

Name: _____

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Homework 1 MTG 3212

Spring 2010

1. (10 pts) (a) Show that if \mathbf{u} and \mathbf{v} are vectors in 3-space

$$\|\mathbf{u} \times \mathbf{v}\|^2 = \|\mathbf{u}\|^2\|\mathbf{v}\|^2 - (\langle \mathbf{u}, \mathbf{v} \rangle)^2 .$$

(b) From (a) deduce that

$$\|\mathbf{u} \times \mathbf{v}\| = \|\mathbf{u}\|\|\mathbf{v}\|\sin \alpha = \text{Area of parallelogram determined by } \mathbf{u} \text{ and } \mathbf{v},$$

where α is the angle between the vectors \mathbf{u} and \mathbf{v} .

2. (10 pts) Show, using vectors, that if $Ax + By + C = 0$ represents a line L in the plane \mathbf{R}^2 and if $P_0(x_0, y_0)$ is a point in \mathbf{R}^2 , then the distance between the point P_0 and the line L is given by the formula

$$d = \frac{|Ax_0 + By_0 + C|}{\sqrt{A^2 + B^2}} .$$

Note: This is Problem 2 from the Chapter 1 of your textbook (and it builds on Problem 1). It is also a part of Pb. 50, page 838, in the 8th edition of Anton's Calculus.