Question: 1. (a) Find the plane containing the points P(1, 1, 3), Q (1, -1, 2) and R(-1, 3, 2).

[6+6+6]   (b) Find the volume of the parallelepiped having adjacent sides AB, AC and AD,

where $A(0, 0, 0)$, $B(1,2,3)$, $C(3,2,1)$ and $D(1,-2,1)$.

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

Question: 2 . (a) If the acceleration of a moving particle is given by $a(t) = i + 2j + 6tk$,

[8+8]   find the object's velocity and position given that the initial velocity is $v(0) = j - k$

and the initial position is $r(0) = i - 2j + 3k$.

(b) Find the projection of $a = 4j + k$ onto $b = 2i + 2j + k$. Also, find $\left\| \text{Proj}_b^a \right\|$

And show that $c = a - \text{Proj}_b^a$ is orthogonal to b .

Question: 3. (a) If the position vector of an object is $r(t) = \left(\tfrac{1}{2}t^2 + 1\right)i + \left(t^2 + t\right)j + \left(t^3 - t\right)k$,

[8+8]   find the tangential and normal components of acceleration, and the curvature of the curve C .

(b) Let C be the curve determined by the vector valued function

$$r(t) = t^2 i + 2\sin tj + 2\cos tk .$$

Find the parametric equations of tangent line to curve C at the point $t = \dfrac{\pi}{3}$.

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