MODELLING PROBLEMS #2

Consider the “arrested topographic wave” problem:

\[
\begin{align*}
\frac{\partial \xi}{\partial y} + \frac{r}{fs} \frac{\partial^2 \xi}{\partial x^2} &= 0 \\
\xi_x &= \frac{Ff}{rg} \quad \text{at } x = 0 \\
\xi &= 0 \quad \text{at } x \to \infty
\end{align*}
\]

where \( r = 0.1 \text{ cm/sec}, \ s = 0.001, \ f = 10^{-4} \text{ sec}. \)

Solve two problems:

a) \( F = 0 \), \quad \xi = \begin{cases} 10 \text{ cm} & 0 \leq x \leq 50 \text{ km} \\ 0 & x \geq 50 \text{ km} \end{cases}

b) \( F = -1 \text{ cm}^2/\text{sec}^2 \), \quad \xi(x,0) = 0

Solve numerically for \( \xi \) at \(-500 \text{ km} < y < 0\) in each problem using both the forward time/centered space scheme and the fully implicit scheme.