

You must justify your answers to receive full credit.

You may use any (correct) method on the extremisation problems, regardless of which section the questions come from.

- 13.2 Q1, 9
- 13.2 Q10 (Hint: the region is unbounded, so you need to use inequalities to justify that the points you find are the maximum and minimum.)
- 13.3 Q6 (You may assume that a shortest distance exists. Hint: minimising the distance function is the same as minimising the distance-squared function, and the algebra is easier if you let the objective function be the distance-squared.)
- 13.3 Q21 (You may assume that this minimum exists.)

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1. to be added later

2. Find the maximum and minimum values of $f(x, y, z) = 2xy^2 + z$ over the closed region bounded by the paraboloid $z = 1 - x^2 - y^2$ and the plane $z = 0$. (Hint: the region has 3 boundary pieces, compare with the half-ball in p7 of week 11 notes. The 1D boundary piece can be parametrised by $(x, y, z) = (\cos t, \sin t, 0)$. I think there are 10 candidate extrema in total.)

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