# 2.2 Linear algebra

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

**KEY WORDS** condition number • eigenvalue

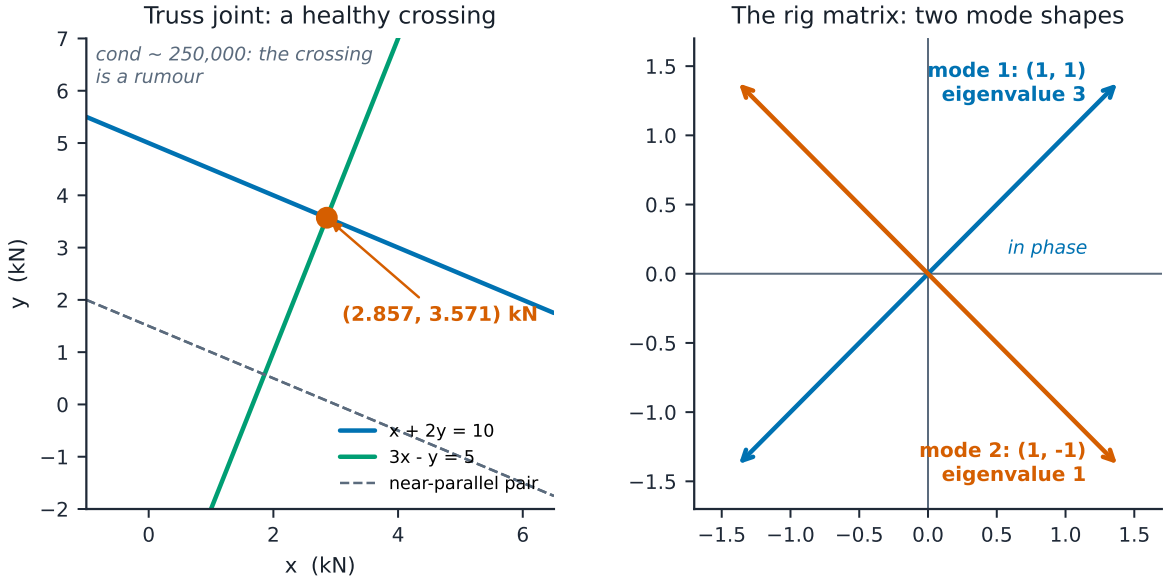
## Objective

Solve small systems, interpret conditioning, and use eigenvalues for mode shapes.

## 1 Key knowledge and worked examples

### ■ Intersections, modes, conditioning

One intersection per system; eigen-directions of a symmetric matrix are orthogonal; the condition number prices how input noise reaches the answer.




*Shallow crossings are rumours*

### ■ Worked example. The rig

Joint (2.857, 3.571) kN; eigenvalues 3 and 1 with modes (1,1), (1,-1); condition numbers 3 against ~250,000 ✓.



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## 2 Practice

**2.1** Solve $2x + 3y = 12$, $x - y = 1$ and verify both equations. [3]

**2.2** The matrix with rows (4, 1) and (1, 4): its eigenvalues and eigenvectors. [4]

**2.3** The matrix with rows (1, 1) and (1, 1.0001): the condition number (nearest thousand), and what it says about the solved answer. [3]

**2.4** An initial displacement (2, 0) of the two-mass rig of 2.2. Express it in the mode basis and state each mode's share. [4]



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