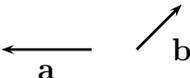


Mth 33, Homework 3 on sections 12.2 – 12.5

Due by Mon, Feb 23.

Please use lots of space and explain your answers, showing clearly any work you had to do. Each question is worth 3 points.

Section 12.2 Vectors

(1) For these vectors  just use this picture to draw

- (a) $a + b$
- (b) $3b$
- (c) $-a$
- (d) $a - b$

(2) For the points $P(-1, 1)$ and $Q(2, -1)$ in the xy -plane, draw the vector $\mathbf{v} = \overrightarrow{PQ}$ and give the components of \mathbf{v} .

(3) If $\mathbf{a} = \langle 3, 4, 5 \rangle$ and $\mathbf{b} = \langle 0, 1, -2 \rangle$ then give the components of $2\mathbf{a} - 5\mathbf{b}$.

(4) Let \mathbf{v} be the vector $-2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$.

- (a) Find $|\mathbf{v}|$
- (b) Find the unit vector that has the same direction as \mathbf{v} .

Section 12.3 The Dot Product

(5) For $\mathbf{a} = \langle 3, 4, 5 \rangle$ and $\mathbf{b} = \langle 0, 1, -2 \rangle$

- (a) Find the dot product $\mathbf{a} \cdot \mathbf{b}$
- (b) Find the angle θ between \mathbf{a} and \mathbf{b} to the nearest degree.

(6) Are these vectors $\mathbf{u} = \langle -5, 4, -2 \rangle$ and $\mathbf{v} = \langle 3, 4, -1 \rangle$ orthogonal, parallel or neither?

(7) Compute the direction cosines and the direction angles for $\langle -6, 2, 9 \rangle$

Section 12.4 The Cross Product

(8) For $\mathbf{u} = \langle 3, 2, 1 \rangle$ and $\mathbf{v} = \langle 2, 0, -1 \rangle$

- (a) Find the cross product $\mathbf{w} = \mathbf{u} \times \mathbf{v}$
(b) Then compute the dot products $\mathbf{u} \cdot \mathbf{w}$ and $\mathbf{v} \cdot \mathbf{w}$.
(c) What does part (b) confirm?
- (9) For the same $\mathbf{u} = \langle 3, 2, 1 \rangle$ and $\mathbf{v} = \langle 2, 0, -1 \rangle$ as in the last question, find $\mathbf{v} \times \mathbf{u}$
- (10) Find a vector that is orthogonal to both $\mathbf{j} - \mathbf{k}$ and $\mathbf{i} + \mathbf{j}$
- (11) Find the area of the triangle that has vertices $P(-2, 0, 4)$, $Q(1, 3, -2)$ and $R(0, 3, 5)$
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Section 12.5 Equations of Lines and Planes

- (12) For the line going through the points $P(4, 1, 2)$ and $Q(1, 0, 3)$:
- (a) Give its vector equation.
(b) Give its parametric equation.
(c) Give its symmetric equation.

- (13) Find the equation of the plane that contains the three points

$$P(1, 0, 0), \quad Q(0, 2, 0), \quad R(0, 0, 3).$$

Give your answer in the form $ax + by + cz + d = 0$.

- (14) Locate the point where the parametric line

$$x = 2 - 2t, \quad y = 3t + 1, \quad z = t - 3$$

meets the plane $x - y + 2z - 4 = 0$.

- (15) Find the acute angle between the planes $x + y + z - 3 = 0$ and $x - y - z + 3 = 0$.
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If you are stuck on a question:

- Ask me about it after class.
- Come to my office hours: Mon 4:30 - 5:30, Wed 4:30 - 5:30 in CP 317.
- Go to the Math Tutorial Lab in person in CP 303 or online.