Solutions: quiz 1, discussion section 10am

Math 226, Fall 2019, Prof. Mazel-Gee

1. Writing $\mathbf{d}$ for the displacement vector, work is given by $W = \mathbf{F} \bullet \mathbf{d}$, where if the force is measured in Newtons and the displacement is measured in meters then work is measured in Joules. Since $\mathbf{d} = \langle 9-4, 8-5, 7-6\rangle = \langle 5, 3, 1\rangle$, we find that

$$W = \langle 1, 2, 3\rangle \bullet \langle 5, 3, 1\rangle = 1 \cdot 5 + 2 \cdot 3 + 3 \cdot 1 = 14 \ .$$

So, the work done is 14 Joules.

2. The distances from an arbitrary point $(x, y, z) \in \mathbb{R}^3$ to these two points are

$$d((x, y, z), (0, 0, 2)) = \sqrt{(x-0)^2 + (y-0)^2 + (z-2)^2} = \sqrt{x^2 + y^2 + (z-2)^2}$$

and

$$d((x, y, z), (1, 1, 0)) = \sqrt{(x-1)^2 + (y-1)^2 + (z-0)^2} = \sqrt{(x-1)^2 + (y-1)^2 + z^2} \ .$$

Since these distances are both nonnegative, equating them is equivalent to equating their squares, and thereafter we simplify to find

$$\begin{aligned} x^2 + y^2 + (z-2)^2 &= (x-1)^2 + (y-1)^2 + z^2 \\ (-4z + 4) &= (-2x + 1) + (-2y + 1) \\ 2x + 2y - 4z + 2 &= 0 \\ x + y - 2z + 1 &= 0 \ . \end{aligned}$$