

Name _____ Section _____



Ho Ho Ho



ES204
Examination I
December 17, 1999

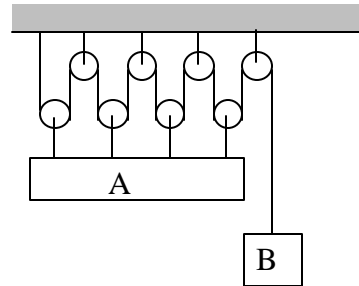
Problem	Score
1	/20
2	/40
3	/40
Total	/100

Show all work for credit
AND
Turn in your signed help sheet



 **Merry Christmas! Frohe Weihnachten!** 

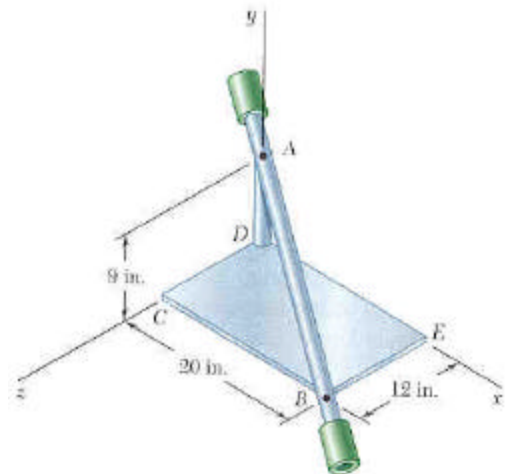
1.1) If B is moving at a constant 16 ft/s downwards what is the velocity of A?



1.2) Given that the acceleration of a particle is given by $a = -D/v^2$, what is the velocity as a function of time if $v = v_0$ at $t = 0$ and D is constant. (Note: not all the algebra is necessarily done to solve for v).

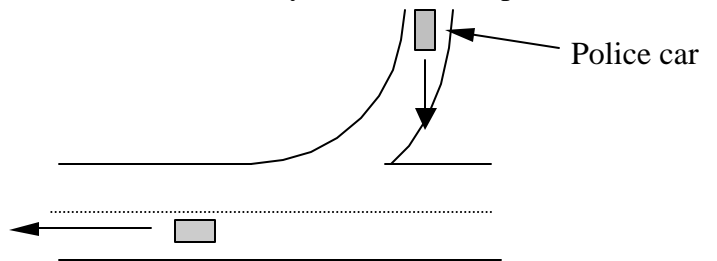
- a) $v = -\frac{Dv^3}{3} + v_0$ b) $v = -Dv^2t + v_0$ c) $v^3 = v_0^3 - 3Dt$ d) none of these

1.3) The assembly shown consists of two rods and a rectangular plate that are welded together. The assembly rotates at a constant angular velocity. The rotation is counter-clockwise as viewed from B.



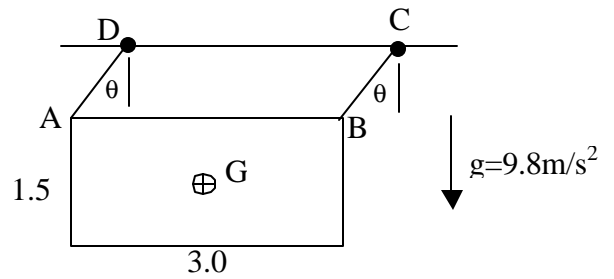
Draw the angular velocity vector on the figure.

1.4) A police car is entering a highway at 35 mph when he takes a radar reading of a car traveling on the highway. The radar gun reads 75 mph.. Assume the radar gun gives the magnitude of the relative velocity between the two cars, what is the actual velocity of the car in mph?



A uniform density 3.0 m x 1.5 m sheet of metal, whose mass is 20 kg, swings from two identical light rods, length = 1.0 m, as shown in the sketch. You may consider the rods' mass to be negligible. At the instant shown the angle $\theta = 45^\circ$. The angular velocity of each of the rods at the instant shown is 2.0 rad/s. Note: ABCD is always a parallelogram.

- a) Determine the velocity vector of point A (5 pts)
- b) Determine the equations necessary to calculate the tension in each wire and the acceleration of the center of mass of the plate at this instant. Use C&A. State the system, property or properties, and whether you are using rate or finite interval form. State the principle or principles in equation form.



DO NOT SOLVE THE EQUATIONS for part b). Your answer should consist of a list of clearly numbered equations.

At the bottom of a loop in the vertical (r - θ) plane at an altitude of 600 m, the airplane P has a horizontal velocity of 150 m/s and no horizontal acceleration. The radius of curvature of the loop is 1200 m. The plane is being tracked by radar at O.

- What is the force the pilot experiences at the instant shown? Express your answer in terms of his mass, m .
- What are the recorded values of \dot{r} , \ddot{r} , $\dot{\theta}$ and $\ddot{\theta}$ for this instant?

Hint: You do not need to use radial and transverse coordinates for both parts of this problem.

