1. a) Does the sequence converge: $\left\{\sqrt{(4n^2-n)}-2n\right\}$, $n=1,2,\ldots$? Why?

   b) Explain what is meant by the convergence of the series $\sum_{n=1}^{\infty} a_n$?

   c) Does the series $\sum_{n=1}^{\infty} \frac{1}{\sqrt{5^{2n}+n}}$ converge? Why?

2. Let $\mathbf{n} = 2\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ be a normal vector to the plane, and the point $P_0 = (1, 2, -1)$ belongs to the plane. Derive with explanations the equation of the plane (in the standard form). Draw also a picture to explain your derivations.

3. Let

$$\begin{cases} x = 1 + t \\ y = t \\ z = 2 - t \end{cases} \qquad t \in \mathbf{R}$$

and

$$\begin{cases} x = -1 + 2t \\ y = 1 + t \\ z = t \end{cases} \qquad t \in \mathbf{R}\,.$$

be lines in the 3-D space. Find a vector that is perpendicular to both the lines. Find a scalar projection of the vector $2\mathbf{i} - \mathbf{j} + \mathbf{k}$ on this vector.

4. a) Calculate the arc-length of the curve

$$\mathbf{r}(t) = 2\cos(cs)\mathbf{i} + cs\mathbf{j} + 2\sin(cs)\mathbf{k},$$

   when $0 \le t \le T$. How c should be chosen to have the arc-length parametrization?

   b) Consider the curve in *a*), and let c be chosen so that we have the arc-length parametrization. Calculate tangent and normal vectors $\hat{\mathbf{T}}$, $\hat{\mathbf{N}}$ as well as the radius of curvature.

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