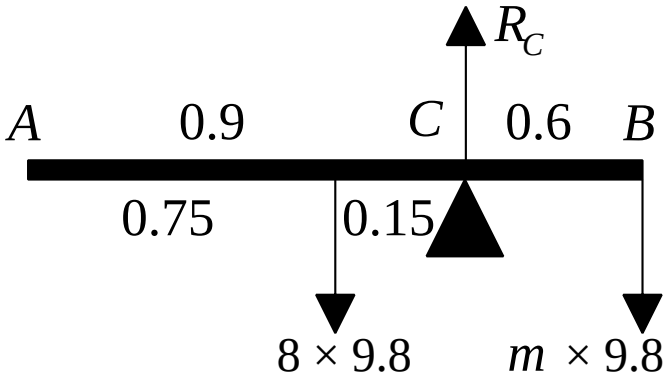
6.2 Answers

A-Level Applied Mathematics
Mechanics : Moments : Year 2

Answer 1
(i)



(ii) Take moments about C,

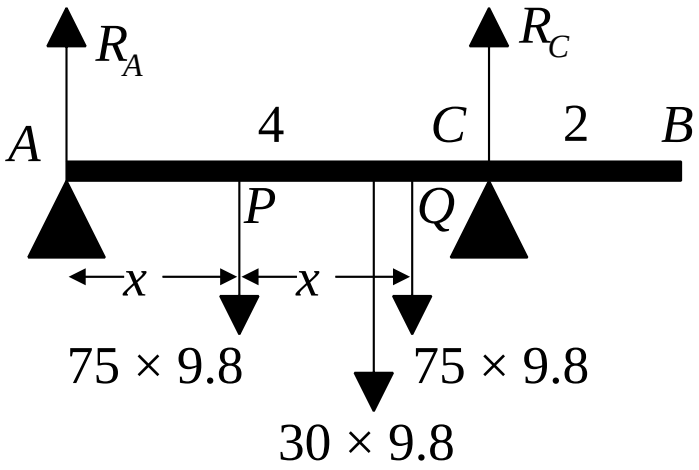
$$m \times 9.8 \times 0.6 = 8 \times 9.8 \times 0.15$$

$$0.6m = 1.2$$

$$m = 2 \text{ kg}$$

Answer 2

(i)



Told that : $R_C = 5R_A$

(ii) Balancing forces vertically,

$$R_A + R_C = 30 \times 9.8 + 75 \times 9.8 + 75 \times 9.8$$

$$R_A + 5R_A = 1764$$

$$R_A = 294 \text{ N}$$

$$\therefore R_C = 1470 \text{ N}$$

(iii) Taking moments about A,

$$75 \times 9.8 \times x + 30 \times 9.8 \times 3 + 75 \times 9.8 \times 2x = R_C \times 4$$

$$735x + 882 + 1470x = 1470 \times 4$$

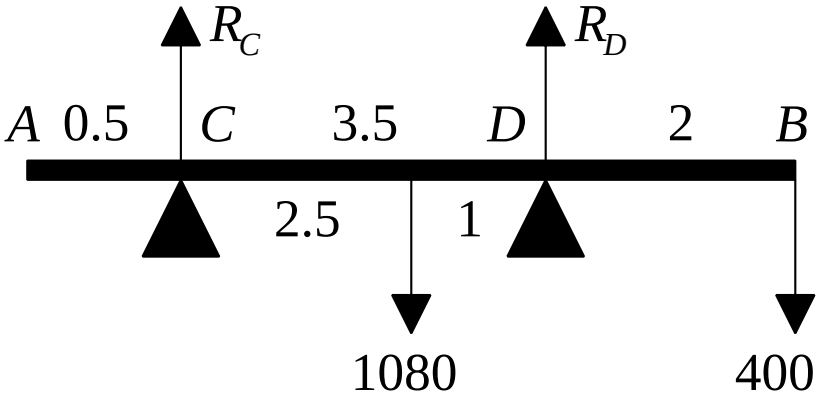
$$2205x = 4998$$

$$x = 2.27 \text{ metres}$$

(iv) The fact that the rod was described as uniform allowed the assumption that the rod's weight all acted at its midpoint to be made.

It was also assumed that the rod did not bend under either load or, indeed, its own weight.

Answer 3



(a) **(i)** Take moments about D,

$$R_C \times 3.5 + 400 \times 2 = 1080 \times 1$$

$$3.5\,R_C = 280$$

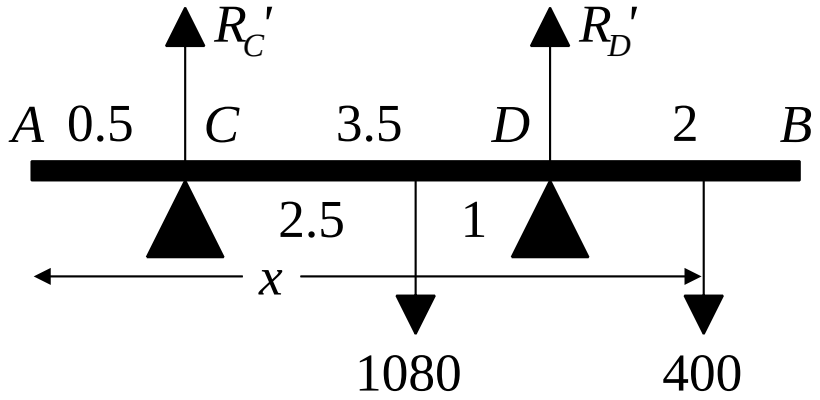
$$R_C = 80 \text{ N}$$

(ii) Balance forces vertically,

$$R_C + R_D = 1080 + 400$$

$$80 + R_D = 1480$$

$$R_D = 1400 \text{ N}$$



(b) Balance forces vertically,

$$R_C' + R_D' = 1080 + 400$$

$$R_C' + (R_C' + 520) = 1480$$

$$2\,R_C' = 960$$

$$R_C' = 480 \text{ N} \text{ and } R_D' = 1000 \text{ N}$$

Take moments about A,

$$R_C \times 0.5 + R_D \times 4 = 1080 \times 3 + 400 \times x$$

$$480 \times 0.5 + 1000 \times 4 = 3240 + 400x$$

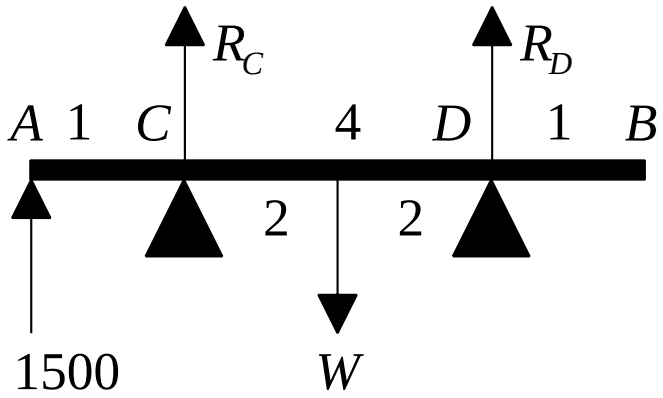
$$400x = 240 + 4000 - 3240$$

$$x = 2.5 \text{ metres}$$

Answer 4

(a) $R_C = 0$ N

(b)

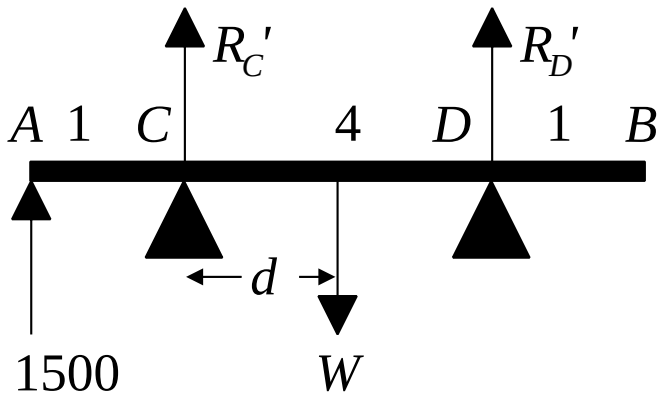


Take moments about R_D,

$$W \times 2 = 1500 \times 5$$

$$W = 3750 \text{ N}$$

(c) The previous information still holds, so rerun part (b) without the assumption that the log is uniform,

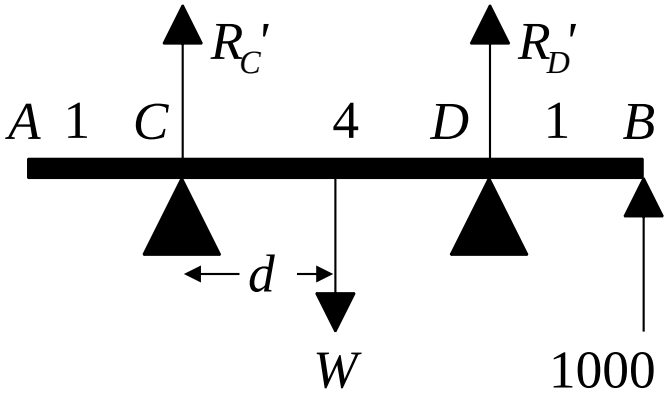


Take moments about R_D,

$$W \times (4 - d) = 1500 \times 5$$

$$4W - Wd = 7500$$

Now to make use of the additional information,



This time, it's R_D that will be zero due to the tilt,
Take moments about R_C,

$$W \times d = 1000 \times 5$$
$$Wd = 5000$$

Combine the two equations by addition,

$$4W - Wd = 7500$$
$$Wd = 5000$$

ADD

$$4W = 12500$$
$$W = 3125\,\text{N}$$

(d)

$$Wd = 5000$$
$$3125d = 5000$$
$$d = 1.6$$