## EE112 – Engineering Mathematics II

## Problem Set 4

Due by 5pm on Monday, 5 March 2018

1. The following three vectors are all in $\mathbb{R}^2$:

$$\vec{A} = 3\hat{\imath} - 2\hat{\jmath}, \quad \vec{B} = -3\hat{\imath} + 4\hat{\jmath}, \quad \vec{C} = 5\hat{\imath}$$

Sketch and label all three of these vectors on the appended coordinate grid (and submit it with the rest of this Problem Set) such that the foot of $\vec{A}$ is at the origin, the foot of $\vec{B}$ is at the point $(-1, 1)$ and the head of $\vec{C}$ is at the point $(2, 0)$.

2. For the three vectors in Problem 1, compute the following:

   (a) $\vec{A} + \vec{B}$, $-\vec{A} - \vec{B} + 3\vec{C}$ and $-12\vec{B}$;

   (b) The magnitude and direction angle (relative to the positive $x$-axis, as usual) of $-\vec{C} - \vec{A}$;

   (c) The dot product $-2\vec{B} \cdot \vec{A}$;

   (d) The angle between $\vec{A}$ and $\vec{C}$.

3. Consider the following $\mathbb{R}^3$ vector:

$$\vec{u} \;\; = \;\; -\hat{\imath} + 7\hat{\jmath} - 2\hat{k}.$$

   (a) Find the magnitude of $\vec{u}$.

   (b) Determine the angles $\vec{u}$ makes with the positive $x$-axis, the positive $y$-axis and the positive $z$-axis when its foot is at the origin.

   (c) Find the value of $\alpha$ such that the vector

$$\vec{w} \;\; = \;\; \hat{\imath} + \alpha\hat{\jmath} - 2\hat{k}$$

   is perpendicular to $\vec{u}$.

   (d) Compute $\vec{u} \times \hat{\jmath}$.