Local curvature, or bending, of a graphene sheet is known to increase the chemical reactivity presenting an opportunity for templated chemical functionalisation. Using first-principles calculations based on density functional theory (DFT), we investigate the reaction barrier reduction for the adsorption of atomic hydrogen at linear bends in graphene. We find a significant barrier lowering (∼15%) for realistic radii of curvature (∼20 Å) and that adsorption along the linear bend leads to a stable linear kink. We compute the electronic transport properties of individual and multiple kink lines, and demonstrate how these act as efficient barriers for electron transport. In particular, two parallel kink lines form a graphene pseudo-nanoribbon structure with a semimetallic/semiconducting electronic structure closely related to the corresponding isolated ribbons; the ribbon band gap translates into a transport gap for electronic transport across the kink lines. We finally consider pseudo-ribbon-based heterostructures and propose that such structures present a novel approach for band gap engineering in nanostructured graphene.