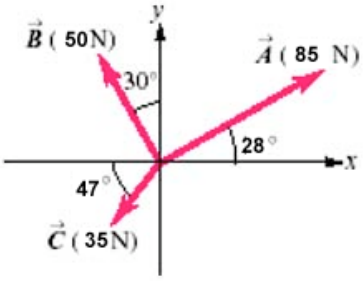
Physics 180A
Final Test - 120 Points

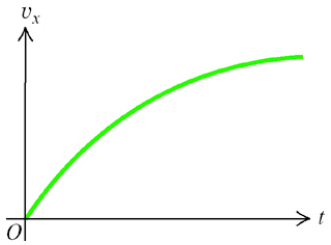
Name _____

1. Three horizontal ropes are attached to a boulder and produce the pulls shown in the figure. Find the magnitude and direction of the resulltant pull. (5 points)

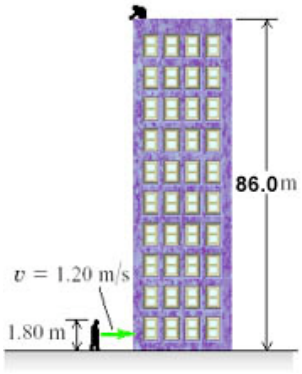


Answer box

2. The figure below shows the velocity of a jogger as a function of time. What statements must be true about the jogger's motion? (5 points)



A. The jogger's speed is decreasing.
B. The jogger's speed is increasing.
C. The jogger's acceleration is decreasing.
D. The jogger's acceleration is increasing.



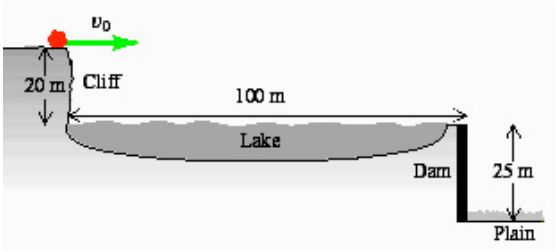
3. You are on the roof of the physics building of your school, 86.0 m above the ground.Your physics professor, who is 1.80 m tall, is walking alongside the building at a constant speed of 1.20 m/s. If you wish to drop an egg on your professor's head, where should the professor be when you release the egg, assuming that the egg encounters no appreciable air drag. (10 points)

4. A ball is thrown horizontally from the top of a building and lands a distanced from the foot of the building after having been in the air for a time T and encountering no appreciable air resistance. If the ball had been thrown horizontally twice as fast, but all else were the same, it would have (5 points)

a. been in the air a time 2T. b. reached the ground with twice the speed it did from the shorter building.

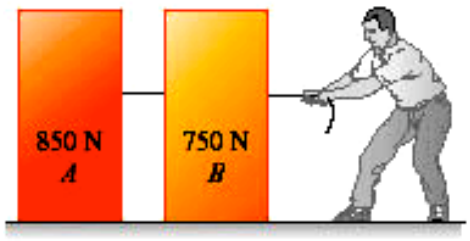
c. been in the air a $T\sqrt{2}$ time. d. landed a distance 2d from the foot of the building.

5. A 76.0 kg boulder is rolling horizontally at the top of a vertical cliff that is 20.0 m above the surface of a lake, as shown in figure. The top of the vertical face of a dam is located 100m from the foot of the cliff, with the top of the dam level with the surface of the water in the lake. A level plain is 25.0 m below the top of the dam. What must the minimum speed of the rock be just as it leaves the cliff so that it will travel to the plain without striking the dam? How far from the foot of the dam does the rock hit the plain? (10 points)

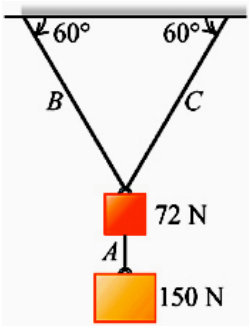


Answer box

6. A dock worker pulls two boxes connected by a rope on a horizontal floor. All the ropes are horizontal, and there is some friction with the floor. Draw a FreeBody Diagram for each box. (5 points)

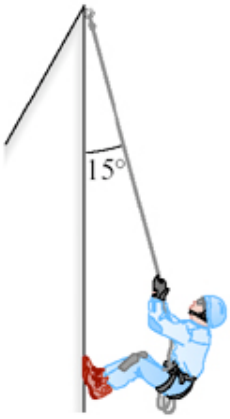


7. Two weights are hanging as shown in the figure. Find the tension in cable A. Find the tension in cables B and C. (10 points)



Answer box

8. The figure shows a technique called *rappelling*, used by mountaineers for descending vertical rock faces. The climber sits in a rope seat, and the rope slides through a friction device attached to the seat. Suppose that the rock is perfectly smooth (i.e., there is no friction) and that the climber's feet push horizontally onto the rock. The climber's weight is 700 N. Find the tension in the rope. Find the force the climber's feet exert on the rock face. Start with a free-body diagram of the climber. (10 points)



Answer box

9. Two massless bags contain identical bricks, each brick having a mass M. Initially, each bag contains four bricks, and the bags mutually exert a gravitational attraction F_1 on each other. You now take two bricks from one bag and add them to the other bag, causing the bags to attract each other with a force F_2. What is the closest expression for F_2 in terms of F_1? (5 points)

a. $F_2 = 1/2F_1$ b. $F_2 = 1/4F_1$ c. $F_2 = F_1$ d. $F_2 = 3/4F_1$

10. Two *identical* objects are pressed against two different springs so that each spring stores 65.0 J of potential energy. The objects are then released from rest. One spring is quite stiff (hard to compress), while the other one is quite flexible (easy to compress). Which of the following statements is or are true? (More than one statement may be true.) (5 points)

a. The stiff spring has a larger spring constant than the flexible spring.
b. Both springs are initially compressed by the same amount.
c. Both objects will have the same maximum speed after being released.
d. The flexible spring must have been compressed more than the stiff spring.
e. The object pressed against the stiff spring will gain more kinetic energy than the other object.

11. The Cosmoclock 21 Ferris wheel in Yokohama City, Japan, has a diameter of 125 m. Its name comes from its 60 arms, each of which can function as a second hand (so that it makes one revolution every 60s). Find the speed of the passengers when the Ferris wheel is rotating at this rate. A passenger weighs 840 N at the weight-guessing booth on the ground. What is his apparent weight at the highest point on the Ferris wheel? What is his apparent weight at the lowest point on the Ferris wheel? (10 points)

Answer box

12. A 82.0 kg skier is moving at 8.50 m/s on a frictionless, horizontal snow-covered plateau when she encounters a rough patch 4.50 m long. The coefficient of kinetic friction between this patch and her skis is 0.250. After crossing the rough patch and returning to friction-free snow, she skis down an icy, frictionless hill 2.50 m high. How fast is the skier moving when she gets to the bottom of the hill? How much internal energy was generated in crossing the rough patch? (10 points)

Answer box

Diagram 10 points **Reason 10 Points** **Solution 10 Points**

From the top edge of a horizontal plateau, a 175 kg bag of mountain-climbing gear is launched horizontally by pressing it against a spring of force constant 395 N/cm. Just before the launch, the spring is compressed 11.0 cm from its equilibrium position. Once the bag is free of the spring, it goes over a vertical cliff 3.45m high and lands in the snow below. How far from the foot of the cliff does the bag land? How fast is it moving when it land? Use energy methods.

Answer box