# Homework 2

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- Go back to Step 2 of the 1D FDM lab class and modify the `FDM_1D_s2.m` function to work with non-uniform right-hand side arrays defined as anonymous functions.

  Test the function by setting $t = 10^{x-2}$ and perform a convergence test using 11, 101 and 1001 uniformly spaced grid nodes. Use the following settings and calls to the new `FDM_1D_s3.m` function.

```
geom.a = 0;
geom.b = 1;
BC.a.val = 1;
BC.a.type = 'D'
BC.b.val = 0;
BC.a.type = 'D'

t = @(x) 10.^(x+2);
```

  You should obtain a plot similar to the following (try to zoom on a node to see the effects of grid refinement!)
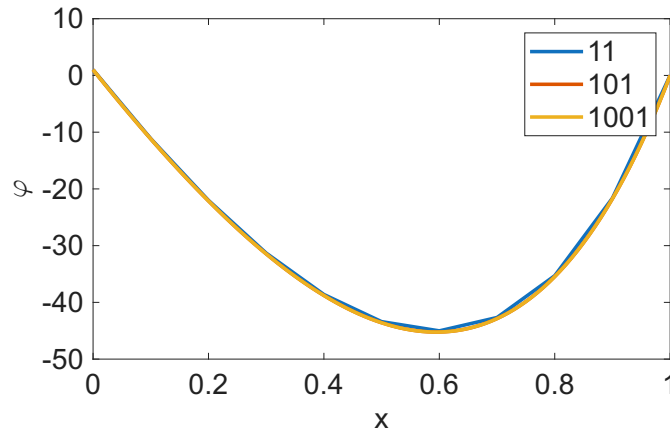
- Use the code to compute the electric field $\boldsymbol{E} = -\nabla\varphi$ between two charged plates separated by $d = 1$ mm and held at 1 kV. Assume no space charge ($\rho = 0$); compare the predicted field to the theoretical expectation ($E = 1$ kV/mm).

- Improve the accuracy of the electric field computation in Step 3 to second-order by changing the expressions at the boundaries; compare the results obtained using the two approaches.