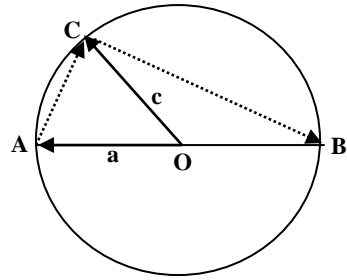


MATH 1300 ASSIGNMENT PROBLEMS (UNIT 1)

- [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 \mathbf{a} and the vector \overrightarrow{OC} by \mathbf{c} .



- (a) Write the vectors \overrightarrow{AC} and \overrightarrow{CB} as linear combinations of the vectors \mathbf{a} and \mathbf{c} .
- (b) Use vector methods to show that $\angle ACB$ is a right angle.
- [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} .
- [10] 3. Let $A = (-1, 2, 3)$ and $B = (1, 4, -3)$ 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 midpoint of the line segment AB .
- (c) The point $C = (k, 9, 4)$ is equidistant from the points A and B . Find the value(s) of k .
- (d) If $\overrightarrow{AX} = (-1, 2, 3)$, find the coordinates of the point X .
- [10] 4. Let $\mathbf{u} = (4, 2, 7)$ and $\mathbf{v} = (2, 1, k)$ 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] 5. 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] 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.

