# Title of the document

Your name(s) here
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## PROBLEM 1.

Given

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

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

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

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 $\vec{w}_i = U\vec{v}_i$

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

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

## PROBLEM 3.

TABLE I. Eigenvector number 1.

| arma::sym | Analytic | Difference |
|---|---|---|
| -0.231921 | -0.231921 | 1.11022e-16 |
| -0.417907 | -0.417907 | 1.11022e-16 |
| -0.521121 | -0.521121 | 3.33067e-16 |
| -0.521121 | -0.521121 | 3.33067e-16 |
| -0.417907 | -0.417907 | 3.33067e-16 |
| -0.231921 | -0.231921 | 3.33067e-16 |

TABLE II. Eigenvector number 2.

| arma::sym | Analytic | Difference |
|---|---|---|
| -0.417907 | -0.417907 | 1.66533e-16 |
| -0.521121 | -0.521121 | 1.11022e-16 |
| -0.231921 | -0.231921 | 8.32667e-17 |
| 0.231921 | 0.231921 | 1.94289e-16 |
| 0.521121 | 0.521121 | 2.22045e-16 |
| 0.417907 | 0.417907 | 2.77556e-16 |

TABLE III. Eigenvector number 3.

| arma::sym | Analytic | Difference |
|---|---|---|
| -0.521121 | -0.521121 | 4.44089e-16 |
| -0.231921 | -0.231921 | 1.66533e-16 |
| 0.417907 | 0.417907 | 0 |
| 0.417907 | 0.417907 | 2.77556e-16 |
| -0.231921 | -0.231921 | 6.66134e-16 |
| -0.521121 | -0.521121 | 2.22045e-16 |

TABLE IV. Eigenvector number 4.

| arma::sym | Analytic | Difference |
|---|---|---|
| -0.521121 | -0.521121 | 2.22045e-16 |
| 0.231921 | 0.231921 | 2.77556e-16 |
| 0.417907 | 0.417907 | 1.66533e-16 |
| -0.417907 | -0.417907 | 1.66533e-16 |
| -0.231921 | -0.231921 | 1.66533e-16 |
| 0.521121 | 0.521121 | 2.22045e-16 |