Problem 1: We choose a random line $L$ and a point $P$ on it.

Problem 2: Consider a point $Q$ on line $L$. There exists a unique point $P$ on line $L$ such that $PQ = 1$. Let $Q_1$ be the point on line $L$ such that $PQ_1 = 1$. Then $Q_1$ is the unique point on line $L$ such that $PQ_1 = 1$.

Conclusion: The distances from point $P$ to lines $L_1$ and $L_2$ are equal.

Proof: Let $L_1$ and $L_2$ be two parallel lines. Choose a point $P$ on $L_1$ and a point $Q$ on $L_2$. Draw a line $L$ through $P$ and parallel to $L_1$ and $L_2$. Then $L$ intersects $L_2$ at a unique point $Q_1$. Therefore, $PQ = PQ_1$. Hence, $L_1$ and $L_2$ are parallel.

Theorem: If two lines $L_1$ and $L_2$ are parallel, then the distances from any point $P$ on $L_1$ to $L_2$ and $L_1$ are equal.

Proof: Let $L_1$ and $L_2$ be two parallel lines. Choose a point $P$ on $L_1$ and a point $Q$ on $L_2$. Draw a line $L$ through $P$ and parallel to $L_1$ and $L_2$. Then $L$ intersects $L_2$ at a unique point $Q_1$. Therefore, $PQ = PQ_1$. Hence, $L_1$ and $L_2$ are parallel.

Corollary: If two lines $L_1$ and $L_2$ are parallel, then the distances from any point $P$ on $L_1$ to $L_2$ and $L_1$ are equal.