1st Year – Maths Techniques II (Algebra) **25/10/2004**

Vectors 1

1. Write the following vectors (in 3D space) in component form:

   (a) $2\mathbf{i}+3\mathbf{j}$ (b) $17\mathbf{i}-4\mathbf{j}-\mathbf{k}$

   (c) $\mathbf{j}$ (d) $x\mathbf{i}+y\mathbf{j}+z\mathbf{k}$

2. If a vector **A** has components $(3,-1,-2)$, write **A** in terms of **i**, **j**, and **k**. Repeat for a vector with components (0, 0, 7).

3. Find the magnitudes of the vectors in question 1.

4. If $\mathbf{p}=4\mathbf{i}+2\mathbf{j}$ and $\mathbf{q}=-\mathbf{i}+3\mathbf{k}$, find the vectors

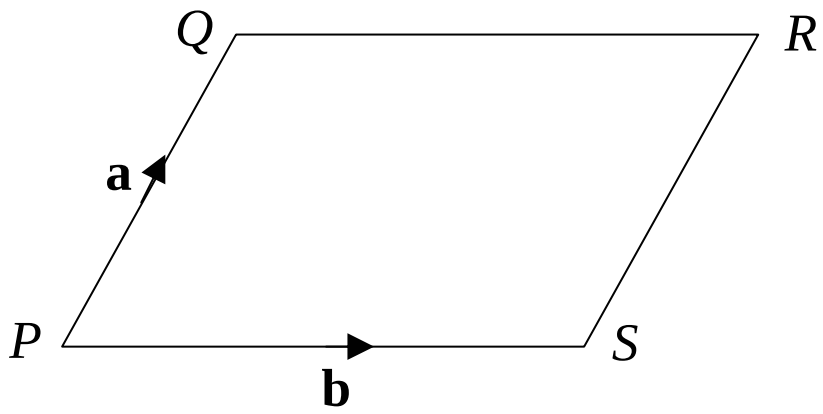
   (a) $-\mathbf{p}$ (b) $2\mathbf{q}$ (c) $\mathbf{p}+\mathbf{q}$ (d) $3\mathbf{p}-5\mathbf{q}$

5. Find the unit vectors corresponding to the four vectors (a)-(d) of question 4.

6. The position vectors of points A and B in the *x*-*y* plane have components (2, 1) and (3, 5) respectively. Find (a) the vector $\overrightarrow{AB}$, (b) the vector $\overrightarrow{BA}$, (c) the length of these vectors, and (d) the position vector of the mid-point of AB.

7. Point P has position vector $3\mathbf{i}+5\mathbf{j}$. What is the angle between $\overrightarrow{OP}$ and the *x*-axis?

8. In the parallelogram shown, $\overrightarrow{PQ}=\mathbf{a}$ and $\overrightarrow{PS}=\mathbf{b}$.



   (a) In terms of **a** and **b**, write down $\overrightarrow{SR}$, $\overrightarrow{RQ}$, $\overrightarrow{PR}$, and $\overrightarrow{SQ}$.

   (b) Defining point *M* as the mid-point of $\overrightarrow{PR}$, and point *N* as the mid-point of $\overrightarrow{SQ}$, find $\overrightarrow{PM}$ and $\overrightarrow{PN}$ in terms of **a** and **b**.

   (c) What property of a parallelogram can you deduce from the result of (b)?