

Name _____

Class _____

Date _____

By the end of this worksheet I can...

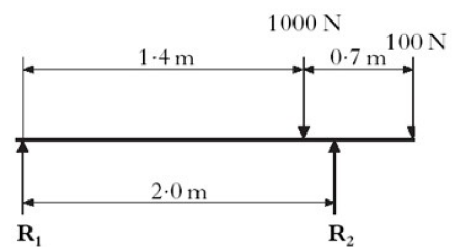
- ☐ draw a free body diagram showing every force, reaction and distance
- ☐ take moments about a support to find a reaction
- ☐ use upward forces = downward forces to find the other reaction
- ☐ find a missing force or distance on a beam in equilibrium

I DO**Key ideas and worked example** Read this first**Moment = $F \times d$** Moment = force $\times$ perpendicular distance from the pivot (N m)

- For equilibrium: **clockwise moments = anticlockwise moments** about any point.
- And **upward forces = downward forces**.
- Take moments about one support to remove its unknown reaction, then use the vertical forces for the other.
- Change masses into weights first: $W = mg$.

A trailer: R_1 at the left end, 1000 N at 1.4 m, R_2 at 2.0 m and 100 N at 2.1 m.

Example Taking moments about R_1 , calculate R_2 , then R_1 .

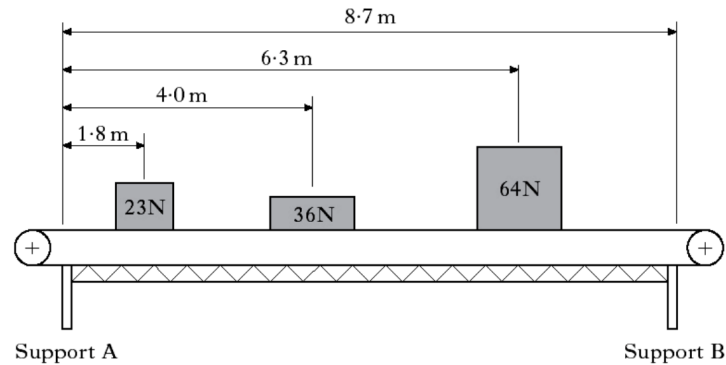
**Worked answer** set out every step like thisClockwise moments about R_1 : $1000 \times 1.4 + 100 \times 2.1 = 1610 \text{ N m}$ Anticlockwise: $R_2 \times 2.0$

$$R_2 = 1610 \div 2.0 = \mathbf{805 \text{ N}}$$

$$R_1 = (1000 + 100) - 805 = \mathbf{295 \text{ N}}$$

YOU DO**On your own** Show your working. Check your answers afterwards.

1 Packages on a stopped conveyor belt are in the positions shown.



a) Draw the free body diagram.

b) Calculate, by taking moments about support A, the reaction at support B.

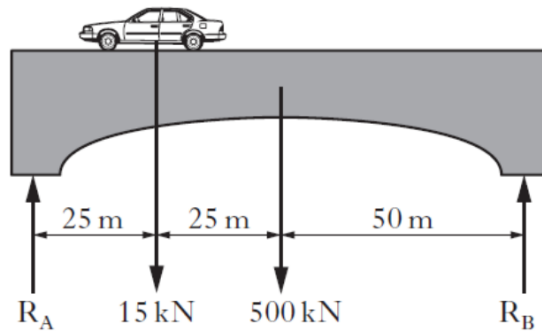
c) Determine the reaction at support A.

2 Soldiers climb across monkey bars 25 m long, supported at each end. A 95 kg soldier stops 9 m from the left-hand end.

a) Draw the free body diagram.

b) Calculate both reactions.

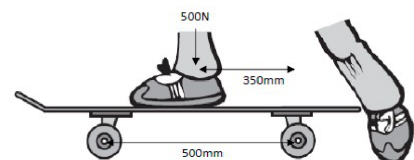
3 A bridge carries a car.



a) Draw the free body diagram.

b) Calculate R_B and R_A .

4 A skateboarder stands on a board with wheels 500 mm apart.

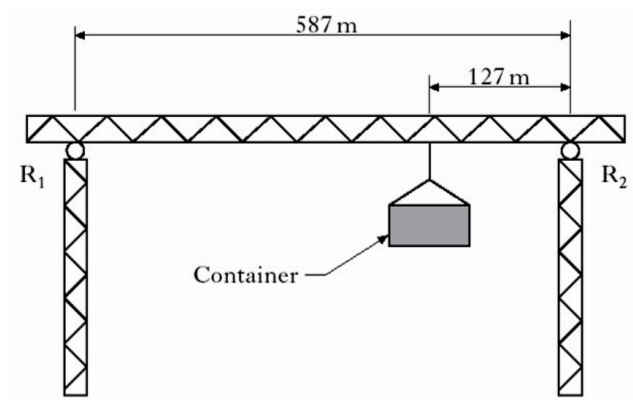


a) Draw the free body diagram.

b) Calculate, by taking moments about R_2 , the reaction R_1 .

c) Determine the reaction R_2 .

5 The structure shown carries a 500 kg container.



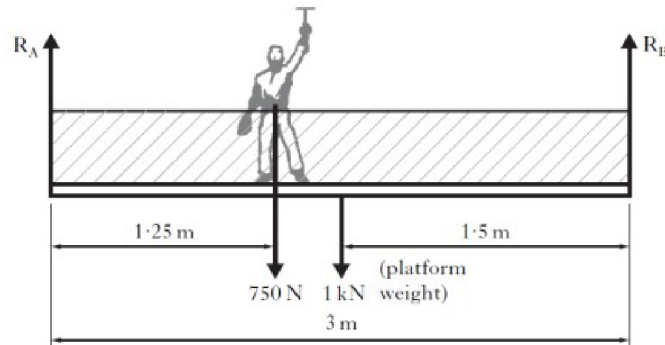
a) Calculate the weight of the container.

b) Draw the free body diagram, showing all forces and distances.

c) Calculate, by taking moments about R_2 , the reaction R_1 .

d) Determine the reaction R_2 .

6 A window cleaner stands on a platform. The platform weighs 1 kN.

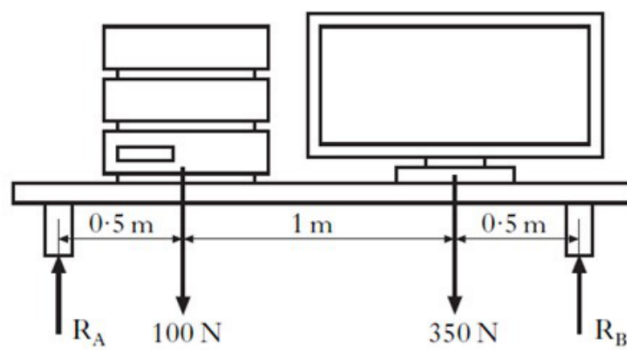


a) Draw the free body diagram.

b) Calculate R_A by taking moments about R_B .

c) Calculate R_B .

7 A unit supports a DVD player and a television.



a) Draw the free body diagram.

b) Calculate R_A by taking moments about R_B .

c) Calculate R_B .

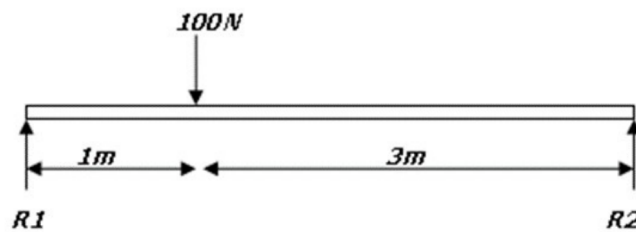
Simply supported beams

Ignore the weight of each beam.

8 Determine the reactions R_1 and R_2 .

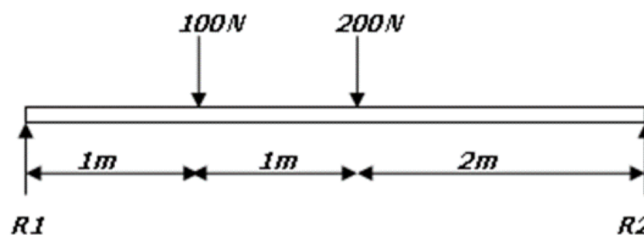
a)

(a)

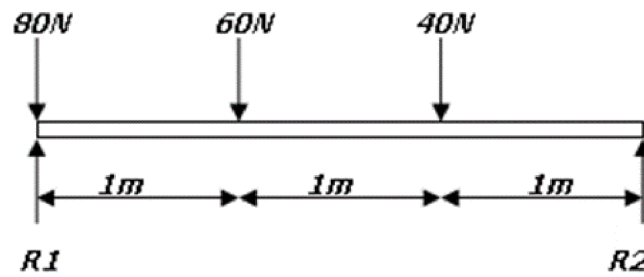


b)

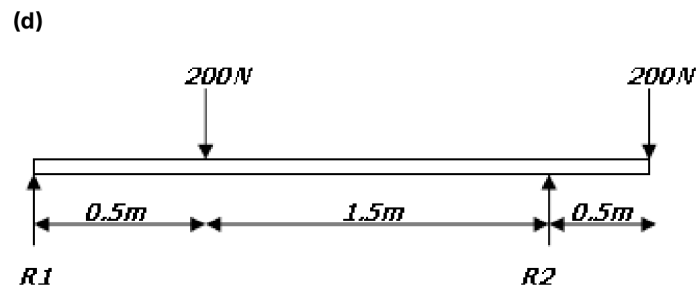
(b)



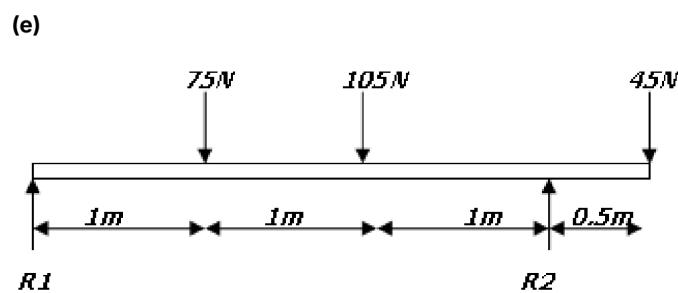
c)



d)



e)



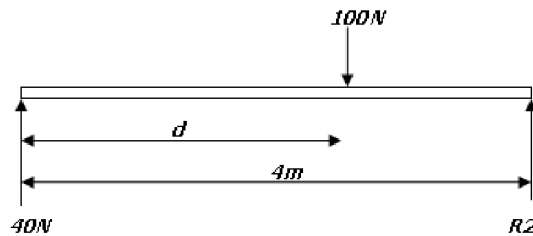
Find the missing quantity

Each beam is in equilibrium.

9 Use the principle of moments to calculate the missing quantities.

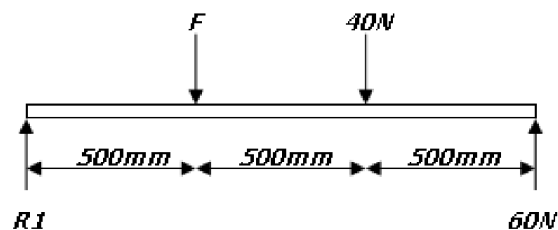
a) Find R_2 and the distance d .

(a)



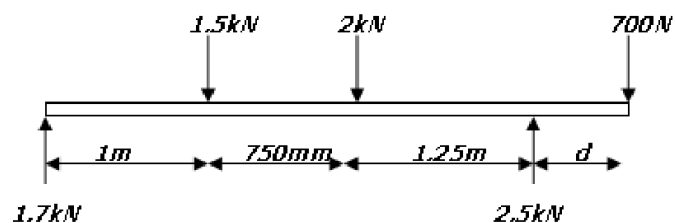
b) Find the force F and the reaction R_1 .

(b)



c) Find the distance d .

(c)



Check and reflect

Mark your answers with the answer sheet. Which “I can” statement above still needs work? Look back at the notes for that topic on the site.
