

Name:

MATH 335-002: Homework #1

Instructor: Travis Askham

askham@njit.edu

NJIT — January 23rd, 2019 (revised January 30, 2019)

Instructions

- This assignment is due in-class Thursday January 31st.
- Please put your full name in the upper right hand corner of each page of your solutions.
- Please show your work and be as neat as possible.
- Submitting typed/ LaTeX-based solutions is encouraged. The LaTeX source for this homework is available on the course website.
- Note that for the exercises from P.C. Matthews' "Vector Calculus" (Corrected Edition), the answers are in the back of the book but you are still expected to write out an answer here. For these problems, it is best to attempt the problem first and then check against the solution.

Outline

In this assignment, we aim to (1) become used to working with vectors, dot products, and cross products and (2) learn the use of these objects in describing geometrical objects (planes, lines, projections).

1 Exercises from Matthews

Please complete exercises 1.2, 1.3, 1.4, and 1.8 from the textbook (2 pts each)

- Exercise 1.2: if $\vec{a} = (2, 0, 3)$ and $\vec{b} = (1, 0, -1)$, find $|\vec{a}|$, $|\vec{b}|$, $\vec{a} + \vec{b}$, $\vec{a} - \vec{b}$, and $\vec{a} \cdot \vec{b}$. What is the angle between vectors \vec{a} and \vec{b} ?
- Exercise 1.3: if $\vec{u} = (1, 2, 2)$ and $\vec{v} = (-6, 2, 3)$. find the component of \vec{u} in the direction of \vec{v} and the component of \vec{v} in the direction of \vec{u} .
- Exercise 1.4: find the (implicit) equation of the plane that is perpendicular to the vector $(1, 1, -1)$ and that passes through the point $x = 1, y = 2, z = 1$.
- Exercise 1.8: Find the equation of the straight line which passes through the points $(1, 1, 1)$ and $(2, 3, 5)$ (a) in parametric form; (b) in cross-product form.

2 Other Exercises

Question 1 (5 pts)

Find an implicit equation for the plane containing both of the following lines

$$\vec{l}_1(t) = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} + t \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}, \quad \vec{l}_2(t) = \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix} + t \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}.$$

Name:

Question 2 (5 pts)

This question has been edited (mistake is crossed out). Answers to either question will be accepted but the corrected one is more interesting!

Find the line through ~~(0, 1, 0)~~ (0, 0, 1) that intersects and is perpendicular to the line

$$\vec{l}(t) = \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix} + t \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} .$$

Hint: The two lines lie in a plane. First, find the plane (in particular, the normal to the plane).

Question 3 (5 pts)

Find a parametric formula for the plane given by

$$r_1 + r_3 = 4$$