Second Mid Term Exam., Summer, 1435
Department of Mathematics
College of Sciences
King Saud University
Math: 107 Full Marks: 25 Time: **90 Min.**

Question 1. [Mark: 2+2+2=6]
(a) Find the scalar c so that the vector $< 2, 1, c >$ is orthogonal to the sum of the vectors $< 1, -1, 2 >$ and $< 3, 2, 1 >$.
(b) Find the direction cosines and direction angles of the vector $\mathbf{a} = 3\mathbf{i} + 2\mathbf{j} + 5\mathbf{k}$.
(c) Find the work done by a constant force $\mathbf{F} =< -5, 3, 1 >$ which moves an object along a straight line from the point $P(3, -4, 5)$ to $Q(1, 3, 6)$.

Question 2. [Marks: 4+3=7]
(a) Determine whether the lines $l_1 : x = 1 - 6t, y = 3 + 2t, z = 4 - 2t$; $l_2 : x = 2 + 2v, y = 6 + v, z = 5 + v$ are parallel or intersecting. If they intersect, find the point of intersection.
(b) Find the equation of the plane determined by the points $P(2, 2, 1)$, $Q(3, 1, 5)$ and $R(3, 3, 4)$.

Question 3. [Mark: 2+1=3]
(a) Identify the surface $4x^2 + 2y^2 - z^2 = 16$, and sketch the graph.
(b) If $\mathbf{r}(t) = (2 - 3t)\mathbf{i} + \sqrt{2 - t}\mathbf{j} + t^2\mathbf{k}$ is a vector valued function, then determine the domain $D_{\mathbf{r}}$ of $\mathbf{r}$.

Question 4. [Mark: 3]
Find the path of the curve when acceleration of the particle moving along this curve is $\mathbf{a}(t) = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$, the initial velocity of the particle is $\mathbf{v}(0) = \mathbf{i} + \mathbf{j}$, and $\mathbf{r}(0) = 2\mathbf{k}$.

Question 5. [Mark: 3+3=6]
(a) Find the radius and radius of curvature for the curve $y = x^3 + 2$ at $P(1, 3)$.
(b) Find the normal component of acceleration of a particle moving along the curve $C : \mathbf{r}(t) = 3t\mathbf{i} + t^2\mathbf{j} + t\mathbf{k}$, when $t = 2$.