Delft Applied Mechanics Course:
Statics

AE1-914-I

January 26, 2007, 14:00–17:00

ANSWER SHEETS

Student number: | | | | | | | |

Name:

Please do not write below this line

Grading:

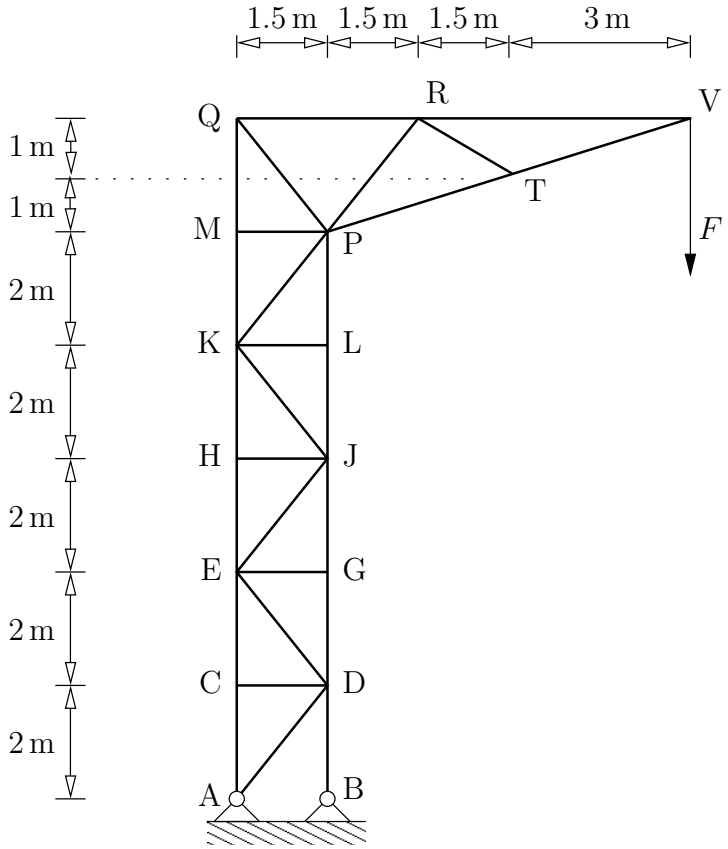
					⟹	

Exam AE1-914-I **Student number:**

January 26, 2007 **Name:**

Problem 1 (Weight 1.5, approx. 30 min.)

The crane in the figure is loaded by a vertical force F in joint V. It can be assumed that the crane is a truss.



Question a

Calculate the reaction forces in the supports A and B and draw them in the figure as they act on the structure in reality.

Answer

Question b

How many zero-force members does this structure have? Indicate the zero-force members in the figure.

Answer

Question c

A maintenance man measures the force acting in member PQ. He discovers the member is loaded in compression and that the normal force in the member is equal to 20 kN. Determine the magnitude of the external load F on joint V.

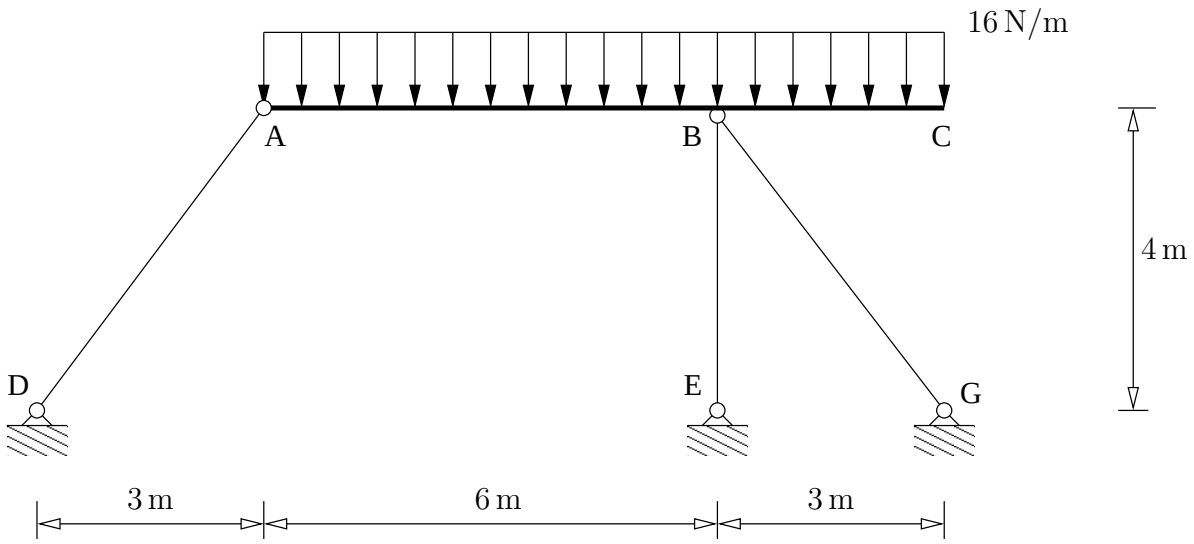
Answer

Exam AE1-914-I **Student number:**

January 26, 2007 **Name:**

Problem 2 (Weight 2.5, approx. 45 min.)

Beam ABC in the figure is loaded by a uniform distributed load of 16 N/m and is supported by the 3 two-force members AD, BE and BG.



Question a

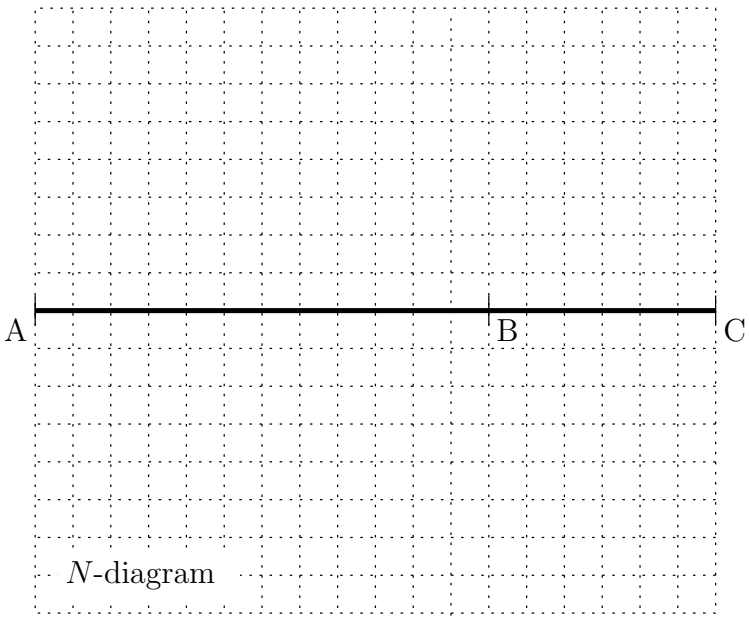
Determine the normal forces in the two-force members AD, BE and BG. Use the correct sign for tension and compression.

Answer

Question b

Draw the normal force diagram (N-diagram) of the beam and use the correct deformation signs. Mention all relevant values.

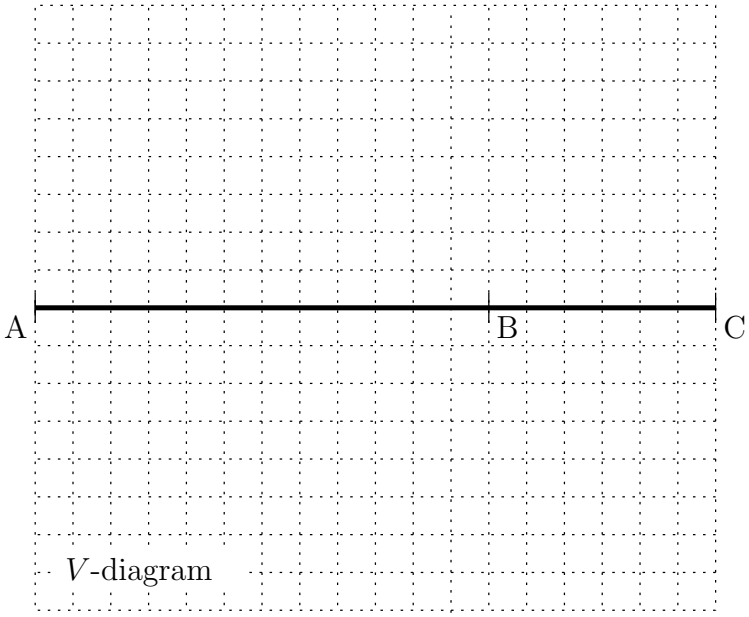
Answer



Question c

Draw the shear force diagram (V-diagram) of the beam and use the correct deformation signs. Mention all relevant values.

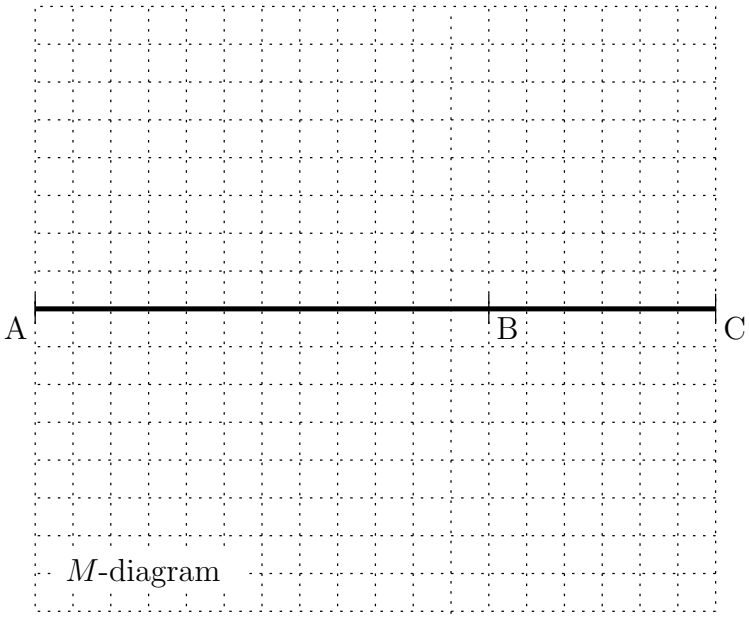
Answer



Question d

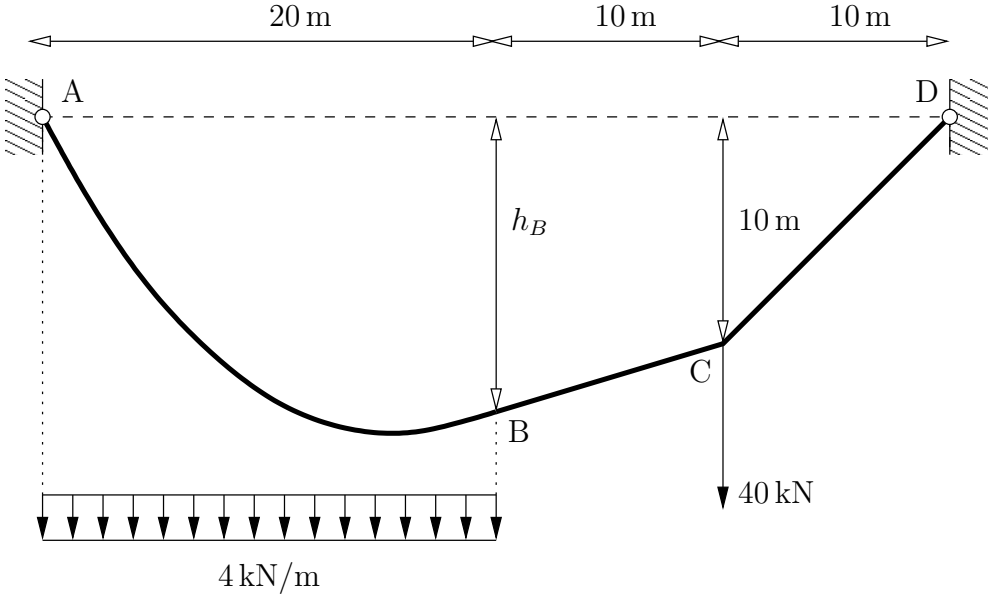
Draw the moment diagram (M-diagram) of the beam and use the correct deformation signs. Mention all relevant values and draw tangents where neccesary.

Answer



Problem 3 (Weight 2.0, approx. 30 min.)

The cable ABCD in the figure is loaded by a distributed load of 4 kN/m acting on part AB and a single force of 40 kN in C. The sag of point C is 10 meters.



Question a

Determine the reaction forces in points A and D. Draw them in the figure as they act on the cable in reality.

Answer

Question b

Determine the sag h_B of point B.

Answer

Question c

Where in the cable does the maximum cable force occur? What is the value of the cable force in that point?

Answer

Question d

Where in the cable does the sag reach its maximum? What is the maximum sag in this point?

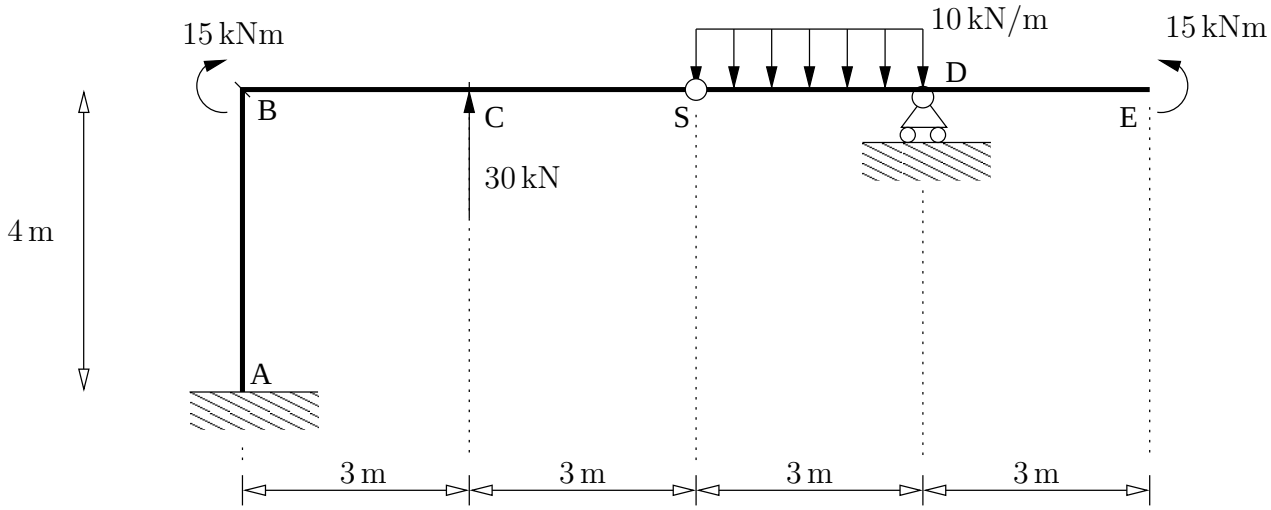
Answer

Exam AE1-914-I **Student number:**

January 26, 2007 **Name:**

Problem 4 (Weight 2.5, approx. 45 min.)

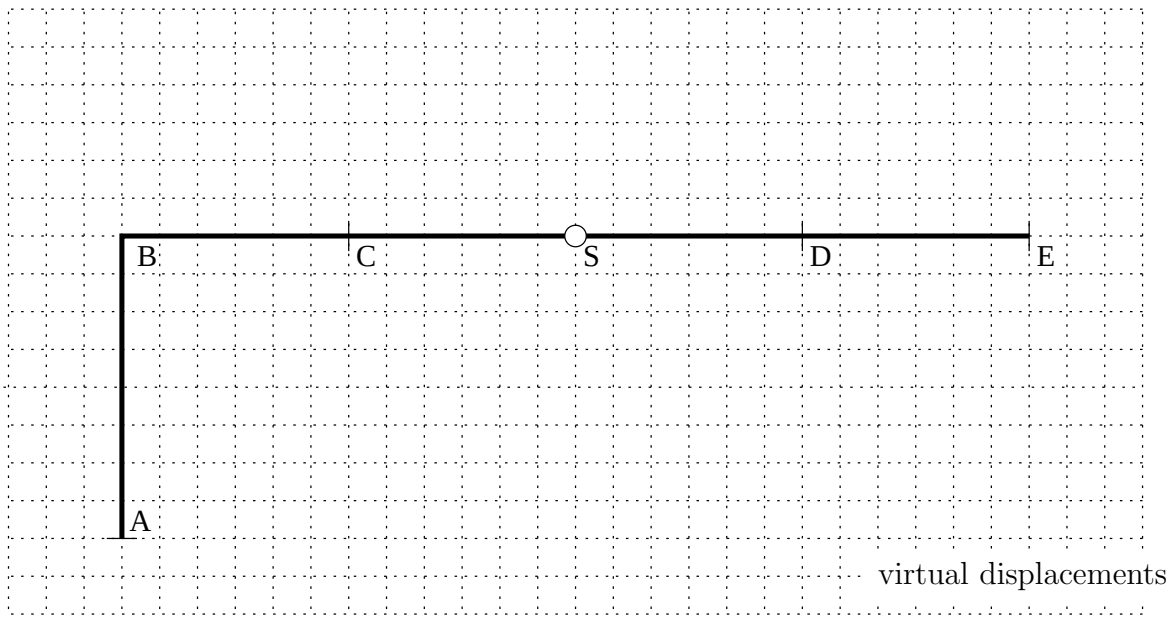
Given the structure in the figure below. Point A is clamped and the rigid corner B and the end E are loaded by a couple of 15 kNm each. Point C is loaded by a vertical force of 30 kN and part SD by a uniform distributed load of 10 kN/m. S is a hinge.



Question a

Using the principle of virtual work, calculate the reaction in point D. Clearly indicate which virtual displacement field and what sign conventions have been used.

Answer



Question b

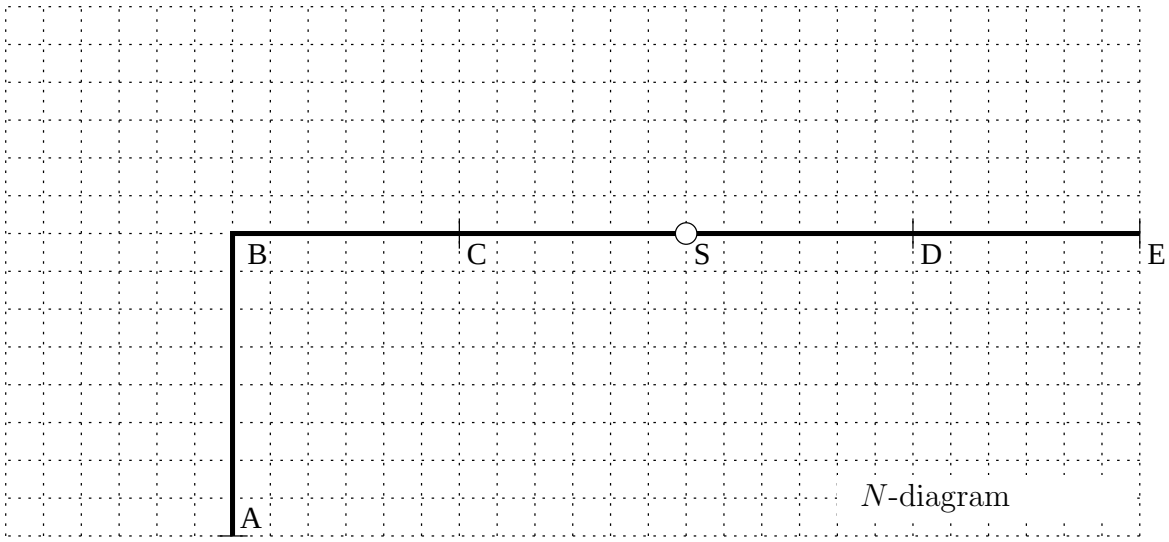
Determine the other reactions by using conventional methods (equilibrium of forces and moments) and draw them in the figure as they act on the structure in reality. If you could not determine the answer for question a), you are permitted to calculate it in this question using conventional methods.

Answer

Question c

Draw the normal force diagram (N-diagram) of the beam and use the correct deformation signs. Mention all relevant values.

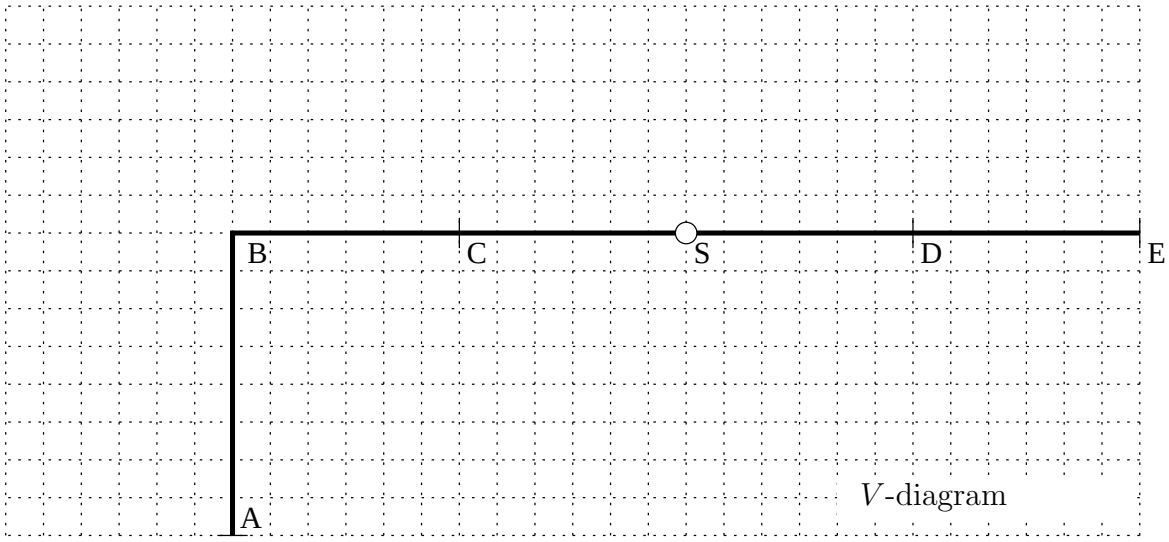
Answer



Question d

Draw the shear force diagram (V-diagram) of the beam and use the correct deformation signs. Mention all relevant values.

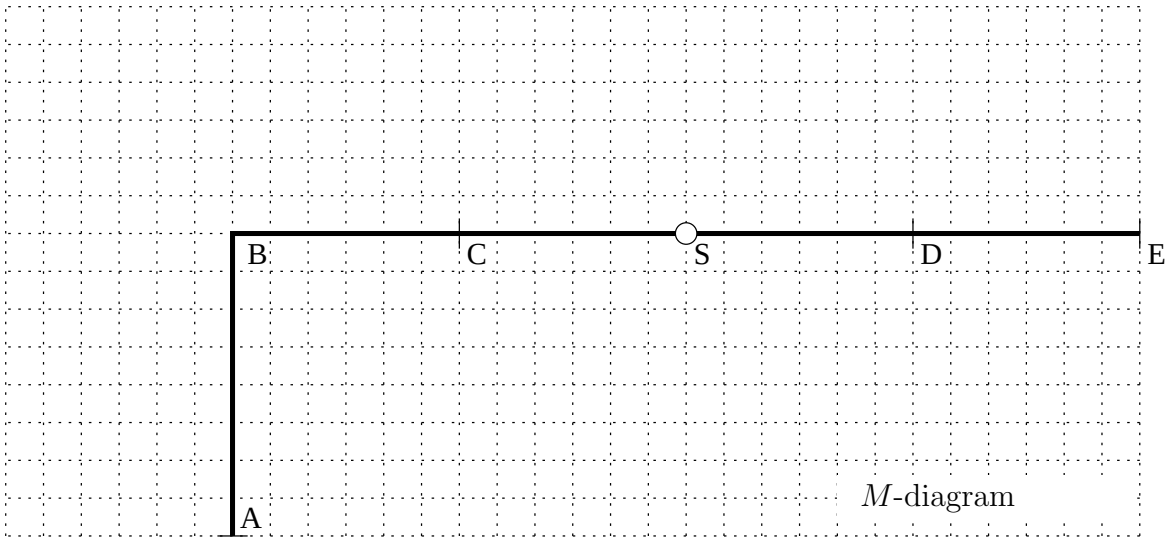
Answer



Question e

Draw the moment diagram (M-diagram) of the beam and use the correct deformation signs. Mention all relevant values and draw tangents where neccesary.

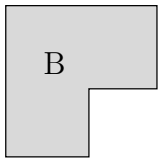
Answer



Question f

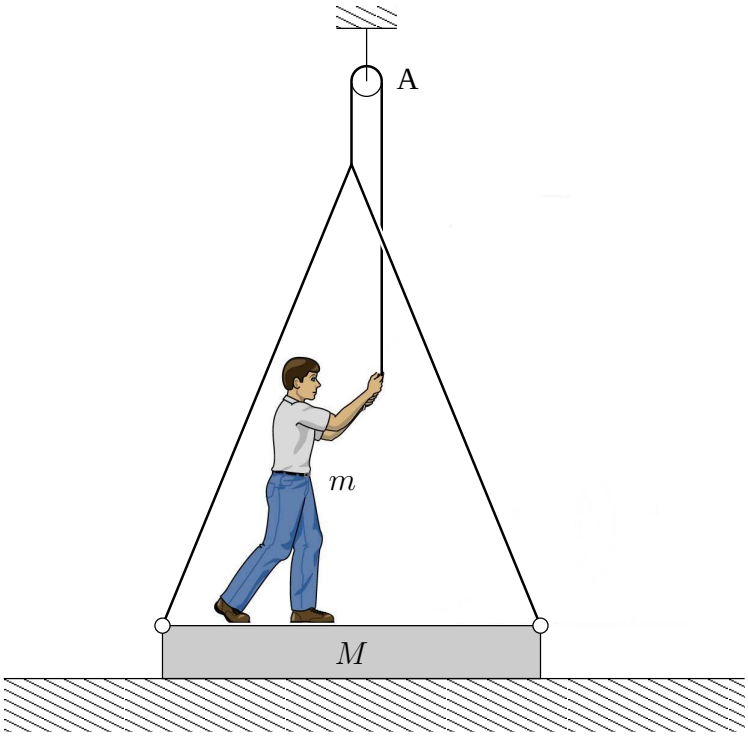
Draw all the forces and moments acting on the corner in B and show that they are in equilibrium.

Answer



Problem 5 (Weight 1.5, approx. 30 min.)

The world's strongest man with mass m is standing on a platform with mass M. The platform currently lies on the floor. Using a cable and a pulley the man can hoist the platform. Neglect the mass of the cables and the pulleys.



Question a

Derive the condition which must be met if the man is to hoist himself using the platform.

Answer

Question b

If the condition in question a) can't be met, what modification would allow the man to hoist himself? You are not required to completely redesign the structure in detail.

Answer