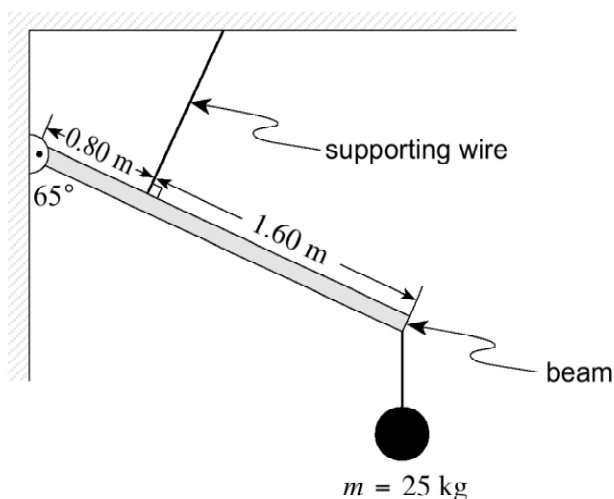


Torque and Equilibrium Review

1.

A 15 kg uniform beam 2.40 m long is suspended from a wall and a ceiling as shown.

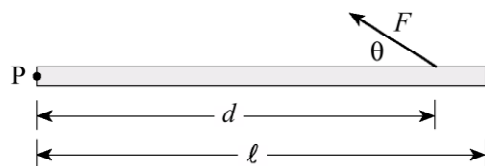


What is the tension in the supporting wire?

- A. 670 N
- B. 740 N
- C. 870 N
- D. 960 N

2.

A force F is applied to a uniform horizontal beam as shown in the diagram below.

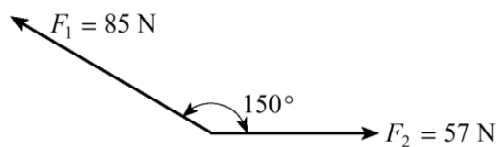


Which of the following is a correct expression for the torque on the beam about pivot point P due to this force?

- A. $F \sin \theta \cdot d$
- B. $F \sin \theta \cdot d/\ell$
- C. $F \cos \theta \cdot d$
- D. $F \cos \theta \cdot d/\ell$

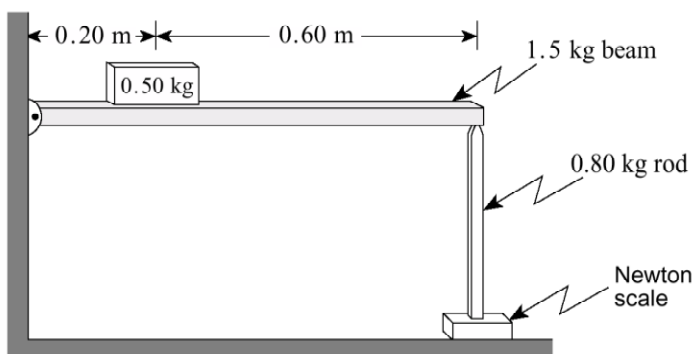
3.

What is the magnitude of the sum of the two forces shown in the diagram below?



- A. 46 N
- B. 102 N
- C. 137 N
- D. 142 N

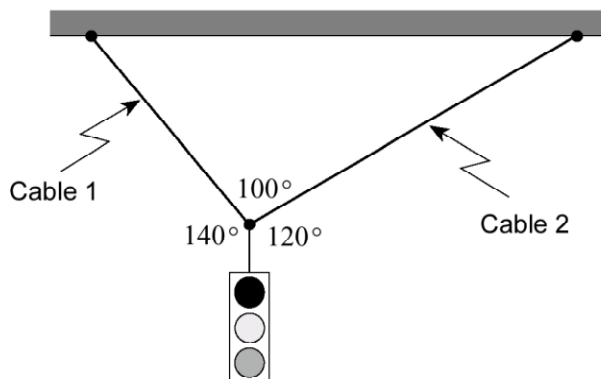
4. A uniform 1.5 kg beam hinged at one end supports a 0.50 kg block. The beam is held level by a vertical 0.80 kg rod resting on a Newton scale at the other end.



What is the reading on the scale?

- A. 8.6 N
 - B. 9.1 N
 - C. 16 N
 - D. 27 N
- 5.

A 35 kg traffic light is suspended from two cables as shown in the diagram.

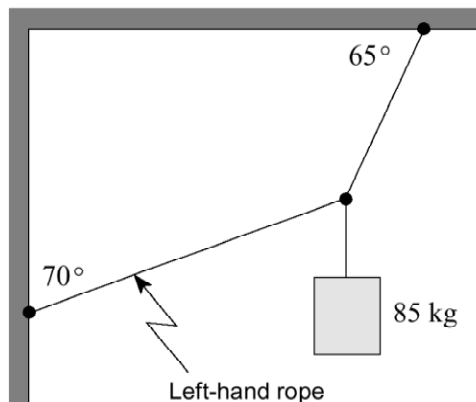


What is the tension in each of these cables?

6. The unit for torque is
- A. J
 - B. N · m
 - C. N · s
 - D. kg · m/s

7.

An 85 kg object is suspended from a ceiling and attached to a wall.

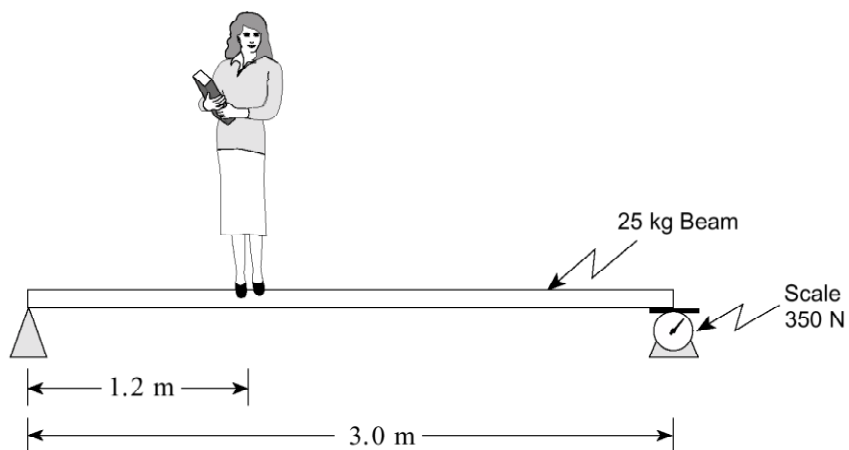


What is the tension in the left-hand rope?

- A. 280 N
- B. 350 N
- C. 500 N
- D. 1 100 N

8.

A student stands on a uniform 25 kg beam. The scale on the right end reads 350 N.



What is the mass of the student?

- A. 45 kg
- B. 54 kg
- C. 58 kg
- D. 89 kg

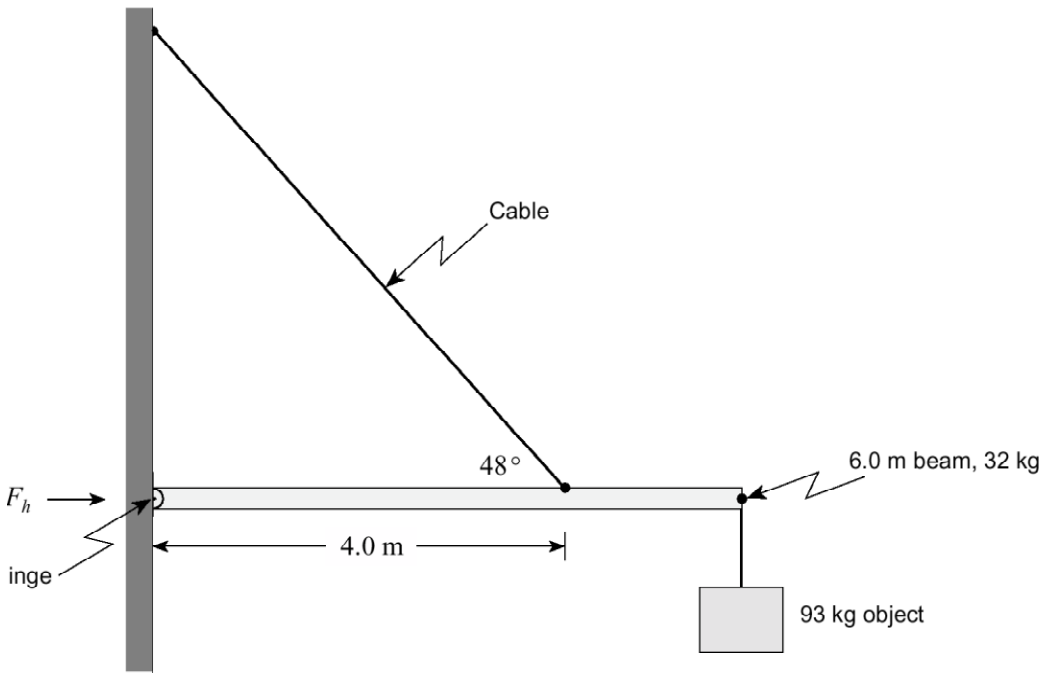
9.

A body is in static equilibrium when

- A. $\Sigma\tau = 0$ only.
- B. $\Sigma F = 0$ only.
- C. $\Sigma F = 0$ and $\Sigma\tau = 0$.
- D. $\Sigma F = 0$ and $\Sigma\tau \neq 0$.

10.

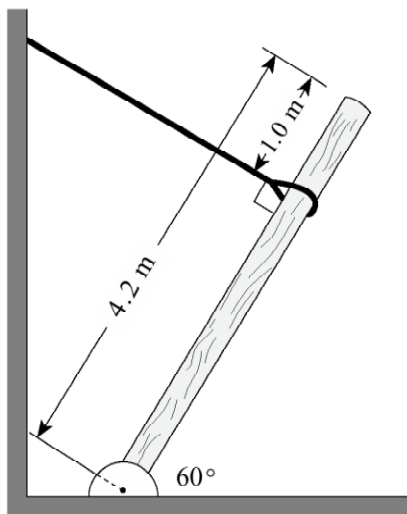
A 6.0 m uniform beam of mass 32 kg is suspended horizontally by a hinged end and a cable. A 93 kg object is connected to one end of the beam.



What is the magnitude of the horizontal force F_h that the hinge exerts on the beam? (7 marks)

11.

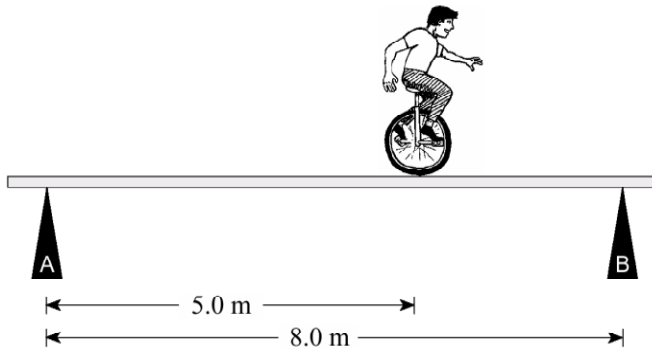
A 4.2 m long uniform post is supported by a cable having a tension of 1 700 N. What is the mass of this post?



- A. 160 kg
- B. 260 kg
- C. 300 kg
- D. 530 kg

12.

A circus performer on a unicycle of total mass 55 kg rides across a uniform 30 kg beam. The supports are placed equal distances from the ends of the beam.



a) When he is at the position shown, determine the forces exerted by the supports on the beam. **(5 marks)**

b) As the performer moves toward the right the force exerted by support B will

- remain the same.
- increase.
- decrease.

(Check one response.)

(1 mark)

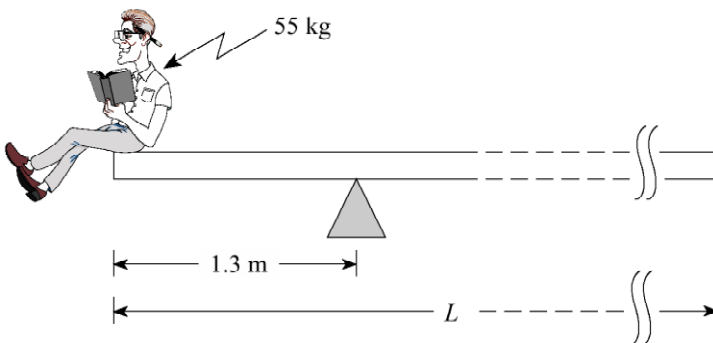
13.

A body is in rotational equilibrium when

- A. $\Sigma\tau = 0$
- B. $\Sigma F = 0$
- C. $\Sigma p = 0$
- D. $\Sigma E_k = 0$

14.

A 35 kg uniform plank is balanced at one end by a 55 kg student as shown.

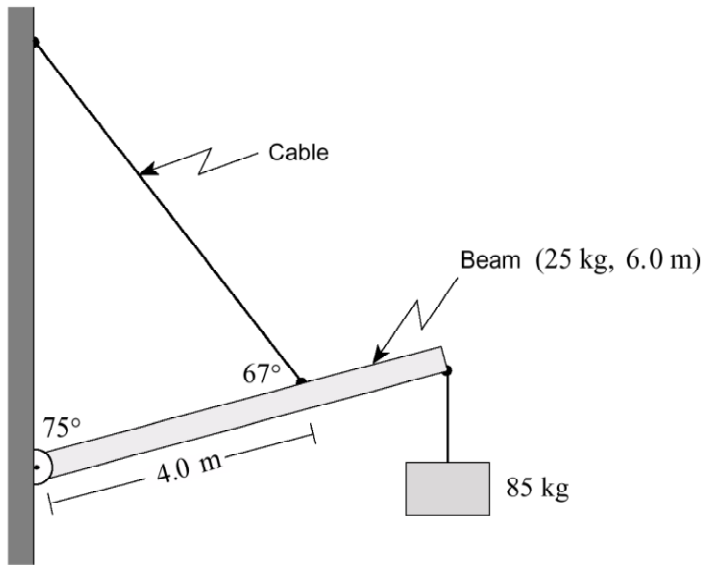


What is the overall length of this plank?

- A. 2.6 m
- B. 3.3 m
- C. 5.4 m
- D. 6.7 m

15.

A 6.0 m uniform beam of mass 25 kg is suspended by a cable as shown. An 85 kg object hangs from one end.

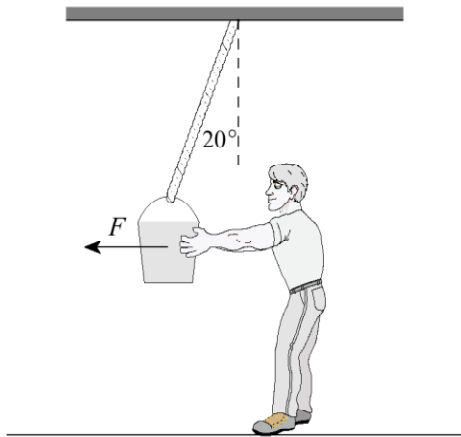


What is the tension in the cable?

(7 marks)

16.

Peter exerts a horizontal force F on a 12 kg bucket of concrete so that the supporting rope makes an angle of 20° with the vertical.



a) Find the tension force in the supporting rope.

(5 marks)

b) Peter now exerts a new force which causes the rope to make a greater angle with the vertical. How will the tension force in the supporting rope change?

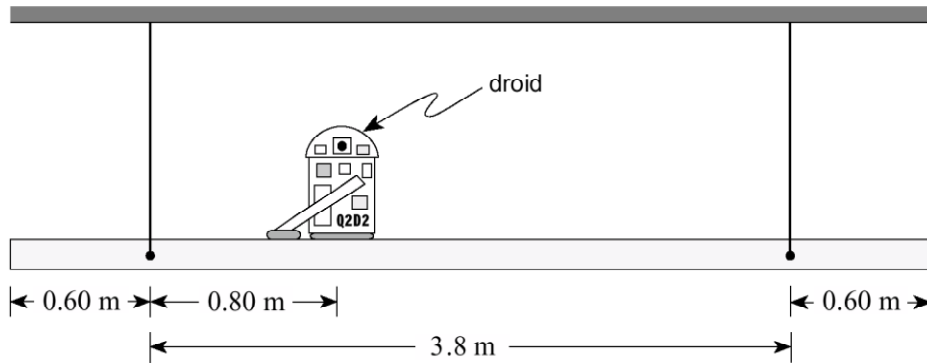
- The tension force will increase.
- The tension force will decrease.
- The tension force will remain the same.

(Check one response.)

(1 mark)

17.

A 25 kg droid rests on a 5.0 m long shelf supported by two cables as shown. The mass of the shelf is 12 kg.



Find the tension in **each** cable.

(7 marks)

Answers:

1. c
2. a
3. a
4. c
5. $T_1=302\text{ N}$, $T_2=224\text{ N}$
6. b
7. c
8. c
9. c
10. $F_i=1.4 \times 10^3\text{ N}$
11. d
12. a) $F_B=480\text{ N}$, $F_A=350\text{ N}$
b) increase
13. a
14. d
15. 1500 N
16. a) $1.3 \times 10^2\text{ N}$ b) increase
c) The vertical component of the tension is equal weight and is unchanged. Peter's horizontal force increases with a larger angle. The horizontal component of the tension is equal to Peter's and therefore also increases. Thus, the resultant tension is increased.
17. $T_L=253\text{ N}$, $T_R=110\text{ N}$