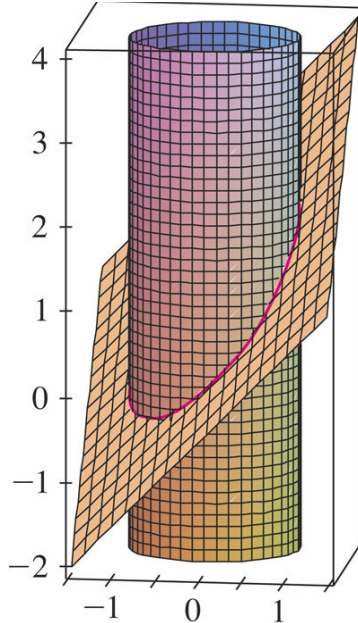# ASE-4040 Exercise Set 5 (Nonlinear optimisation)

Problem 1

Consider the problem of minimising $x_1 + 2x_2 + 3x_3$ on the intersection of the plane $x_1 - x_2 + x_3 - 1 = 0$ and the cylinder $x_1^2 + x_2^2 - 1 = 0$.

Verify that $x = (\frac{2}{\sqrt{29}}, -\frac{5}{\sqrt{29}}, 1 - \frac{7}{\sqrt{29}})$ is a feasible point and satisfies the first-order conditions (i.e. the Lagrange multiplier equations) of an optimiser.

Problem 2

Find the smallest sphere that contains the points whose coordinates are

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 0.3423   -0.4614   -0.7857   -0.8973    0.4951
 1.1052    1.3299   -1.6986   -1.5359    0.2815
-1.2265   -1.7246    0.8027    0.2764   -0.1611
```

Which points are on the sphere boundary?

Answers   1. $\lambda_1 = -3$, $\lambda_2 = \frac{\sqrt{29}}{2}$ 2. Centre $(-0.6235, -0.1843, -0.4609)$, radius 1.9789, points 2 and 3