

Question: 1. (a) Find the distance of the point R (1, 1, 1) to the line through P(0,0,0) and Q(1,2,3) . [6+6+5]

(b) For the given points in the space

$$A(2, 0, 3), B(3, -1, 6), C(4,-3,5) \text{ and } D(5,-4,4)$$

find the volume of the box with edges AB, AC and AD

(c) A constant force of magnitude 5 pounds has the same direction as the vector $a = i - j$. If the distance is measured in feet, find the work done if the point of application moves along the x - axis from P(0, 1, 2) to (3, 1, 2).

Question: 2 . (a) Determine whether the lines [5+5+5]

$$x = 2 + t, \quad y = -1 + 2t, \quad z = 3 + 3t \text{ and}$$

$$x = 5 + 3v, \quad y = 1 + 2v, \quad z = 4 + v$$

intersect, and if so, find the point of intersection.

(b) Find the equation of the plane P_2 that passes through the point Q(2, -1, 2) and parallel to plane $P_1 : 3x - y - z = 2$.

Also find the distance between these planes.

(c) Identify the surface $2x^2 - 4y^2 + z^2 = -1$. Find its traces on the coordinate planes and then sketch the surface.

Question: 3. (a) Let C be the curve determined by the vector valued function [6+6+6]

$$r(t) = (t \cos t)i + \sqrt{1 + 4t}j + (3t + 1)k .$$

Find the parametric equation of tangent line to curve C at the point P (0,1,1).

(b) Find the Unit Tangent vector and Principal Normal vector of the curve C determined by the parametric equations

$$x = 1 + \sin 2t, \quad y = 1 - \cos 2t, \quad z = 2t .$$

(c) Find the curvature for the curve $y = e^{2x}$ at the point P (0,1) .