Solution to Problem 1) a) Let AA' be the altitude dropped from the vertex A onto the opposite side BC. We will have $\overline{AA'} = \overline{AB}\sin B = \overline{AC}\sin C$. The area of the triangle is one-half the length of the base BC times the altitude AA'. Therefore,

$$\text{Area of } ABC = ½\overline{BC} \times \overline{AA'} = ½\overline{BC} \times \overline{AB}\sin B = ½\overline{BC} \times \overline{AC}\sin C$$

$$= ½ac\sin B = ½ab\sin C.$$

The remaining equality can be proven by dropping the altitude BB' from the vertex B onto the opposite side AC, then repeating the above argument.

b) Upon dividing the identity obtained in part (a) by $½abc$, we will arrive at the desired relation:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}.$$