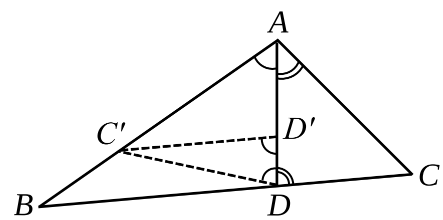
Problem 5) There exist a couple of different ways of solving this problem. Here is a somewhat different method than the one suggested in the statement of the problem.



Step 1: Pick the point C' on AB such that $\overline{AC'} = \overline{AC}$.

Step 2: Draw a straight line from D to C'. The equality of triangles ACD and $AC'D$ implies that $\overline{C'D} = \overline{CD}$ and $\widehat{ADC} = \widehat{ADC'}$.

Step 3: Draw the straight line $C'D'$ parallel to BD and observe that $\widehat{C'D'D} = \widehat{ADC}$. Therefore, the triangle $DC'D'$ is isoceles, meaning that $\overline{C'D} = \overline{C'D'}$.

Step 4: The similar triangles $AC'D'$ and ABD now yield $\overline{AC'} : \overline{AB} = \overline{C'D'} : \overline{BD}$.

Considering that $\overline{AC'} = \overline{AC}$ and $\overline{C'D'} = \overline{C'D} = \overline{CD}$, we will have $\overline{AC} : \overline{AB} = \overline{CD} : \overline{BD}$, thus completing the proof.