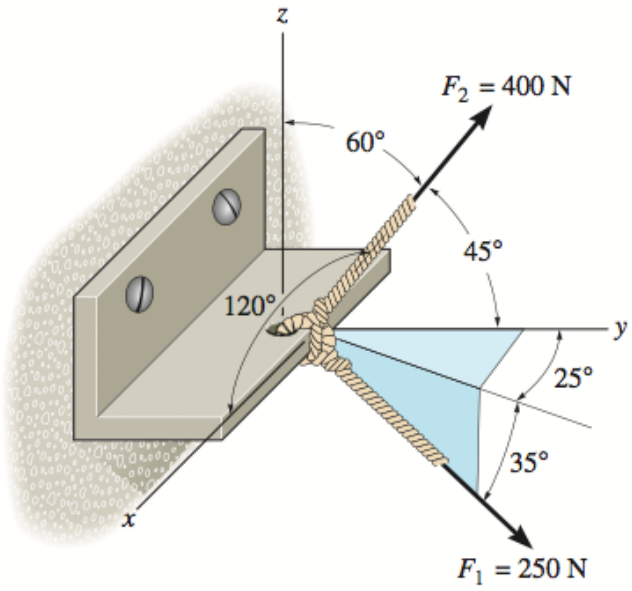


Figure Q1-(a)

Question 2

(a) A projectile is fired from the platform at *B*. The shooter fires his gun at point *A* at an angle of 30º as shown in Figure Q2-(a).

i) Determine the time when the bullet hits the projectile at *C*.

(5 marks)

ii) Calculate the speed of the bullet when it leaves the muzzle and hits the projectile at point *C*.

(4 marks)

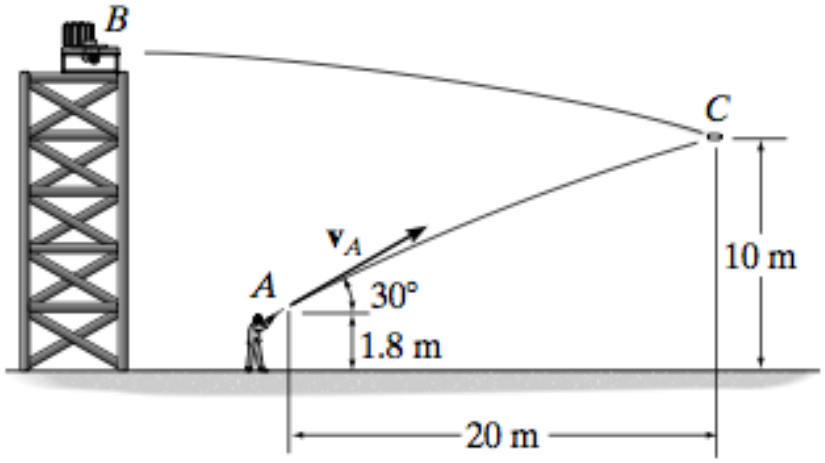


Figure Q2-(a)

(b) The following force system acting on the post as shown in Figure Q2-(b). Calculate,

i) the total horizontal component force.

(3 marks)

ii) the total vertical component force.

(3 marks)

iii) the magnitude and direction of resultant force.

(5 marks)

iv) the length of moment arm that cause a moment at the post AB measured from point A.

(5 marks)

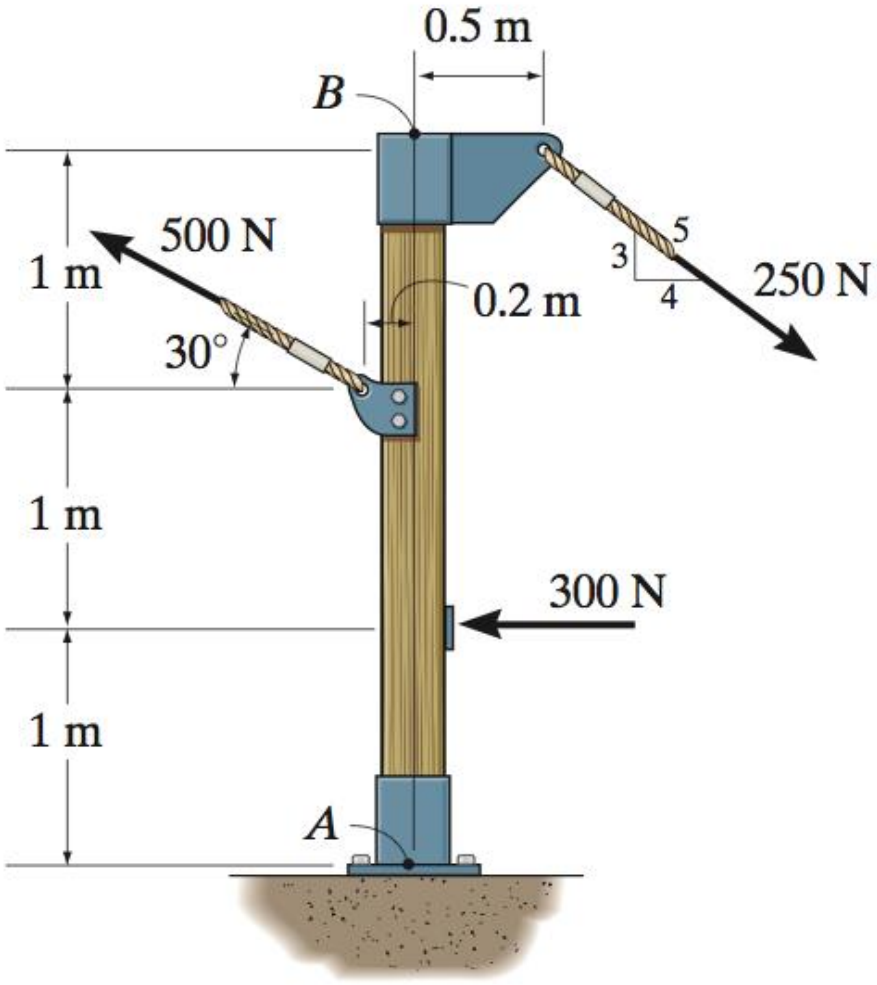


Figure Q2-(b)

Question 3

(a) Determine the reactions at the supports in Figure Q3-(a).

i) Calculate the reaction force at point A,

(9 marks)

ii) Then, the reaction force at point B.

(5 marks)

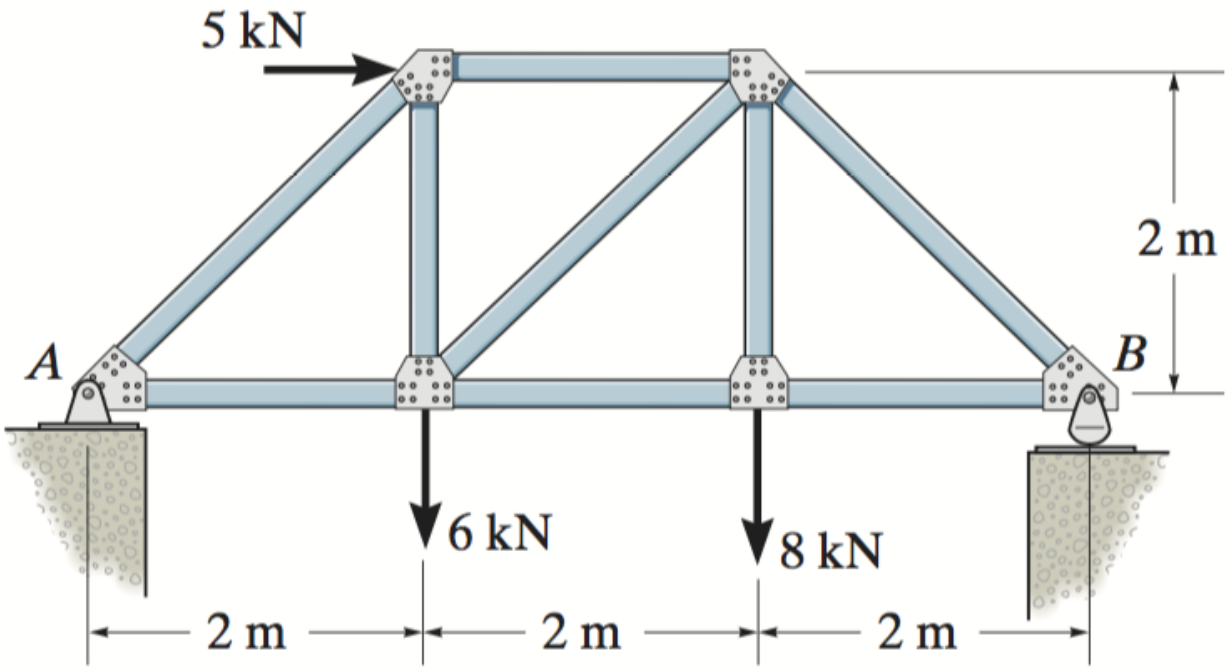


Figure Q3-(a)

(b) The car has a mass of 2 Mg and center of mass at G in Figure Q3-(b).

i) Sketch a free-body diagram for Figure Q3-(b).

(2 marks)

ii) Determine the towing force **F** required to move the car if the back brakes are locked while the front wheels are free to roll. Coefficients of friction is $\mu_S = 0.3$.

(9 marks)

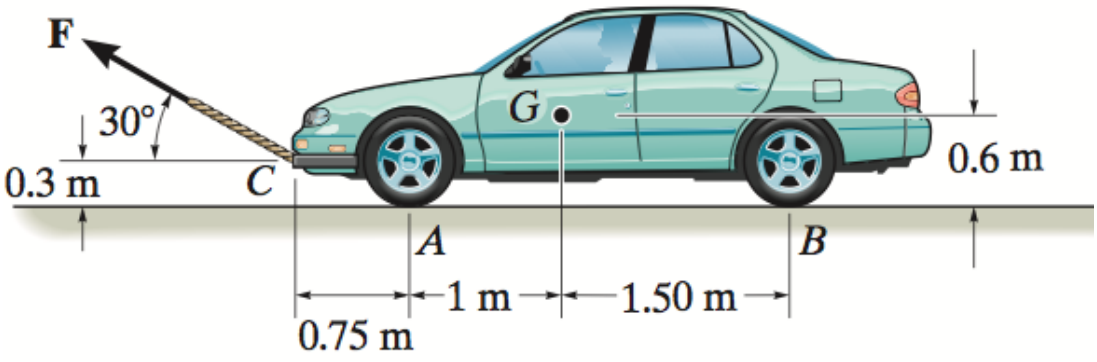


Figure Q3-(b)

Question 4

(a) Locate the centroid $\bar{x}$ of the area cover by the quadratic equation as shown in Figure Q4-(a).

i) Sketch a diagram and state the equation for the element of area involved.

(4 marks)

ii) Calculate the centroid $\bar{x}$ and express your answer in fraction form.

(6 marks)

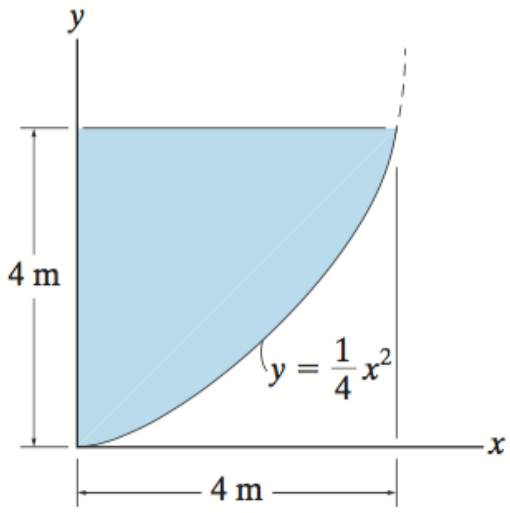


Figure Q4-(a)

(b) A particle travels along a straight line with velocity changes with displacement as described by the graph in Figure Q4-(b). Construct the acceleration – displacement (a – s) graph.

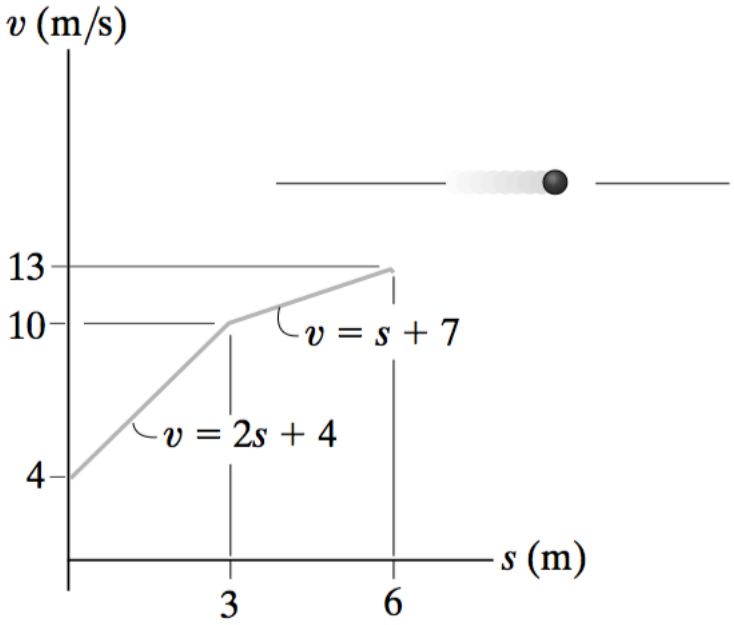


Figure Q4-(b)

(15 marks)

Question 5

(a) Calculate the moment of inertia for the shaded area as shown in Figure Q5-(a) about the x axis.

(7 marks)

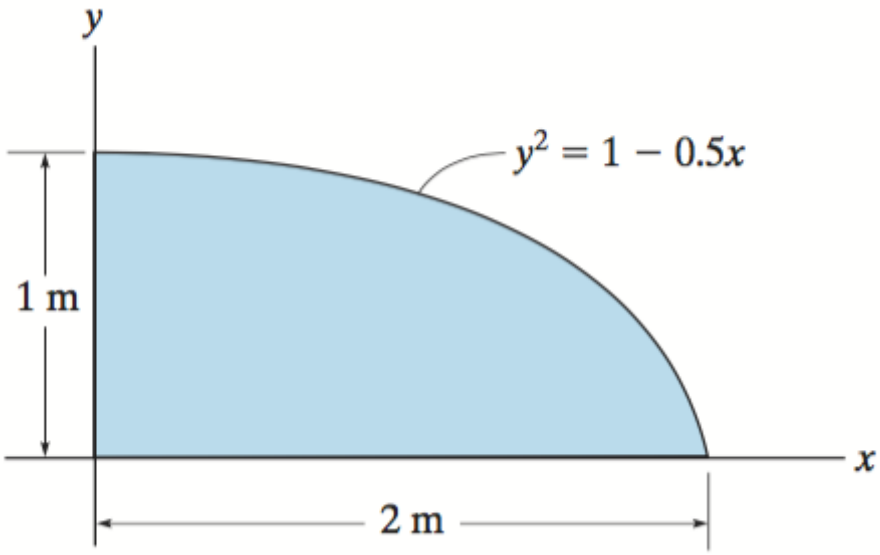
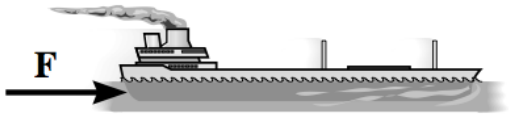


Figure Q5-(a)

(b) The tanker has a mass of 130 Gg. It is originally at rest. The horizontal trust provided by its propeller varies with time as shown in Figure Q5-(b) in accordance with linear impulse and momentum. Neglect the effect of water resistance. Determine its speed when time, t = 10 s.

(8 marks)



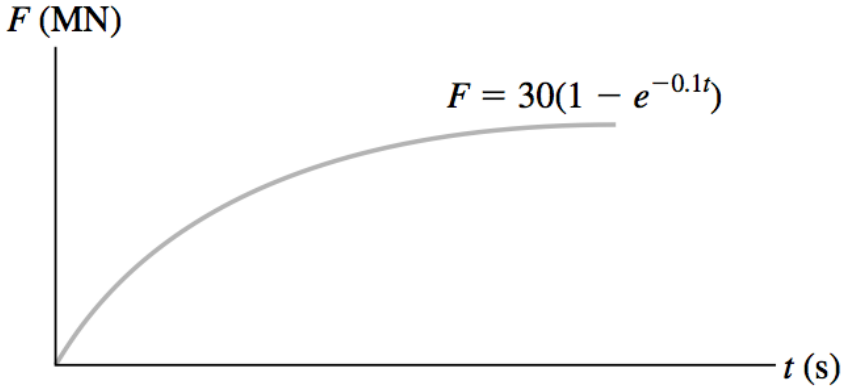


Figure Q5-(b)

(c) The 8 kg block B is moving with an initial speed of 5 m/s as shown in Figure Q5-(c). The coefficient of kinetic friction between the block and the plane is $\mu_k = 0.25$.

i) Sketch the free body diagram.

(2 marks)

ii) Calculate the normal force.

(2 marks)

iii) Determine the compression in the spring when the block momentarily stops.

(6 marks)

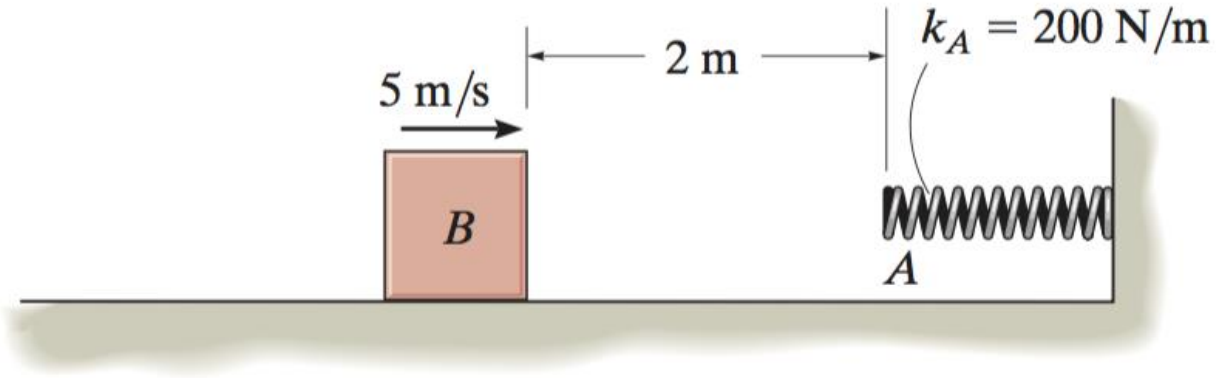


Figure Q5-(c)

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