

PHYS 221 Examination 1

Name (print): _____

Signature _____

Problem 1 _____

Problem 2 _____

Problem 3 _____

Problem 4 _____

Problem 5 _____

Problem 6 _____

Total _____

Directions: Time allowed: 2 hours. There are six problems worth 20 points each. You may work all six problems for 120/100 possible points. Feel free to ask for help. You may leave the room at any time provided you are not gone for more than a couple of minutes, and do not take anything with you. Good Luck!

Problem 1. a) Given $\mathbf{A} = 2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, $\mathbf{B} = -2\mathbf{i} + \mathbf{j} + 5\mathbf{k}$, compute the following:

$$\mathbf{A} + \mathbf{B}$$

$$\mathbf{A} \cdot \mathbf{B}$$

$$\mathbf{A} \times \mathbf{B}$$

b) The motion of a particle is described by the function $\mathbf{x} = 3t^2\mathbf{i} + \cos(t)\mathbf{j} + e^t\mathbf{k}$.

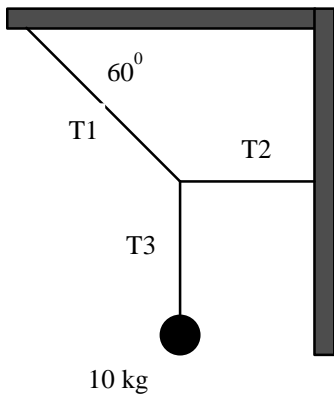
- Find the equations that describe the velocity and acceleration of the particle.
- Find the position, velocity, and acceleration of the particle at $t = 2\pi$ seconds.

c) A vector is given by $\mathbf{R} = 5\mathbf{i} + \mathbf{j} + 3\mathbf{k}$. Find the magnitude of \mathbf{R} , the magnitudes of the x, y, and z components.

Problem 2. A speeding motorist traveling 38 m/s north on I-15 passes a stationary officer of the law at exit 93 (Blackfoot). The officer immediately begins pursuit. He is in a car capable of a constant acceleration of 2.75 m/s^2 . At what mile marker will the officer catch the motorist if the motorist continues driving north at a constant speed? Note: the mileage on mile markers increases as one travels north.

Problem 3. A mountain biker traveling 20 m/s approaches a ramp that launches her into the air at an angle of 30° above the horizontal. The ramp is on one side of a 5 meter wide ditch. The other side of the ditch is 1 meter lower than the side she takes off from. Where does she land? Does she clear the ditch?

Problem 4. Determine the tension in each cord in the system shown below. The mass of the cords may be neglected.



Problem 5. Short Answer

a) Write Newton's laws

b) What are the four fundamental forces in nature?

c) Sketch graphs for displacement vs. time, velocity vs. time and acceleration vs. time for an object in free fall.

Problem 6. A skier leaves the ramp of a ski jump with a velocity of 10 m/s, 15 degrees above the horizontal. The slope below is angled at 40 degrees below horizontal. Find (a) the distance from the ramp to where the skier lands, (b) the velocity components just before landing.

