Sultan Qaboos University
Department of Mathematics and Statistics

Math3110 | Fall 2014
Test I | Time: 60 minutes

Name:. . . . . Section: . . . . . Number. . . . .

Important Instructions

- Write your name, ID # and Section # on the front cover of your answer booklet.
- You need to show your complete, mathematically correct and neatly written solution.
- You are NOT allowed to share calculators or any other material during the test.
- Cellular phones are NOT allowed to be used for any purpose during the test.
- You should NOT ask the invigilator questions about the exam.
- You need to solve questions **Q1** through **Q7**.

Q1: *(3 + 2 points)*

(a) Find a vector of magnitude 4 that is orthogonal to $V =< 3, 0, 4 >$.

(b) Given $U =< 0, -3, 4 >$ and $V =< 2, 0, -2 >$. Find $Comp_U(V)$.

Q2: *(3 + 4 points)*

(a) Are the vectors $V =< 1, -3, 1 >$, $U =< 2, -1, 0 >$ and $W =< 0, -5, 2 >$ coplanar (belong to the same plane)? Justify your answer.

(b) Find an equation of the plane containing the point $(3, -2, 1)$ and parallel to the plane $x + 3y - 4z = 2$.

Q3: For any three vectors U, V_1 and V_2 in space, show that *(4 points)*

$$Proj_U(V_1 + V_2) = Proj_U(V_1) + Proj_U(V_2).$$

Q4: Identify the graph (NO need to sketch) of each of the following in space *(6 points)*
(i) $x^2 + y^2 = 4$ (ii) $x - y = 1$ (iii) $3x^2 + 4y^2 + 5z^2 = 10$.

Q5: (a) Evaluate *(3 + 4 points)*

$$\lim_{t\to\infty} < te^{-t}, \frac{t^3 + t}{2t^3 - 1}, t\sin\left(\frac{1}{t}\right) > .$$

(b) Find the antiderivative of $r'(t) =< \cos(t), e^{-t}, \sqrt{t} >$ satisfying the initial condition $r(0) =< 1, 2, 3 >$.

Q6: *(3 + 4 points)*

(a) Find a parametric representation of the elliptic paraboloid $z = x^2 + 4y^2$.

(b) At what points does the curve of $r(t) =< t, 0, 2t - t^2 >$ intersect the paraboloid $z = x^2 + y^2$?

Q7: Let $r(t)$ be a differentiable vector valued function. Is it true that *(4 points)*

$$\frac{d}{dt}\|r(t)\| = \|r'(t)\|?$$

Justify your answer.

Best Wishes | Total: 40 points