

Name _____ Section _____



Ho Ho Ho



ES204
Examination I
December 14, 2001

Problem	Score
1	/24
2	/36
3	/40
Total	/100

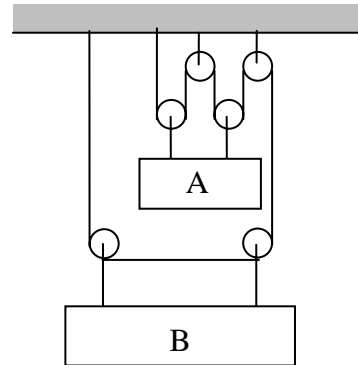
Show all work for credit
AND
Turn in your signed help sheet



 **Merry Christmas! Frohe Weihnachten!** 

1.1) If B is moving at a constant 2 ft/s downwards what is the velocity of A? (3 pts)

- a) 0.25 ft/s up
- b) 0.4 ft/s up
- c) 0.5 ft/s up
- d) 1 ft/s up
- e) 2 ft/s up
- f) 2.5 ft/s up
- g) 4 ft/s up
- h) 10 ft/s up

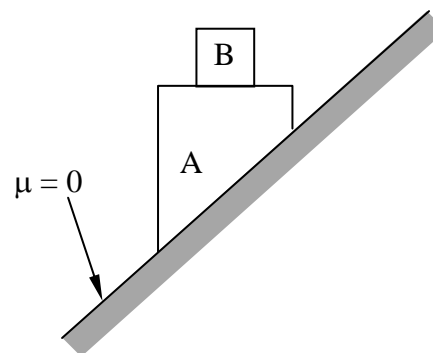


1.2) Object A has a velocity with respect to object B of $3\hat{i} + 4\hat{j}$ ft/s. If the actual velocity of A is $2\hat{i} + 2\hat{j}$ ft/s determine the velocity of object B. (3 pts)

- a) $2\hat{i} + 2\hat{j}$ ft/s
- b) $-\hat{i} - 2\hat{j}$ ft/s
- c) $\hat{i} + 2\hat{j}$ ft/s
- d) 0 ft/s
- e) $5\hat{i} + 6\hat{j}$ ft/s

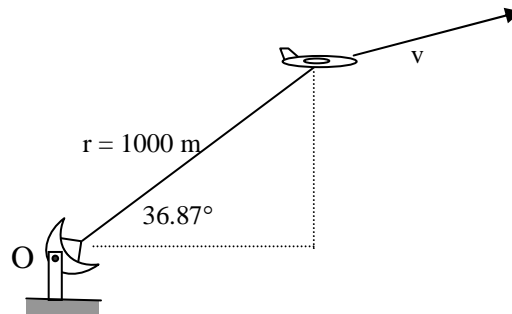
1.3) The system shown is released from rest in the position shown. Qualitatively the normal force between block A and B is (circle one) (3 pts)

- a) less than the weight of B
- b) equal to the weight of B
- c) greater than the weight of B
- d) not enough information is given



1.4) A plane is traveling as shown. At the instant shown r is increasing at a constant rate of 300 ft/s and the angle, θ , is decreasing at a constant rate of 0.18 rad/s. Determine the speed of the plane. (3 pts)

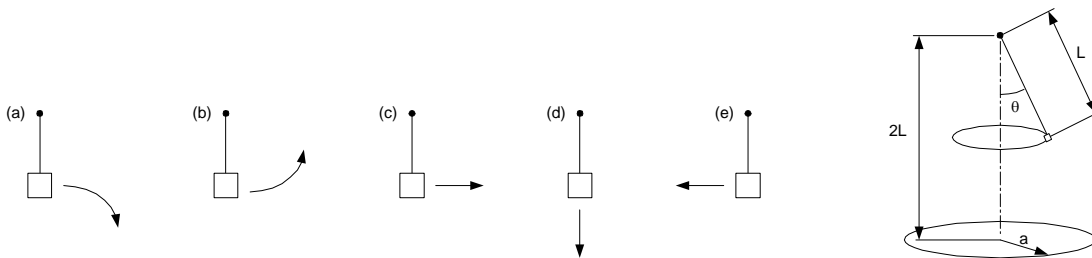
- a) 120 ft/s
- b) 180 ft/s
- c) 300 ft/s
- d) 350 ft/s
- e) 480 ft/s



1.5) Determine the acceleration of the plane shown in problem 1.4. (3 pts)

- a) 0 ft/s
- b) 32.4 ft/s
- c) 108 ft/s
- d) 112.8 ft/s
- e) 140.4 ft/s

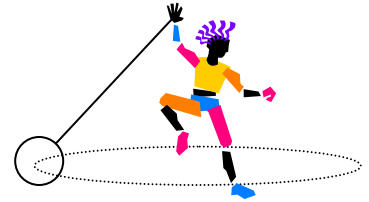
1.6) A bucket is attached to a rope of length L and is made to revolve in a horizontal circle. The bucket is rotating counterclockwise when viewed from the ceiling. Drops of water fall from the bucket and strike the floor along the perimeter of a circle of radius a . Which sketch accurately reflects the path of a drop of water as viewed from the ceiling? (3 pts)



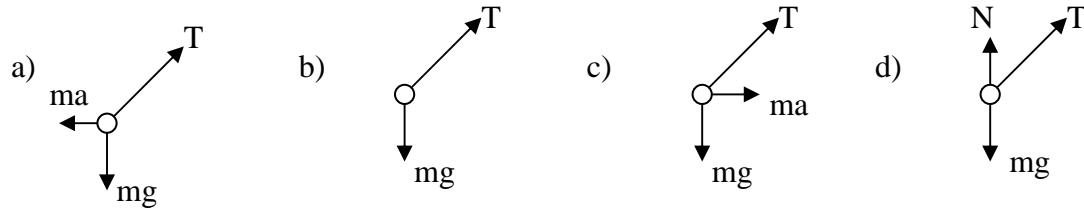
1.7) A weight at the end of a string moves at a constant speed around a circle path in a horizontal plane as shown. Circle ALL the following statements that are correct. (3 pts)

There will be a non-zero component of acceleration

- a) in the same direction as the velocity
- b) directed radially inward towards the center of the circular path
- c) directed radially outward from the center of the circular path
- d) in the vertical direction due to gravity

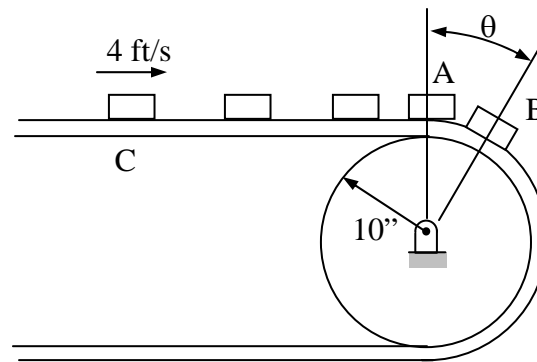


1.8) For the weight shown in Problem 1.7, the correct free body diagram is



A series of small packages, each weighing 0.75 lb, are discharged from a conveyor as shown. The belt moves at a constant speed. Knowing that the coefficient of static friction between each package and the belt is 0.4, and the coefficient of kinetic friction is 0.35, determine,

- the normal force the belt exerts on the package at point C
- the friction force at point C
- the force exerted by the belt on the package just after it passes point A
- the angle θ defining the point B where the package first slips relative to the belt. **NOTE: for part d) just derive the necessary equations so that the angle could be determined. You do not need to solve the equations.**



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Problem 3

40 pts
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The Caterpillar 769D dumptruck, $W = 10$ tons, is used at the Ajax Mine just east of Terre Haute. A 15 ton boulder is dropped 20 feet from a crane into its bed. Assuming the coefficient of restitution is 0.8, the *four* springs in the suspension are initially compressed 1" and that the springs can deflect no more than 3 additional inches, determine the spring constant k .



DO NOT SOLVE THIS PROBLEM - SET IT UP ONLY

Your solution should consist of a table of unknowns/equations and a numbered collection of equations. Clearly define all your terms.

unk	eqs