MAT273 **3D Space**
12.1

1. Determine the distance between the points $(1, -3, 4)$ and $(5, 8, 1)$ and the midpoint between them.

2. Determine the equation, center and radius of the sphere given by the equation $x^2 + y^2 + z^2 + 3x - 4z + 1 = 0$.

Answers:

1. The distance is $\sqrt{(5-1)^2+(8+3)^2+(1-4)^2} = \sqrt{4^2+11^2+(-3)^2} = \sqrt{146}$ and the midpoint is $\left(\frac{5+1}{2}, \frac{8+(-3)}{2}, \frac{1+4}{2}\right) = \left(3, \frac{5}{2}, \frac{5}{2}\right)$.
2. Use completing the square to get the equation $\left(x+\frac{3}{2}\right)^2 + y^2 + (z-2)^2 = \frac{21}{4}$, which is a sphere with center $\left(-\frac{3}{2}, 0, 2\right)$ and radius $\frac{\sqrt{21}}{2}$.