

MA1012: Problem Sheet 1

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1. Prove that every convergent sequence in \mathbb{R}^3 is bounded.
2. Prove that every bounded sequence in \mathbb{R}^2 has a convergent subsequence.
3. Find a parametric equation of the line of intersection of $x - 2y = 3$ and $2y + z = 5$.
4. Find the parametric representation of the circle of radius 3 centered at $(1, 0, 2)$ and parallel to the yz -plane.
5. Reparametrize the curve $R(t) = (2 + t, 3 - t, 5t)$ where $t \geq 0$ in terms of the arc length.
6. Show that $R''(t) = T' \frac{ds}{dt} + T \frac{d^2s}{dt^2}$, where T is the unit tangent vector of the curve given by $R(t)$.
7. Find the unit tangent vector, principal normal and the curvature for the curve $R(t) = (\sqrt{2} \cos t, \sin t, \sin t)$ where $t \in \mathbb{R}$.
8. For which point is the curvature maximum for the curve $y = \ln x$, $x > 0$?