

TIME: 90 min  
M - 107

KING SAUD UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
II MID TERM EXAM

FULL MARKS: 40

NOTE: Attempt all Questions.

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Question: 1.(a) Find a unit vector perpendicular to the plane determined by  $A(1, -1, 0)$ ,  $B(2,1,-1)$ , and  $C(-1,1,2)$ , also find area of the triangle ABC. [6+5]

(b) Find the volume of the parallelepiped determined by the vectors  $a = \langle 1, 2, -1 \rangle$ ,  $b = \langle -2, 0, 3 \rangle$  and  $c = \langle 0, 7, -4 \rangle$ .

Question: 2.(a) Check whether lines  $x = -4 - 3t$ ,  $y = 5 + t$ ,  $z = -1 - t$  and

[7+7]  $x = 4 + 5v$ ,  $y = 7 + \frac{v}{2}$ ,  $z = 3 + \frac{v}{2}$  intersect, if they intersect find the point of intersection.

(b) If the line  $\frac{x}{3} = \frac{y}{5} = \frac{z}{2}$  is perpendicular to a plane which contains the line  $x = 1 + 2t$ ,  $y = 3t$ ,  $z = 2 - t$ , find the equation of that plane.

Question: 3(a). Identify the surface  $x^2 - 4y^2 - z^2 = 0$ . Find its traces on the coordinate planes [5+5+5] and then sketch the surface.

(b) The position vector of a point P is moving in xyz-plane is

$$r(t) = (\cos t)i + (\sin t)j + t k,$$

i. Find the velocity of P at time t

ii. Find the equation of tangent line to the curve at  $t = \frac{\pi}{2}$ ,

(c) Find the curvature of the curve  $y = x^3$  point P(1,1)