

## Title of the document

Your name(s) here  
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### PROBLEM 1.

Given

$$\gamma \frac{d^2 u(x)}{dx^2} = -Fu(x) \quad (1)$$

with the definition  $\hat{x} = x/L$ , such that

$$\frac{d\hat{x}}{dx} = \frac{1}{L} \implies dx = Ld\hat{x}$$

Equation 1 can be written

$$\gamma \frac{d^2 u(\hat{x})}{L^2 dx^2} = -Fu(\hat{x}) \implies \frac{d^2 u(\hat{x})}{d\hat{x}^2} = -\frac{FL^2}{\gamma} u(\hat{x}) = -\lambda u(\hat{x})$$

with  $\lambda = FL^2/\gamma$ . ■

### PROBLEM 2.

For an arbitrary composite matrix  $A = BC$  the transpose of  $A^T = (BC)^T = C^T B^T$ . Hence for  $\vec{w}_i = U\vec{v}_i$

$$\vec{w}_i^T \vec{w}_j = \vec{v}_i^T U^T U \vec{v}_j = \vec{v}_i^T \vec{v}_j = \delta_{i,j}$$

as  $U^T U = U^{-1} U = I$