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We present a complete theoretical solution for the determination of the maximum distance between a point on the first link and a point on the last link of a serial manipulator with revolute joints. The known necessary condition for critical configurations is developed into a simple necessary and sufficient criterion for the global maximum. We use Morse-Bott theory for the squared distance function and establish at the same time a formula for the Euler characteristic of the inverse kinematics solution space in terms of indices of critical configurations. For manipulators with coplanar consecutive joints this approach identifies all extremal configurations. Our proofs work in arbitrary dimension d . (Received February 25, 2009)