

### Problem M2

A cable (i.e. a rope, string or chain) is a structural member that can only carry axial tensile loads (i.e the tension in the cable at a particular point acts in the direction of the cable at that point) . Nevertheless it can deflect in the transverse direction. The deflection is related to the load that it is carrying and the tension in the cable.

- A flexible cable weighing  $10 \text{ N/m}$  is stretched between two points at the same level  $100 \text{ m}$  apart. In addition to its weight it supports a vertical load of  $500 \text{ N}$  at a horizontal distance of  $30 \text{ m}$  from one end. The dip (distance below the horizontal) at that point being  $1.9 \text{ m}$ . Find (approximately) the horizontal component of the cable tension and the dip at midspan.
- If the cable has an effective cross-sectional area of  $1000 \text{ mm}^2$  and an effective Young's modulus of  $2 \text{ GPa}$ , *estimate* the extension of the cable due to the loading in part (a). Would this extension affect the assumptions you made to evaluate the tension in the cable in part (a)?.

