MATH 2415 Calculus of Several Variables

Fall-2019

PLTL Packet# 1(Sec 12.1, 12.2, 12.3)

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1. Given point $P(-3, 4, -6)$ find the following.
   (a) the projection onto the coordinate planes: $xy,\ yz$ and $xz-$plane.
   (b) the distance from the coordinate planes: $xy,\ yz$ and $xz-$plane.
   (c) the distance from the coordinate axes: $x,\ y$ and $z-$axis.
   (d) the distance from origin.

2. Find the equation of the following spheres
   (a) center= $(-3, 4, -1)$ and radius $= 3$
   (b) center $= (-3, 4, -1)$ and through the point $(0, 3, 1)$
   (c) center $= (-3, 4, -1)$ and touches the $xz-$ plane.
   (d) one of the diameter has end points at $(0, 1, 3)$ and $(-6, 7, -5)$

3. Describe the intersection of each of the spheres in Q.N.#2 with each of the coordinate planes.

4. Show that the equation $3x^2 + 3y^2 + 3z^2 + 6x + 12z = 80$ represents a sphere. Find its center and radius.

5. Given vectors $\mathbf{a} = 4\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = 3\mathbf{i} - 2\mathbf{k}$, find
   (a) $\mathbf{a} + \mathbf{b}$
   (b) $3\mathbf{a} - 2\mathbf{b}$
   (c) $|\mathbf{a}|$
   (d) $|2\mathbf{a} - \mathbf{b}|$.
   (e) $\hat{\mathbf{a}}$, the unit vector in the direction of $\mathbf{a}$.
   (f) $\mathbf{u} =$ a vector with length 3 but is in opposite direction to $\mathbf{a}$.

6. Find $\mathbf{u} \cdot \mathbf{v}$
   (a) $\mathbf{u} = 4\mathbf{i} - 3\mathbf{j} + 2\mathbf{k},\ \mathbf{v} = 3\mathbf{i} - 2\mathbf{k}$
   (b) $|\mathbf{u}| = 5,\ |\mathbf{v}| = 2$ and the angle between $\mathbf{u}$ and $\mathbf{v}$ is $\frac{\pi}{3}$
   (c) $\mathbf{u} = \langle 2, -3,\ 5\rangle,\ \mathbf{v} = \langle -3,\ 5,\ 2\rangle$

7. Find the scalar and vector projections of $\mathbf{u}$ onto $\mathbf{v}$
   (a) $\mathbf{u} = 4\mathbf{i} - 3\mathbf{j} + 2\mathbf{k},\ \mathbf{v} = 3\mathbf{i} - 2\mathbf{k}$
   (b) $\mathbf{u} = \langle 2, -3,\ 5\rangle,\ \mathbf{v} = \langle -3,\ 5,\ 2\rangle$

8. Determine all real values of t so that angle between the vectors $\langle 3 - t,\ 5 + t,\ -8\rangle$ and $\langle -8,\ 3 - t,\ 5 + t\rangle$ is $\frac{2\pi}{3}$.