

TIME: 90 min
M - 107

KING SAUD UNIVERSITY
DEPARTMENT OF MATHEMATICS
Special MID TERM EXAM (SEM II) 1433-1434

FULL MARKS: 50

NOTE: Attempt all Questions.

Question: 1 (a) Let $a = \langle 3, 2, -1 \rangle$ and $b = \langle -1, 0, 4 \rangle$ be two vectors in space [5+5]
and $\alpha \in [0, \pi]$ be the angle between vectors a and b ,

- use dot product to find $\cos \alpha$
- use cross product to find $\sin \alpha$
- find a unit normal vector orthogonal to both vectors a and b

(b) For the given points in the space $P(2, 0, 1)$, $Q(-1, 2, 0)$, $R(0, 1, 2)$ and $S(1, 0, 1)$, find the volume of the parallelepiped with edges PQ , PR , and PS

Question: 2 (a) Find the scalar m so that the vector $\langle 4, 2, m \rangle$ is perpendicular to the sum of the vectors $\langle 1, -1, 2 \rangle$ and $\langle 2, 3, 4 \rangle$. [5+5]

(b) Determine whether the lines are parallel or intersect. If they intersect find their point

of intersection: $l_1 : x = 3 + t, y = 2 - 2t, z = 1 + 2t$
 $l_2 : x = 5 + 2v, y = 3 + 2v, z = -1 + 3v$

Question: 3 (a) Find the line of intersection of the planes $x - y + z - 10 = 0$, [6+6]
and $2x - 3y + z - 8 = 0$.

(b) Identify the surface $4x^2 + y^2 - 9z^2 - 36 = 0$.
Find its traces on the coordinate planes and then sketch the surface.

Question: 4 (a) If the motion of a point moving along the curve is given by [6+6+6]
 $v(t) = e^t(\cos t i + \sin t j + k)$,

find the velocity, acceleration and speed at time $t = \frac{\pi}{2}$

(b) Find the radius and center of curvature of the curve $y = x^5 + 3$ at point $P(1, 4)$

(c) Let $r(t) = (3t+1)i + t^2j + t^3k$ be the position vector of moving point P ,
determine tangential and normal components of acceleration and curvature
at the point $(4, 1, 1)$.