A quotient map which is neither open nor closed

The example in Exercise 3 on page 145 of Munkres is given by taking $A = \mathbb{R} \times \{0\} \cup [0, \infty] \times \mathbb{R}$ and letting $f : A \to \mathbb{R}$ send $(x, y) \in A$ to x. It is not closed, for if B is the hyperbola defined by the equation $xy = 1$ and $C = A \cap B$ then C is closed in A but its image under f is the nonclosed set $(0, \infty)$. It is not open, for if $W \subset \mathbb{R}^2$ is the open rectangular region $(-2, 2) \times (1, 2)$, then $V = W \cap A$ is open in A but its image under f is the nonopen subset $[0, 2)$.

There are several ways to check that f is a quotient map. The quickest is to use the preceding exercise; by the latter, if we can find a map $\sigma : \mathbb{R} \to A$ such that $f \circ \sigma$ is the identity, then f is a quotient map. If we take $\sigma(x) = (x, 0)$, then σ has the required property.$\blacksquare$