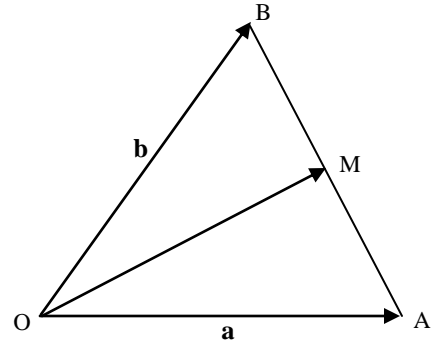


MATH 1300 ASSIGNMENT PROBLEMS (UNIT 1)

- [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 plane $x+2y+2z=4$ intersects the positive coordinate axis OX, OY and OZ in three points A, B and C respectively.

(a) Find the coordinates of the three points A, B and C .

(b) Find the area of the triangle ABC .

