UNIVERSITY OF NAIROBI
DEPARTMENT OF PHYSICS

CAT 2: SPH 101 – MECHANICS I Date: 5/11/2019

1. (a) Define a dot product of 2 vectors. (1 mark)
   (b) Two sides of a triangle are formed by vectors $A = 3i + 6j - 2k$ and $B = 4i - j + 3k$. Determine the angle between the vectors A and B. (2 marks)
2. (a) Give a concise definition of torque (τ) hence establish the vector relation between torque τ and the force F acting at a perpendicular distance r. (4 marks)
   (b) A torque of $1Nm$ is applied to a wheel of mass 10 kg and radius of Gyration $50cm$. Calculate the acceleration of the wheel. (3 marks)
3. a) A particle of mass m is moving with velocity v, show that its kinetic energy K is given by; $K = \frac{P^2}{2m}$ where p is the linear momentum of the particle. (2 marks)
   b) The particle in (a) above has the mass of 0.04 kg has the same kinetic energy as a baseball of mass 0.145 kg. Determine which of these 2 objects has a greater momentum. (2 marks)
4. a) A box of mass $72\ kg$ slides down a 15^o inclined plane as shown below. Given that the mass accelerates at $0.72\ m/s^2$, calculate the coefficient of frictional force acting up the slope. (3 marks)

5. a) State the Bernoulli's theorem. (1 mark)
   b) Water flows in a horizontal pipe line of varying cross-sections. At a point where the pressure of water is 0.05 m of mercury, the velocity of the flow is 0.25 m/s. Calculate the pressure at another point where the velocity of flow is 0.4 m/s given that the density of water is 1000 kg/m^3. (2 marks)