

## PHAS1245: Mathematical Methods I - Problem Sheet 6

(Solutions to be handed in at the lecture on Tuesday 20st November 2006)

**Staple** your answer sheets together and put **your name** and your **tutor's name** on your script (or Dr. Konstantinidis, if you have no tutor in the P&A department).

1. What is the condition for two lines  $\vec{r} = \vec{a}_1 + \lambda_1 \vec{b}_1$  and  $\vec{r} = \vec{a}_2 + \lambda_2 \vec{b}_2$  to be parallel? What is the distance between the two lines in this case? [4]
2. What is the condition for the line  $\vec{r} = \vec{a} + \lambda \vec{b}$  to be parallel to the plane  $ax + by + cz = d$ ? What is in that case the distance from the line to the plane? [4]
3. Given two points A and B with position vectors  $\vec{a}$  and  $\vec{b}$  respectively, deduce the vector equation of the plane which is perpendicular to the line AB and equidistant from A and B. [4]
4. A particle is moving with constant velocity  $\vec{v} = u\hat{i}$  along the line  $y = 2$ . Describe  $\vec{v}$  in polar coordinates. [4]
5. A bead moves along the spoke of a wheel at constant speed  $u$  meters per second. The wheel rotates with uniform angular velocity  $d\theta/dt = \omega$  about an axis perpendicular to the  $xy$  plane. At  $t = 0$ , the spoke is along the  $x$  axis and the bead is at the origin. Find the velocity at time  $t$  (a) in polar coordinates and (b) in cartesian coordinates. [8]