2019–20 **MATH117 Mathematics for Architecture – Homework 3** N. Course

DEADLINE: Friday 25 October 2019, 4:50pm

Exercise 11 (Three Dimensional Cartesian Coordinates). Find the centre and the radius of the sphere

$$3x^2 + 3y^2 + 3z^2 + 2y - 2z = 9.$$

Exercise 12 (Vectors).

(a) Find $(5\mathbf{a} - 3\mathbf{b})$ if $\mathbf{a} = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $\mathbf{b} = 3\mathbf{i} + 5\mathbf{k}$.

(b) Find a unit vector which points in the same direction as $\mathbf{v} = 9\mathbf{i} - 2\mathbf{j} + 6\mathbf{k}$.

Exercise 13 (The Dot Product and the Cross Product). Let $\mathbf{u}$, $\mathbf{v}$ and $\mathbf{w}$ be vectors. Which of the following make sense? Give reasons for your answers. The first one is done for you.

(ω) $3 \cdot \mathbf{u}$ *Solution:* This does not make sense because 3 is a number, not a vector. We can only calculate $\mathbf{a} \cdot \mathbf{b}$ if both $\mathbf{a}$ and $\mathbf{b}$ are vectors.

(a) $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$

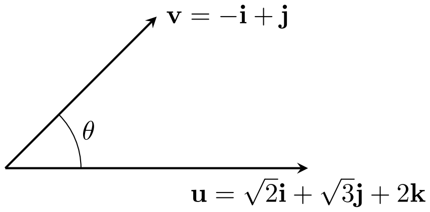
(b) $\mathbf{u} \times (\mathbf{v} \cdot \mathbf{w})$

(c) $\mathbf{u} \times (\mathbf{v} \times \mathbf{w})$

(d) $\mathbf{u} \cdot (\mathbf{v} \cdot \mathbf{w})$

Solutions to homework 1 are now available at `www.neilcourse.co.uk/math117.html`

Exercise 14 (The Dot Product). Let $\mathbf{u} = \sqrt{2}\mathbf{i} + \sqrt{3}\mathbf{j} + 2\mathbf{k}$ and $\mathbf{v} = -\mathbf{i} + \mathbf{j}$. Let θ denote the angle between $\mathbf{u}$ and $\mathbf{v}$.

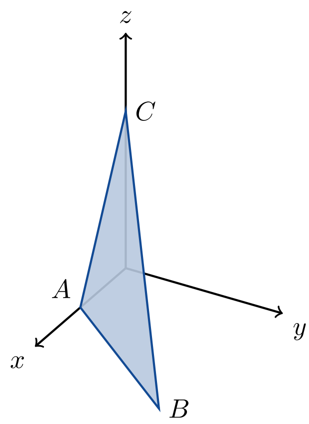


(a) Find $\mathbf{v} \bullet \mathbf{u}$.

(b) Find $\cos\theta$.

(c) Find $\operatorname{proj}_{\mathbf{v}} \mathbf{u}$.

Exercise 15 (The Cross Product). Find the area of the triangle with vertices at $A(1, 0, 0)$, $B(1, 1, -1)$ and $C(0, 0, 2)$.



I declare that this assignment is entirely my own work. I did not copy from another student and I did not allow anyone to copy from me. *Bu ödevin tamamen kendi çalışmamın ürünü olduğunu, başka bir öğrencinin ödevini kopyalamadığımı; başkasının da benim çalışmamı kopyalamasına izin vermediğimi beyan ederim.*

SIGNATURE: