1. (10 points) Prove that the medians of a triangle trisect themselves.

2. (10 points) Find the shortest distance $d_s$ between the line passing through points $A(0, 4, 0)$ and $B(4, 0, 2)$ and the line passing through points $C(0, 2, 6)$ and $D(4, -2, 4)$.

\[ \overrightarrow{AB} = <4, -4, 2> \quad \overrightarrow{CD} = <4, -4, -2> \]
\[ \mathbf{N} = \overrightarrow{AB} \times \overrightarrow{CD} = 16(\mathbf{i} + \mathbf{j}) \quad \mathbf{n} = \mathbf{N}/N = (\mathbf{i} + \mathbf{j})/\sqrt{2} \]
\[ \overrightarrow{CA} = <0, 2, -6> \quad d_s = |\mathbf{n} \cdot \overrightarrow{CA}| = 2/\sqrt{2} \]

\[ d_s = \sqrt{2} = 1.414 \]