MAT 1201 – MATHEMATICAL METHODS I
Assignment 1

Instructions: Answer all the questions and submitt on or before 11th May, 2023

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1. If $\vec{a}$ and $\vec{b}$ are the vectors determined by two adjacent sides of a regular hexagon, what are the vectors determined by the other sides taken in order?

2. Calculate the modulus and the unite vector along the sums of vectors: $2\vec{i} + \vec{j} + 4\vec{k}, 3\vec{i} - 2\vec{j} + 7\vec{k}, 5\vec{i} + 2\vec{j} - 3\vec{k}$.

3. Show that the vectors $\vec{a} = 3\vec{i} - 2\vec{j} + \vec{k}$, $\vec{b} = \vec{i} - \vec{j} + 5\vec{k}$ and $\vec{c} = 2\vec{i} + 2\vec{j} - 4\vec{k}$ form a right-angled triangle.

4. If ABS is triangle and if P is any point on BS. Supposing $\overrightarrow{PQ}$ is the resultant of $\overrightarrow{AP}$, PB and $\overrightarrow{PC}$, show that $ABQC$ is a parallelogram.

5. Find a unite vector in the opposite direction of $\vec{a} = \vec{i} - 3\vec{j} + 10\vec{k}$.

6. Find a unite vector in the same direction as $\vec{a} = \vec{i} - 3\vec{j} + 2\vec{k}$.

7. Find a vector $\vec{b}$ that is four times as long as $= \vec{i} - \vec{j} + \vec{k}$.

8. Find a vector $\vec{b}$ for which $\left|\vec{b}\right| = \frac{1}{2}$ that is parallel to $\vec{a} = -6\vec{i} + 3\vec{j} - 2\vec{k}$ but has opposite direction.

9. If A, B, and C are the points whose position vectors are $2\vec{i} - \vec{j} + 5\vec{k}, \vec{i} - 2\vec{j} + \vec{k}$, and $3\vec{i} + \vec{j} - 2|veck$, respectively. L and M are midpoints f AC and CB. Show that LM is parallel to BA.

10. Find the angle that the vector $3\vec{i} - 2\vec{j}$ makes with x-axis.

11. A, B, C, and D are the points @$(0, 0, 2), (-1, 3, 2), (-3, -7,)$, and $(-1, 2 - 2)$, respectively. Find the vectors reprsenting $\overrightarrow{AB}, \overrightarrow{BD}, \overrightarrow{CD}, \overrightarrow{CD}$.

12. Find the coordinates of Q if $\left|\overrightarrow{OQ}\right| = 1$ and $\overrightarrow{OQ}$ is in the direction of $3\vec{i} + 2\vec{j} + 6\vec{k}$.

13. A vector $\vec{v}$ is inclined at equal acute angles to Ox, Oy, and Oz. If the magnitude of $\vec{v}$ is 6, find $\vec{v}$.

14. Find the direction cosines and direction angles of the vector $\vec{a} = 2\vec{i} + 5\vec{j} + 4\vec{k}$.

15. The velocity of a boat relative to water is represented by $3\vec{i} + 4\vec{j}$ and that of water relative to the eath is $\vec{i} - 3\vec{j}$. What is the velocity of the boat relative to the earth if $\vec{i}$ and $\vec{j}$ reepresent one kilometer an hour East and North, respectively?

16. Let $\vec{v_1} = \vec{i} + \vec{j} + \vec{k}, \vec{v_2} = \vec{i} + 2\vec{j} + 2\vec{k}$, and $\vec{v_3} = \vec{i} + \vec{j}$. Show that $\vec{v_1}, \vec{v_2}$ and $\vec{v_3}$ form a basis for $\mathbb{R}^3$.