Problem 4-3.6.2:

If $\mathbf{A}$ is irrotational

$$
\begin{equation*}
\nabla \times \mathbf{A}=0 \tag{1}
\end{equation*}
$$

To show that $\mathbf{A} \times \mathbf{r}$ is solenoidal we need to show that

$$
\begin{equation*}
\nabla \cdot(\mathbf{A} \times \mathbf{r})=0 \tag{2}
\end{equation*}
$$

Using the result of problem (3.5.9)

$$
\begin{equation*}
\nabla \cdot \mathbf{A} \times \mathbf{B}=\mathbf{B} \cdot(\nabla \times \mathbf{A})-\mathbf{A} \cdot(\nabla \times \mathbf{B}) \tag{3}
\end{equation*}
$$

we obtain

$$
\begin{equation*}
\nabla \cdot \mathbf{A} \times \mathbf{r}=\mathbf{r} .(\nabla \times \mathbf{A})-\mathbf{A} \cdot(\nabla \times \mathbf{r})=0 \tag{4}
\end{equation*}
$$

since the first term vanishes because of (1) and the second since $\nabla \times \mathbf{r}=0$.

