30 Sept, 2011
Math 1104, Section B

TEST 1

1. For this question let $z = 4 - 3i$ [6 marks].
   (a) What is the **complex conjugate** of z?
   (b) Evaluate $|z|$.
   (c) Simplify $\frac{1}{z}$ into the form $a + bi$.

2. Consider the following vectors to answer the following questions [20 marks]:

$$\vec{u} = \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix}, \vec{v} = \begin{pmatrix} -1 \\ 3 \\ 1 \end{pmatrix}, \vec{w} = \begin{pmatrix} 2 \\ -2 \\ 4 \end{pmatrix}$$

   (a) **Normalize** $\vec{u}$.
   (b) Find the unit vector which has the **opposite** direction of $\vec{u}$.
   (c) Evaluate $(\vec{u} \times \vec{v}) \bullet \vec{w}$
   (d) Evaluate $(\vec{v} \times \vec{v}) \bullet \vec{u}$
   (e) Evaluate $(\vec{w} \bullet \vec{v}) \times \vec{w}$
   (f) What is the angle between $\vec{v}$ and $\vec{w}$? Give your answer in **degrees**.
   (g) Are $\vec{u}$ and $\vec{v}$ **orthogonal**? Justify your answer.
   (h) Evaluate $3\vec{u} - \vec{v} - \frac{1}{2}\vec{w}$

3. Use the matrices given below to perform the required matrix operations [14 marks].

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

   (a) Evaluate $A^T + 2C$.
   (b) Evaluate $B + D$.
   (c) Evaluate AC.
   (d) Evaluate $C^T D$.
   (e) Is B **symmetric**? Justify your answer.