Exercise Sheet 3

Vectors II , Storrer 1 + 2

Hand in: Wednesday, **11.10.2017**, ahead of the lecture.

MUST

Exercise 1

a) Use the vectors

$$\overrightarrow{a} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix} \quad , \quad \overrightarrow{b} = \begin{pmatrix} 2 \\ 5 \\ -1 \end{pmatrix} \quad \text{and} \quad \overrightarrow{c} = \begin{pmatrix} -1 \\ 1 \\ 1 \end{pmatrix}$$

to verify the rules

1) $(\overrightarrow{a} + \overrightarrow{b}) \cdot \overrightarrow{c} = \overrightarrow{a} \cdot \overrightarrow{c} + \overrightarrow{b} \cdot \overrightarrow{c}$

2) $(\overrightarrow{a} + \overrightarrow{b}) \times \overrightarrow{c} = \overrightarrow{a} \times \overrightarrow{c} + \overrightarrow{b} \times \overrightarrow{c}$

3) $\overrightarrow{a} \times \overrightarrow{b} = -\overrightarrow{b} \times \overrightarrow{a}$

b) Set up the equation for the line passing through the points A(1/2/3) and B(2/5/9).

c) Set up the equation for the plane that contains the point A(1/5/9) and is normal to $\overrightarrow{n} = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$.

STANDARD

Exercise 2 (4 points)

a) (2 points) Compute the angle between the plane $E\colon\ -3x - 2y + z + 12 = 0$ and the line UV with $U(2/0/2)$ and $V(1/-1/5)$.

b) (2 points) Determine the intersection line of the planes $E\colon 9x + 6y + 3z = 12$ and $F\colon 2x + y + z = 2$.

Exercise 3 (5 points)

Let the vectors $\overrightarrow{v_1} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ and $\overrightarrow{v_2} = \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$.

a) (3 points) Write the vector $\overrightarrow{a} = \begin{pmatrix} 5 \\ 2 \\ 7 \end{pmatrix}$ as a linear combination of the vectors $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$.

b) (2 points) Write the vector $\overrightarrow{b} = \begin{pmatrix} 10 \\ -4 \\ 7 \end{pmatrix}$ as a linear combination of the vectors $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$.

Hint: A linear combination of $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$ is a vector of the form $\lambda_1 \cdot \overrightarrow{v_1} + \lambda_2 \cdot \overrightarrow{v_2}$

Exercise 4 (3 points)

Which points on the line $x = 8$ in the xy-plane have a distance of 10 to the point $P(0/7)$?

HONOURS

Exercise 5 (3 points)

Show that the angle bisectors of two intersecting lines with arbitrary direction vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are perpendicular.