MATH6040: Test 1 Sample

Name:

Answer all questions. Marks may be lost if necessary work is not clearly shown.

PLEASE READ ALL QUESTIONS CAREFULLY.

1. Given $\mathbf{T_1} = -2\mathbf{i} + 3\mathbf{j} + 6\mathbf{k}$ and $\mathbf{T_2} = 2\mathbf{i} + 4\mathbf{j} - 3\mathbf{k}$, determine
   (a) $\mathbf{T_1} + \mathbf{T_2}$,
   (b) $|\mathbf{T_1}|$,
   (c) the value for t for which $\mathbf{T_1}$ is perpendicular to $\mathbf{T_3}$, given that $\mathbf{T_3} = t\mathbf{i} + 2t\mathbf{j} - 3\mathbf{k}$.
2. Given $\mathbf{p} = -2\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$ and $\mathbf{q} = 6\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$, find
   (a) $\mathbf{p} - \mathbf{q}$,
   (b) $\mathbf{p} \cdot \mathbf{q}$.
3. Given $\mathbf{v} = 3\mathbf{i} + 2\mathbf{j} + 6\mathbf{k}$, find
   (i) Find the magnitude of $\mathbf{v}$.
   (ii) Find a unit vector in the same direction as $\mathbf{v}$.
4. A triangle ABC has vertices $A(4, -2, 0)$, $B(4, 1, 1)$ and $C(3, 0, 2)$.
   (i) Find the vectors **AB**, **BC** and **CA** and hence find their sum.
   (ii) Determine the lengths of the sides of the triangle.
   (iii) Determine the angle $\angle ABC$.
   (iv) Find the area of the triangle ABC.
5. Find a *unit* vector orthogonal to both $\mathbf{i} + \mathbf{j} + \mathbf{k}$ and $2\mathbf{i} + \mathbf{k}$.
6. A constant force with vector representation $\mathbf{F} = 10\mathbf{i} + 18\mathbf{j} - 6\mathbf{k}$ moves an object along a straight line from the point $(2, 3, 0)$ to the point $(4, 9, 15)$. Find the work done if the distance is measured in metres and the magnitude of the force is measured in Newtons.
7. A force of 12 units acts through the point $P(2, 3, -5)$ in the direction of the vector $4\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$. Find its moment about the point $A(1, 2, -3)$.