COMP2208
Math problem sheet 3

1 OVERVIEW

The key points of this problem-sheet are:

- This problem-sheet counts for 5% of this module.

- The questions in this problem-sheet are in multiple-choice format. For each question, select the solution from the choices given.

- The deadline[1] for submission of your solutions: **20th Nov. 2020 by 4pm.**

- Summative feedback will be given within 2 weeks after the deadline.

- Learning Outcome: Test your knowledge on vectors.

For submission instructions, please see Section 3 at the end of this document.

2 PROBLEMS

QUESTION 1   (1 point). Consider the vectors $\vec{x} = (1, 2, 3)$, $\vec{y} = (2, 3, 1)$ and $\vec{z} = (1, -1, 0)$. Calculate the length of the vector $\vec{u} = \alpha\vec{x} + \beta\vec{y} + \gamma\vec{z}$ where $\alpha = 2$, $\beta = 3$ and $\gamma = -1$.

    a 17.69

    b 18.91

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[1]Solutions submitted after the deadline will not be accepted.

c 16.23

d 18.06

QUESTION 2   (1 point). As discussed in the lecture, a plane can be defined by a set of all points $\vec{x} = (x, y, z)$ for which $E(\vec{x}) = 0$ with $E(\vec{x})$ given by the following equation:

$$E(\vec{x}) = n_1(x - x_0) + n_2(y - y_0) + n_3(z - z_0)$$

Now consider a plane that is parallel to the vectors $\vec{r}_1 = (3, 1, 1)$ and $\vec{r}_2 = (2, 3, 1)$, and which include the point $(0, 1, 0)$. What is the distance of the point $(1, 1, 3)$ from this plane?

a 1.87

b 2.59

c 2.08

d 3.21

QUESTION 3   (1 point). In the standard basis $\vec{e}_1 = (1, 0, 0)$, $\vec{e}_2 = (0, 1, 0)$, $\vec{e}_3 = (0, 0, 1)$ one vector is given by $\vec{x} = (2, 1, 2)$. Find the coordinates of this vector in the basis $\{(1, 2, 3), (2, 3, 1), (3, 0, 1)\}$.

a $(0.5, 0, 0.5)$

b $(0.75, 0, 0.25)$

c $(0.25, 0.5, 0.75)$

d $(0.5, 0.25, 0.75)$

QUESTION 4   (1 point). Consider the vectors $\vec{a} = (2, 6, -1)$ and $\vec{b} = (3, 4, 7)$. Find the vector perpendicular to $\vec{a}$ and $\vec{b}$. What is the magnitude of this vector?

a 48.09

b 52.76

c 50.05

d 51.23

QUESTION 5 (1 point). Consider a linear map $\vec{v} = T(\vec{u})$ that rotates the vector $\vec{u}$ by 72°
counter-clockwise. Determine $\vec{v}$ for $\vec{u} = (3, 2)$.

a $(-0.7, 3.25)$

b $(-0.99, 3.47)$

c $(-1.3, 2.76)$

d $(-0.5, 3.21)$

3 Submission Instructions

Submit your work using the ECS electronic hand-in system. The submission is to be made by
4pm on the due date listed above. Please submit a single file to the ECS electronic hand-in
system as detailed below:

- Your submission file must be named as **comp2208-ps3.txt**.

- Your submitted file must be in a **plain ASCII text file format**.

- You can use Notepad (Windows operating system users) or vim, emacs etc. (Linux
  users) to create the file.

- Each line of the submitted text file should only contain the question number, followed
  by a single space, and the selected solution for that question.

- Example, if a, b, c, d and a are the solutions you have selected for Questions 1, 2, 3, 4
  and 5, respectively, your submitted file should have the following:
  1   a
  2   b
  3   c
  4   d
  5   a

- So, a problem sheet with five questions will have five lines of text.

- Make sure the questions are answered in ascending order in your text file.

- Failure to follow these instructions will incur a penalty.