Homework #1

Problem 3 - 1.7.8:

We know that $\mathbf{r} = (2,1,3)$ km, $\mathbf{v} = (1,2,3)$ m/s, and $\mathbf{x}_0 = (1,1,1)$ km. The position of the rocket at time t is given by

$$\mathbf{x} = \mathbf{x}_0 + \mathbf{v}t = (1000 + t, 1000 + 2t, 1000 + 3t)m \tag{1}$$

The distance between the observer and the rocket is:

$$|\mathbf{r} - \mathbf{x}| = [(\mathbf{r} - \mathbf{x}).(\mathbf{r} - \mathbf{x})]^{1/2} =$$

$$= (10^6 + 4 \times 10^6 - 14000t + 14t^2]^{1/2}. \tag{2}$$

We can obtain the value of t for which Eq.(2) is a minimum by taking the derivative of Eq.(2) with respect to t and equating it to 0. We find $t = 500$ s which replacing in Eq.(2) gives us a minimum distance equal to $\sqrt{1.5}$ km.