

2 October, 2015  
MATH 1104, Section D  
Total Marks: 46

### TEST 1

1. Simplify the following into the form  $a + bi$  [6 marks]:

$$\frac{3 - 2i}{2 + i} - \frac{1 + i}{1 - i}$$

2. Find the complex roots of the polynomial  $x^2 + 4x + 5 = 0$  [3 marks].  
3. Solve for the **complex value**,  $z$  [5 marks]:

$$iz - (2 + i)^2 = 2 + i$$

4. Consider the following 3 vectors and use them to answer the following [2 marks each]:

$$\vec{u} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}, \vec{x} = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix}, \vec{t} = \begin{pmatrix} -2 \\ 0 \\ 1 \end{pmatrix}$$

- (a) Determine the **cosine** of the angle between  $\vec{u}$  and  $\vec{t}$ .  
(b) Find the angle between  $\vec{x}$  and  $\vec{t}$ . Give your answer in **radians**.  
(c) Evaluate  $\vec{u} - \vec{x}$ .  
(d) Evaluate  $|3\vec{u} + 2\vec{x} + \vec{t}|$ .  
(e) Find the projection of  $\vec{u}$  onto  $\vec{x}$ .  
(f) Normalize  $\vec{u}$ .  
(g) Find the unit vector that points in the **opposite** direction of  $\vec{t}$ .
5. Use the matrices given below to perform the required matrix operations [3 marks each].

$$A = \begin{bmatrix} 1 & 0 & 1 \\ -1 & 2 & 4 \end{bmatrix}, B = \begin{bmatrix} 2 & -2 \\ 1 & 5 \end{bmatrix}, C = \begin{bmatrix} 2 & 6 \\ 10 & -1 \\ 1 & 2 \end{bmatrix}, D = \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}$$

- (a) Evaluate  $A^T + 2C$ .  
(b) Evaluate  $B - 2I$ .  
(c) Evaluate  $C + D$ .  
(d) Evaluate  $AC$ .  
(e) Evaluate  $C^T D$ .  
(f) Evaluate  $B^2$ .