

Worksheet 14

Spring 2016

MATH 222, Week 14: Planes!

Name: _____

You aren't necessarily expected to finish the entire worksheet in discussion. There are a lot of problems to supplement your homework and general problem bank for studying.

Problem 1. Suppose that a merchant sells three types of goods in quantities q_1, q_2, q_3 and that the merchant sells these goods at prices p_1, p_2, p_3 dollars per unit respectively. Suppose further that it costs the merchant c_i dollars to make one unit of the i^{th} good. If

$$\vec{q} = \begin{pmatrix} q_1 \\ q_2 \\ q_3 \end{pmatrix} \quad \vec{p} = \begin{pmatrix} p_1 \\ p_2 \\ p_3 \end{pmatrix} \quad \vec{c} = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix}$$

What is the significance of the quantity $\vec{q} \cdot (\vec{p} - \vec{c})$? Describe in words why the merchant cares if this quantity is positive or negative?

Problem 2. Write down the equations for the following planes:

- (a) The plane normal to the vector $\langle -2, 4, 9 \rangle$ passing through the origin.
- (b) The plane normal to the vector $\langle 1, 5, 7 \rangle$ containing the point $(-2, 0, 4)$.
- (c) The plane containing the point $(3, 0, -4)$ and orthogonal to the line given by $\vec{r}(t) = (12 - t, 1 + 8t, 6 + 6t)$.
- (d) The plane containing the point $(-8, 3, 7)$ and parallel to the plane given by $4x + 8y - 2z = 45$

Problem 3. Determine if the two planes described are parallel, orthogonal or neither

- (a) The plane given by $4x - 9y - z = 2$ and the plane given by $x + 2y - 14z = -6$.
- (b) The plane given by $-3x + 2y + 7z = 9$ and the plane containing the points $(-2, 6, 1)$, $(-2, 5, 0)$ and $(-1, 4, -3)$.

Problem 4. Determine where the lines intersect the planes or show that it does not intersect the plane:

- (a) The line given by $\vec{r}(t) = (-2t, 2 + 7t, -1 - 4t)$ and the plane given by $4x + 9y - 2z = -8$.
- (b) The line given by $\vec{r}(t) = \langle 4 + t, -1 + 8t, 3 + 2t \rangle$ and the plane given by $2x - y + 3z = 15$.

HOW TO DO FINALS

DURING THE EXAM:

Draw pictures for your instructor.

1 llama
correlates to a
3% grade
increase.



Super cool llama IN SPACE
= INSTANT 4.3
(because that's how grades work)