

PHYS 221 Examination 1

Name (print): _____

Signature _____

Problem 1 _____

Problem 2 _____

Problem 3 _____

Problem 4 _____

Problem 5 _____

Problem 6 _____

Directions: Time allowed: 2 hours. Work all six problems. An equation sheet has been provided for you. You are also permitted to use CRC math tables. Good luck!

Problem 1. a) Given: $A = 3i + 2j - 5k$, $B = -2i + j + 5k$, compute the following;

$$A + B$$

$$A \times B$$

$$A \cdot B$$

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

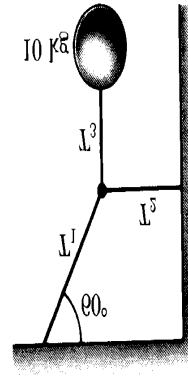
- Find the equations that describe the velocity and acceleration of the particle.

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

c) A vector is given by $\mathbf{R} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$. Find the magnitudes of the x , y , and z components and the magnitude of \mathbf{R} .

Problem 2. A mountain biker comes down the single track off Kinport Peak. Near the bottom the rider encounters a ditch being dug for a new pipeline which he attempts to jump without hesitation. The ditch is 5 meters wide and the far edge is 2 meters lower than the edge the bike launches from. If the launch point and landing are flat, and the velocity of the bike as it becomes airborne is 20 m/s, determine (a) time of flight, (b) range, (c) the direction of the bike's velocity just before it lands. Does the bike clear the ditch?

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



Problem 5. When two unequal masses are hung vertically over a light, frictionless pulley the arrangement is known as *Atwood's machine*. Assume that $m_2 > m_1$. Make a sketch of this system. Sketch separate free-body diagrams for each of the masses. Then show that:
for the system.

$$a = \left(\frac{m_2 - m_1}{m_1 + m_2} \right) g$$