University of Hawai'i at Mānoa | Department of Mathematics
W. Erb | Spring 2018

Math 253A - Accelerated Calculus III

Homework sheet 1 **Due 01/19/2017**

To read: Section 11.1, 11.2 and 11.3 in the book.

Problem 1
A bird flies from its nest 8 km in the direction 60° north of east, where it stops to rest on a house. It then flies 10 km in the direction due southeast and lands atop a telephone pole. Place an xy-coordinate system so that the origin is the bird's nest, the x-axis points east and the y-axis points north.

a) At what point is the house located?

b) At what point is the telephone pole located?

c) Give the component form of the vector from the house to the telephone pole.

d) What is the distance from the bird's nest to the telephone pole?

Problem 2

a) Find the radius and the center of the sphere

$$2x^2 + 2y^2 + 2z^2 - 2x + 4z + 1 = 9.$$

b) Find the equation of a sphere if one of its diameters has endpoints $(2, 1, 4)$ and $(4, 3, 10)$.

c) Find the equation of the sphere with largest radius centered at $(1, 2, 3)$ that is contained in the first octant of $\mathbb{R}^3$ (i.e. $x, y, z \geq 0$).

d) Find a pair of equations for the intersection of the cone $z = 2x^2 + 2y^2$ with the cylinder $x^2 + y^2 = 3$. Describe the set of all intersection points.

Problem 3

a) Compute the distance between the points $P = (0, -1, 3)$ and $Q = (2, -2, 3)$.

b) Give the component form of the vectors $\overrightarrow{PQ}$ and $\overrightarrow{QP}$. Show that $\overrightarrow{PQ} = -\overrightarrow{QP}$.

c) Calculate the magnitudes of the vectors $\overrightarrow{PQ}$ and $-4\overrightarrow{QP} + \overrightarrow{PQ}$.

d) Find the components of the vector $3\vec{u} - 2\vec{v}$ for $\vec{u} = \langle -1, 0, -3\rangle$ and $\vec{v} = \langle 1, -1, 2\rangle$.

Problem 4

a) Show that the equation $\langle a_1, a_2\rangle \cdot \langle x - x_0, y - y_0\rangle = 0$, with a vector $\vec{a} = \langle a_1, a_2\rangle$ describes a line L through the point (x_0, y_0) in the xy-plane. What is the geometric significance of $\langle a_1, a_2\rangle$? Give the slope and the x- and y-intercepts of this line. Be careful about either a_1 or a_2 being zero.

b) Describe the set of points (x, y, z) in the three dimensional space that are equidistant from the origin $(0, 0, 0)$ and the point $(1, 0, 1)$. Give an equation for this set.