

**Issued:** November 03, 2017

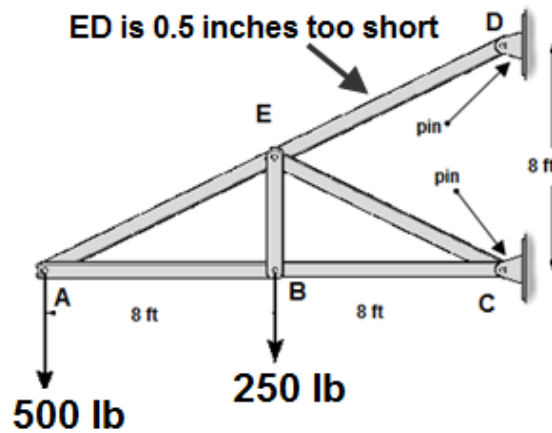
**Due:** Monday November 13, 2017, 17h00

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**Marking:** marked out of **20 marks**

**Problem 1 (5 marks)**

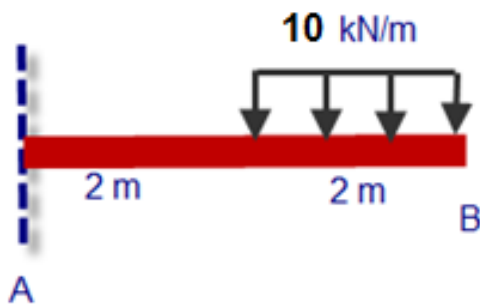
For the truss shown below determine the vertical displacement at **joint A** using the **method of virtual work**. In addition to the external loading, member ED is manufactured 0.5 inches too short. For all members:  $A = 2 \text{ in}^2$  and  $E = 29 \times 10^3 \text{ GPa}$ .



**Problem 2 (5 marks)**

For the following beam use the **method of virtual work** to determine:

- Solve for the slope at B using **Direct Integration**
- Solve for the displacement at B using **Mohr's tables**



A is fixed.  $E = 200 \text{ GPa}$ ,  $I = 50(10^6) \text{ mm}^4$

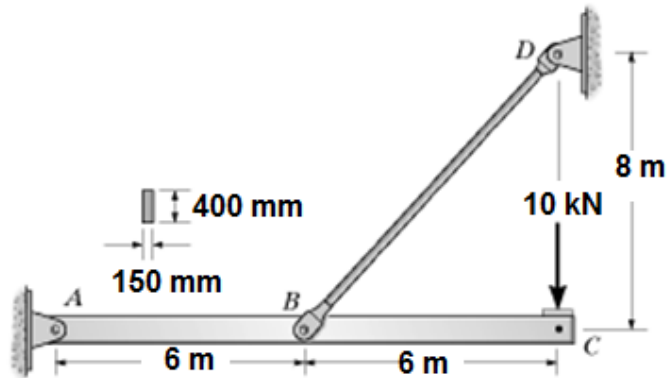
**Problem 3 (10 marks)**

Beam **ABC** has a rectangular cross-section of 400 mm by 150 mm.

The rod (truss member) **DB** has a diameter of 50 mm.

Find the displacement at point **C** due to the loading using the method of virtual work.

- consider **bending** effects only in **ABC**
- consider **axial** effects only in **BD**



(Note: A is a pin, C is free. The rod is attached at B. B is not an internal hinge)

(**Hint:** to analyze the beam, replace the Rod by an inclined axial force  $N_{BD}$ )