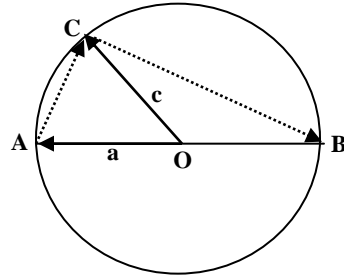# MATH 1300 ASSIGNMENT PROBLEMS (UNIT 1)

[10]   1. AOB is the diameter of a circle with centre at O
and C is any other point on the circle. Denote the
vector $\overrightarrow{OA}$ by **a** and the vector $\overrightarrow{OC}$ by **c**.

(a) Write the vectors $\overrightarrow{AC}$ and $\overrightarrow{CB}$ as linear combinations
of the vectors **a** and **c.**

(b) Use vector methods to show that $\angle ACB$ is a right
angle.

[10]   2. Let A = (2, 1, −5) and B = (1, −2, 4) be two points in $\mathbf{R}^3$.

(a) Find the components of the vectors $\overrightarrow{AB}$ and $\overrightarrow{BA}$.

(b) Find the coordinates of the point C if $\overrightarrow{AC} = \overrightarrow{CB}$.

(c) The point D = (k, 1, 5) is equidistant from the points A and B. Find the value(s) of k.

(d) Find the coordinates of the point X for which $\overrightarrow{AX} = 2\overrightarrow{AB}$.

[10]   3. Let $\mathbf{u} = (4,3,1)$, $\mathbf{v} = (5,4,-2)$ and $\mathbf{w} = (7,-3,4)$ be three vectors in $\mathbf{R}^3$. Find the
following.

(a) $2\mathbf{u} - 3\mathbf{v} + \mathbf{w}$

(b) $\mathbf{u} \cdot \mathbf{v}$

(c) $\mathbf{v} \times \mathbf{u}$

(d) $\text{proj}_\mathbf{v} \mathbf{u}$

(e) sine of the angle between the vectors **u** and **v**.

[10]   4. Let **u** = (4, 2, 7) and **v** = (2, 1, k) be two vectors in **R**^{3}.

(a) For what value(s) of k will the two vectors **u** and **v** be parallel? Explain.

(b) For what value(s) of k will the two vectors **u** and **v** be orthogonal? Explain.

(c) For what value(s) of k will the two vectors **u** and **v** be of equal length?

[10]   5. Let l: $3x + 4y = 12$ be a line and P = (6, 7) be a point in **R**^{2}.

(a) Let Q be the point on the line l having its y-coordinate = 0 and let R be the point on the line l having its x-coordinate = 0. Find the coordinates of the points Q and R.

(b) Plot the points P, Q, R and the line l on a two-dimensional Cartesian coordinate system.

(c) Find the components of the vector $\overrightarrow{QP}$.

(d) Find a normal vector **n** to the given line l.

(e) Find the distance between the point P and the line l.

[10]   6. The four points A(5,0,0), B(0,0,2), C(0,4,0) and D(5,6,–3) form a quadrilateral lying on the plane $4x + 5y + 10z = 20$. Find the area of this quadrilateral.