46. Of course, the shortest possible path between $A$ and $B$ is the straight line path which does not go to the mirror at all. In this problem, we are concerned with only those paths which do strike the mirror. The problem statement suggests that we turn our attention to the mirror-image point of $A$ (call it $A'$) and requests that we construct a proof without calculus. We can see that the length of any line segment $AP$ drawn from $A$ to the mirror (at point $P$ on the mirror surface) is the same as the length of its "mirror segment" $A'P$ drawn from $A'$ to that point $P$. Thus, the total length of the light path from $A$ to $P$ to $B$ is the same as the total length of segments drawn from $A'$ to $P$ to $B$. Now, we dismissed (in the first sentence of this solution) the possibility of a straight line path directly from $A$ to $B$ because it does not strike the mirror. However, we *can* construct a straight line path from $A'$ to $B$ which does intersect the mirror surface! Any other pair of segments ($A'P$ and $PB$) would give greater total length than the straight path (with $A'P$ and $PB$ collinear), so if the straight path $A'B$ obeys the law of reflection, then we have our proof. Now, since $A'P$ is the mirror-twin of $AP$, then they both approach the mirror surface with the same angle $\alpha$ (one from the front side and the other from the back side). And since $A'P$ is collinear with $PB$, then $PB$ also makes the same angle $\alpha$ with respect to the mirror surface (by vertex angles). If $AP$ and $PB$ are each $\alpha$ degrees away from the front of the mirror, then they are each $\theta$ degrees (where $\theta$ is the complement of $\alpha$) measured from the normal axis. Thus, the law of reflection is consistent with the concept of the shortest light path.