[tex138] Polytropic process of classical ideal gas

Consider an ideal monatomic gas $[pV = Nk_BT, C_V = \frac{3}{2}Nk_B]$ confined to a cylinder by a movable piston. The gas is compressed from volume V_1 to volume $V_2 < V_1$ under circumstances such that the relation $pV^x = a$ with $a = \text{const}$ is satisfied. In this polytropic process, determine the quantities ΔW (work done on the system), ΔU (change in internal energy), and ΔQ (heat added to the system) as functions of V_1 and V_2. Determine for which values of x $(0 < x < 2)$ each of these quantities is positive or negative.

Solution: