ME 274 – Summer 2010 ***Name*** _____

Final Exam

PROBLEM NO. 4d *(5 points max)*

Given: Particle A (of mass m) strikes a fixed horizontal surface with a speed of v. Particle B (of mass 2m) also strikes the same horizontal surface with a speed of v. Both impacts have the same coefficient of restitution e.

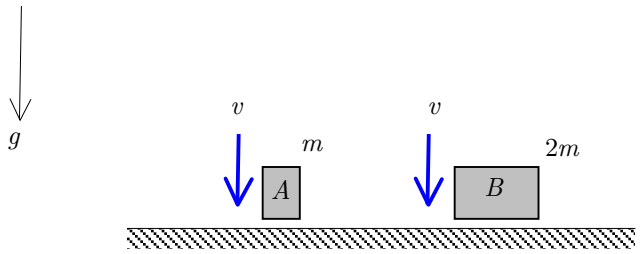
Find: Circle the response below that most accurately describes the *maximum rebound heights* of A and B after impact:

a) Particle A bounces to a *greater height* than particle B.

b) Particle A bounces to the *same height* as B.

c) Particle A bounces to a *lesser height* than particle B.

Provide a mathematical justification for your answer.



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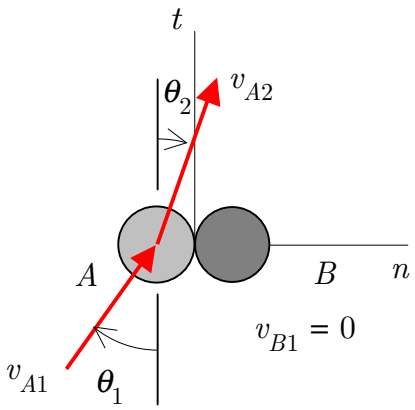
Examination No. 2

PROBLEM NO. 4c *(5 points max)*

Given: Particle A (of mass m) is traveling with a speed of v_{A1} in the direction shown below when it strikes a stationary particle B (of mass m). The coefficient of restitution for the impact of A with B is known to be $e = 0$.

Find: If $\theta_1 = 36.87°$, what is the direction of travel of particle A *after* impacting B? Provide a mathematical justification for your answer.



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Examination No. 2

PROBLEM NO. 4c *(4 points max)*

Given: Trucks A and B (having masses of M_A and M_B, respectively, where $M_A = 2M_B$) experience a low-speed, head-on collision on an icy road. The drivers of these two trucks (each having the same mass m) are both securely constrained by shoulder harnesses (and, fortunately, are not injured in the collision). *Let F_A and F_B represent the magnitudes of the respective forces acting on the drivers by their shoulder harnesses during the collision*. Assume that the collision does not do appreciable damage to either truck and that the trucks behave as rigid bodies during impact.

Find: Circle the answer below that most accurately describes the size of the force F_A as compared to the force F_B:

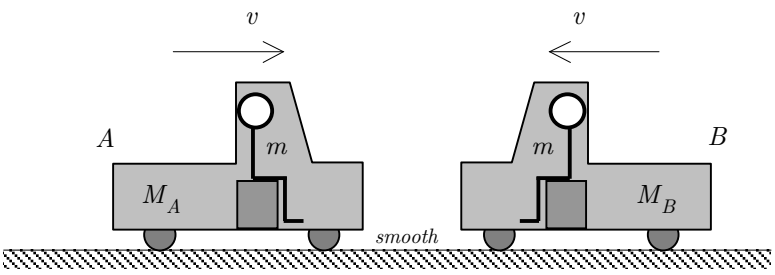
a) $F_A < F_B$

b) $F_A = F_B$

c) $F_A > F_B$

d) More information is needed about the collision to answer this question.

Provide a mathematical justification for your answer.



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Examination No. 2

PROBLEM NO. 4d *(5 points max)*

A rope is wrapped around a homogeneous disk having an outer radius of R and mass m. A force F acts on the right end of the rope. The center of the disk, G, is known to have an UPWARD acceleration. Assume that the rope does not slip on the disk. Circle the answer below that describes the tension in section CD of the rope, T_{CD} :

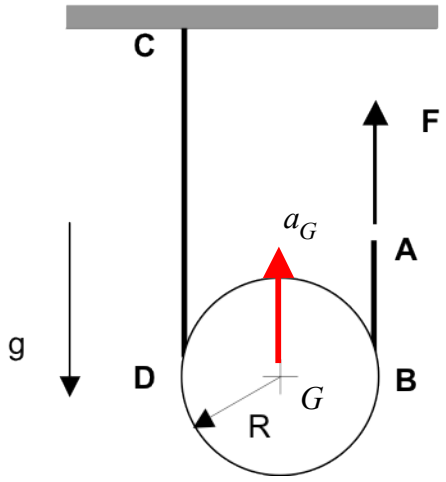
a) $T_{CD} < F$

b) $T_{CD} = F$

c) $T_{CD} > F$

d) More information is needed to answer this question. The additional information needed is:

Provide a mathematical justification for your answer.



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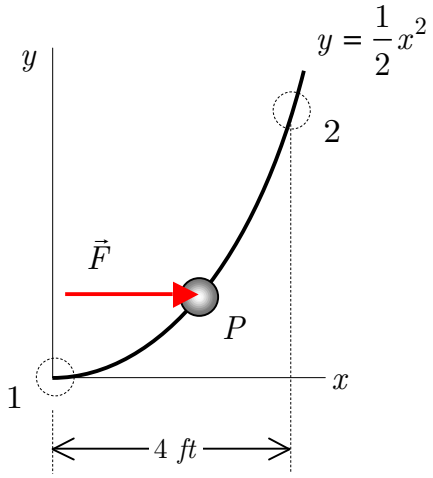
Final Exam

PROBLEM NO. 5a *(5 points max)*

Given: Particle P moves along a curved guide whose shape is given by the Cartesian description of $y = \frac{1}{2}x^2$, where x and y are given in feet. Between positions 1 and 2 shown on the figure below, a force $\vec{F}$ having a *constant* magnitude of $100\ lbs$ acts on P to the right.

Find: Determine the work done on P by $\vec{F}$ in going from position 1 to position 2.



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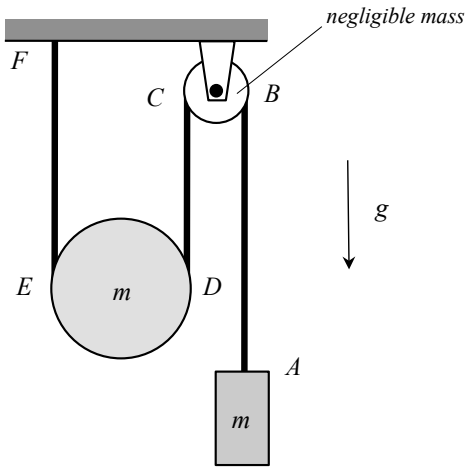
Final Examination
PROBLEM NO. 5 (continued)

Part C (2 points)**:** The circular disk and block A (each having the same mass m) are supported by the single cable shown. All sections of the cable not wrapped around the pulley and disk are vertical. The pulley has negligible mass. The system is released from rest. Let T_{AB}, T_{CD} and T_{EF} represent the tensions in sections AB, CD and EF, respectively, of the cable. Assume that the cable does not slip on the disk.

Circle the answer below that correctly describes the relative sizes of T_{AB} and T_{CD}:

a) $T_{AB} > T_{CD}$
b) $T_{AB} = T_{CD}$
c) $T_{AB} < T_{CD}$



Part D (3 points)**:** Consider again the system in Part D above. Circle the answer below that correctly describes the relative sizes of T_{CD} and T_{EF}:

a) $T_{CD} > T_{EF}$
b) $T_{CD} = T_{EF}$
c) $T_{CD} < T_{EF}$

PART B – 3 points

Particle A, of mass m, is moving to the right with a speed of v_{A1} when it strikes a stationary particle B (having a mass of 2m). For a coefficient of restitution between A and B of $e = 0.2$, circle the answer below that most accurately describes the motion of A after impact:

a) A is moving to the right.

b) A is stationary.

c) A is moving to the left.

d) A numerical value for v_{A1} is needed to answer this question.

You do NOT need to provide justification for your answer.