

# Math 11 Fall 2010: written part of HW2 (due Wed Oct 6)

*Please give your working. The space indicates the relative weight of each question sub-part.*

1. [11 points]

- (a) Write in the form  $ax + by + cz + d = 0$  the equation for the plane passing through the points  $(1, 0, 0)$ ,  $(3, 1, 0)$ , and  $(1, -1, 1)$ .

- (b) Find the distance from the origin to the plane  $\mathbf{r} \cdot \mathbf{n} = 4$  where  $\mathbf{n} = (1, 2, 3)$ .

(c) Find the location where the plane in part (b) is intersected by the line which passes through the points  $(2, 6, 6)$  and  $(4, 10, 12)$ .

(d) Is this above line orthogonal to the plane in part (b)?

2. [8 points] A point particle starts at the origin at  $t = 0$  with a speed of 1 moving in the direction of the positive  $x$ -axis. The particle experiences a constant acceleration vector  $(0, 1, 2)$ .

(a) Compute the position vector as a function of time  $t$

(b) Consider a particle with position vector  $(2 + t, 1 + t^2/2, t^2)$ . Compute the *unit* tangent vector at time  $t = 1$ .

(c) For the particle in part (b), compute the curvature  $\kappa$  as a function of time  $t$ .

3. [6 points]

(a) Compute the arclength of the space curve defined by  $(e^{-t} \cos t, 0, e^{-t} \sin t)$  for  $0 \leq t < \infty$

(b) Compute the unit normal vector  $\mathbf{N}$  at the point  $(0, 0, e^{-\pi/2})$  on this space curve.