

Q1

- (a) We can see that the surface S , is defined implicitly $f(x, y, z) = 0$ where $f : \mathbb{R}^3 \rightarrow \mathbb{R}$ is continuously differentiable (as it is a polynomial). Thus, we can see that as $(a, b, c) = (1, 2, 1)$ is a surface point, the tangent plane is given by:

$$\begin{aligned} 0 &= \frac{\partial f}{\partial x}(a, b, c)(x - a) + \frac{\partial f}{\partial y}(a, b, c)(y - b) + \frac{\partial f}{\partial z}(a, b, c)(z - c) \\ &= 2a(x - a) + 4b(y - b) - 10c(z - c) \\ &= 2(x - 1) + 8(y - 2) - 10(z - 1) \\ &= 2x - 2 + 8y - 16 - 10z + 10 \\ &= 2x + 8y - 10z - 8 \end{aligned}$$

- (b) **MATLAB**

- (c) We are considering a surface defined by a function $f(x, y, z) = 0$,

Q3

- (a) A
- (b) The mass of the wire will be given by:

$$m = \int_0^{\frac{\pi}{2}} \rho(r(t)) dt$$