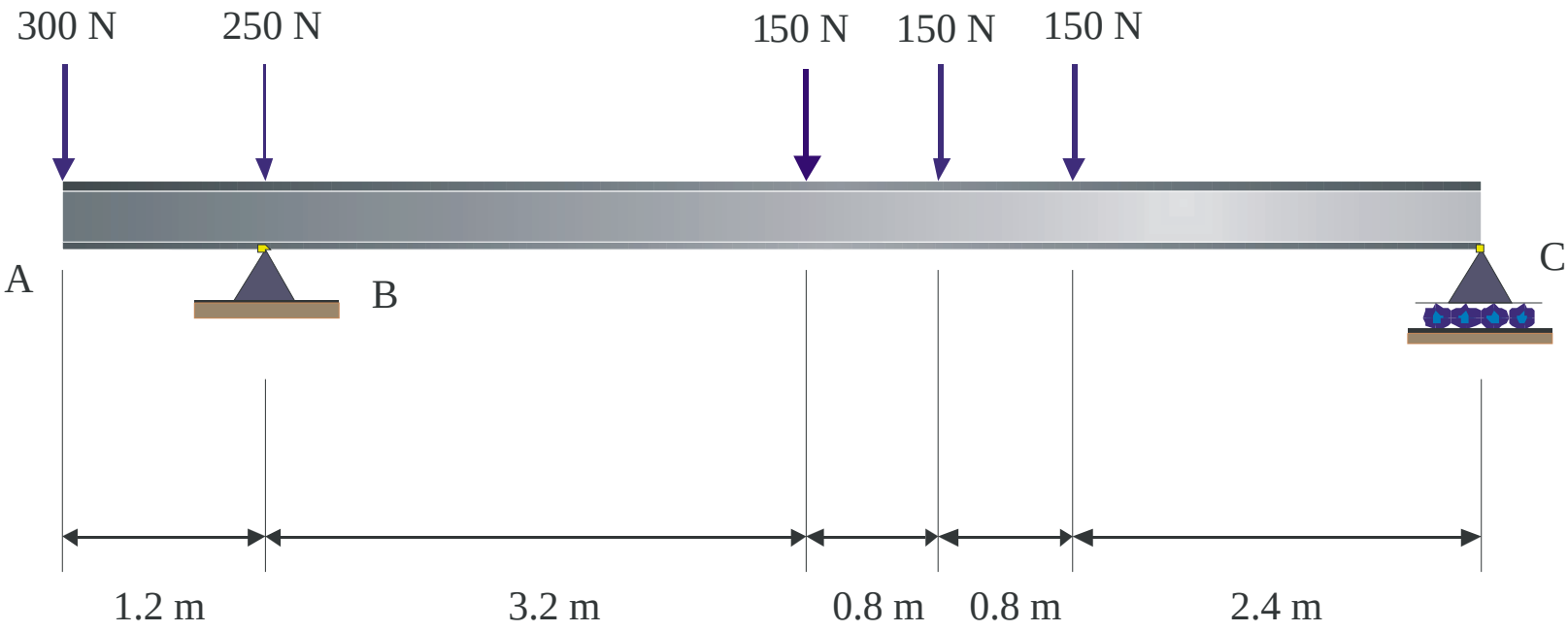
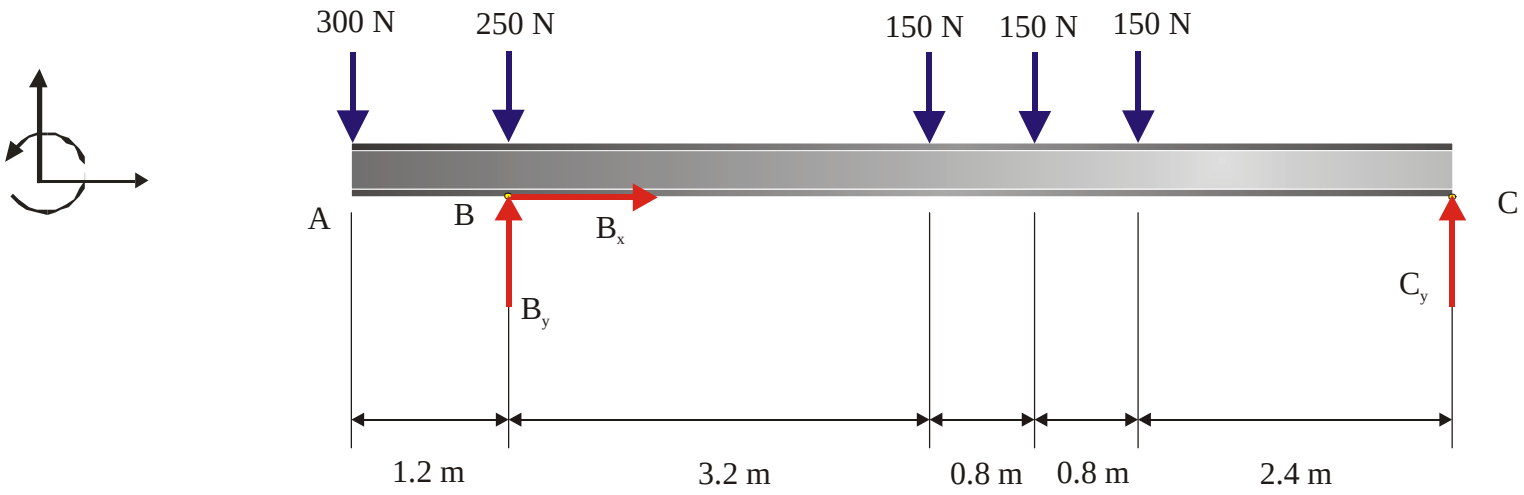
Example 3.10

J. Frye

For the beam shown, determine the reactions at B and C.



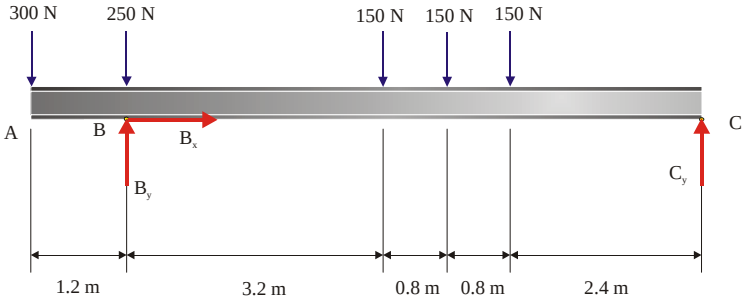
We Draw the FBD!!!!!!



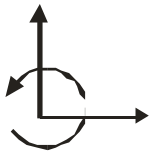
FBD

IMPORTANT: On the FBD the senses of the unknown forces are assumed. On solving the equilibrium equations, if we get a negative value, our assumption of the sense was incorrect. We continue to use this negative value until all unknowns have been determined. We then redraw the FBD indicating all reaction forces in their correct direction. We check equilibrium by taking moments about a different point on the rigid body.

We apply the equilibrium equations to the FBD



FBD



$$\sum F_x = 0 \rightarrow$$

$$B_x = 0 \quad (1)$$

$$\sum F_y = 0 \uparrow$$

$$-300 - 250 + B_y - 150 - 150 - 150 + C_y = 0 \quad (2)$$

$$\sum M_B = 0$$

$$300(1.2) - 150(3.2) - 150(4) - 150(4.8) + C_y(7.2) = 0 \quad (3)$$

$$C_y = \frac{1440}{7.2} = +200\text{N} \quad (\text{+sign indicates assumption of sense of } C_y \text{ was correct})$$

$$\therefore \mathbf{C_y} = 200\text{N} \uparrow$$

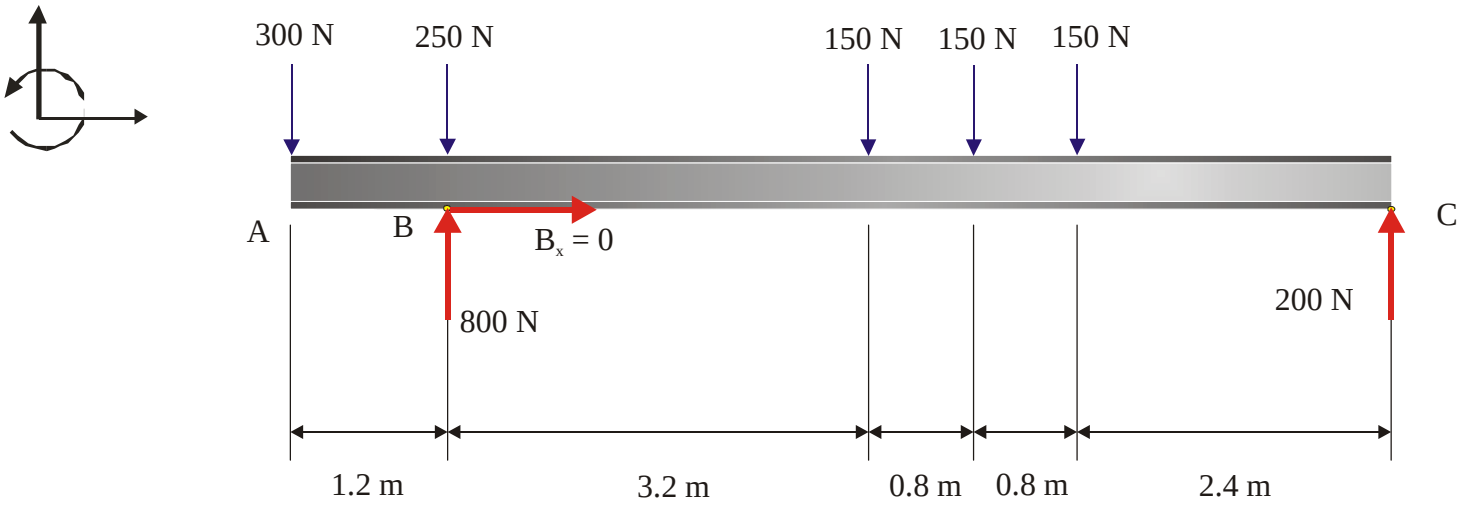
Substitute in (2):

$$B_y + 200 = 1000$$

$$B_y = +800\text{N} \quad (\text{+sign indicates assumption of sense of } B_y \text{ was correct})$$

$$\therefore \mathbf{B_y} = 800 \uparrow$$

Check – We check by taking moments about a different point on the rigid body.



FBD

$$\sum M_C = 0 \quad \circlearrowleft$$

$$300(8.4) + 250(7.2) - 800(7.2) + 150(4) + 150(3.2) + 150(2.4) = 0$$

$$0 = 0$$