

Solutions

2.1 B Spherical radial dependence gives $\nabla^2 f = (1/r^2) d(r^2 f')/dr = f'' + (2/r)f'$.

Compare the rejected options: f'' ; $f'' + (1/r)f'$; $f'' - (2/r)f'$; $(1/r)f''$. Use the stated model and conditions.

2.2 D The factor is -1.5 ; its magnitude exceeds 1 and its sign alternates.

Compare the rejected options: converges monotonically; converges with decaying oscillation; diverges without sign change; stays constant. Use the stated model and conditions.

2.3 100. $f_1 = c/(2L) = 100/1 = 100$ Hz.

2.4 False. Its divergence is zero away from the origin; all source strength sits at the origin as a distribution.

3.1 Explicit factor is $1 - \lambda h$. Nonnegative monotone decay needs $0 < h \leq 1/\lambda$; at equality one step reaches zero, unlike the exact exponential. Implicit Euler solves $y_{n+1} = y_n - \lambda h y_{n+1}$, so its factor is $1/(1 + \lambda h)$, between zero and one for every positive h . It is stable but only first-order accurate; refine h at fixed final time and compare with $e^{-\lambda t}$. Award factors, monotonicity range, endpoint, implicit stability and accuracy/refinement distinction.