MATH 1300 ASSIGNMENT PROBLEMS (UNIT 1)
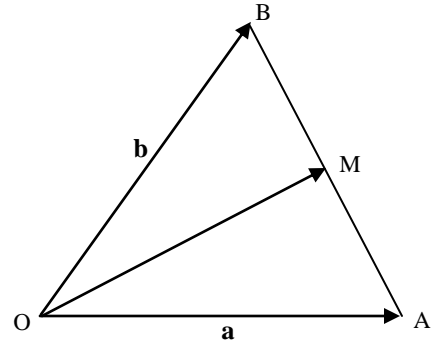
[10] 1. OAB is an isosceles triangle with OA = OB and M is
the mid-point of AB. Let $\overrightarrow{OA} = \mathbf{a}$ and let $\overrightarrow{OB} = \mathbf{b}$.

(a) Write the vectors $\overrightarrow{AB}$ and $\overrightarrow{OM}$ as linear
combinations of the vectors $\mathbf{a}$ and $\mathbf{b}$.

(b) Use vector methods to show that
$\overrightarrow{OM}$ is perpendicular to $\overrightarrow{AB}$.

[10] 2. Let $\mathbf{u} = (1, -3, 2)$, $\mathbf{v} = (3, 1, -2)$ and $\mathbf{w} = (4, 0, 1)$ be three vectors in $\mathbf{R}^3$. Find the
following.

(a) $3\mathbf{u} - 2\mathbf{v} + 4\mathbf{w}$

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

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

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

(e) cosine of the angle between the vectors $\mathbf{u}$ and $\mathbf{v}$.

[6] 3. Show that the 3 points P=(1, 3, 4), Q=(3, 2, 5) and R=(5, 1, 6) all lie on the same
straight line.

[4] 4. Let $\mathbf{u} = (3, 1, 0)$ and $\mathbf{v} = (1, 2, c)$ be two vectors in $\mathbf{R}^3$. For what value(s) of c is the
angle between the vectors equal to 60°?

[10] 5. Let $\mathbf{u} = (8, 12, 1)$ and $\mathbf{v} = (4, 6, k)$ be two vectors in $\mathbf{R}^3$.

(a) For what value(s) of k will the two vectors $\mathbf{u}$ and $\mathbf{v}$ be parallel? Explain.

(b) For what value(s) of k will the two vectors $\mathbf{u}$ and $\mathbf{v}$ be orthogonal? Explain.

(c) For what value(s) of k will the two vectors $\mathbf{u}$ and $\mathbf{v}$ be of equal length?

[10] 6. Let l: $2x+5y=9$ be a line and P $= (3, 6)$ be a point in $\mathbf{R}^2$.

(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 $\mathbf{n}$ to the given line l.

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

[10] 7. 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.