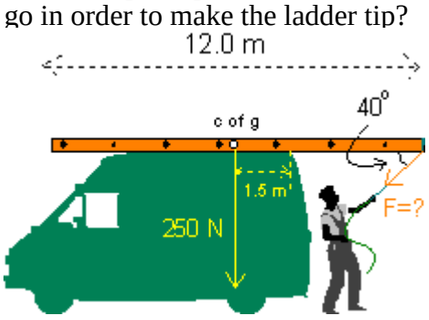
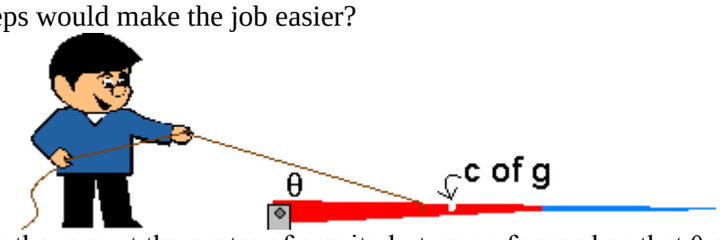
Review Sheet – Torques

1. In the picture below the large uniform ladder is 12.0 m long and has a mass of 250 N. In order to reach the ladder the worker pulls on a rope that makes an angle of 40° with the ladder. A point on the roof of the van 1.5 m from the ladder's c of g serves as a pivot point. What is the minimum force in the rope beyond which the worker must go in order to make the ladder tip?



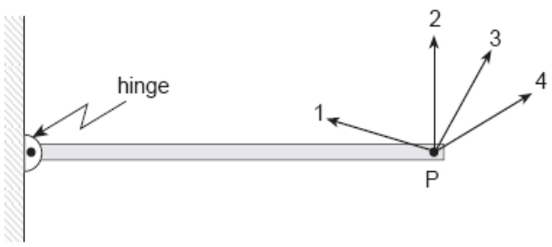
A. 62.5 N
B. 109 N
C. 130 N
D. 250 N

2. The picture show an ambitious physics student attempting to raise a flag pole. Which of the following steps would make the job easier?



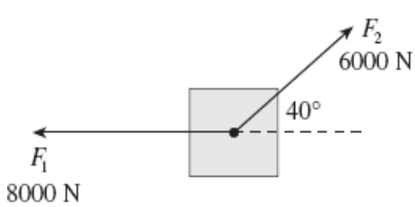
A. attach the rope at the centre of gravity but move forward so that θ stays the same
B. attach the rope beyond the centre of gravity and climb a sturdy step ladder so that θ is larger.
C. attach the rope much nearer the pivot but step backward so that θ stays the same
D. stay on the ground and attach the rope at the centre of gravity but move backward so that θ becomes smaller

3. The diagram below shows a force F applied in several different directions at the point P on a hinged beam. In which direction will the force produce the **smallest** torque about the hinge?



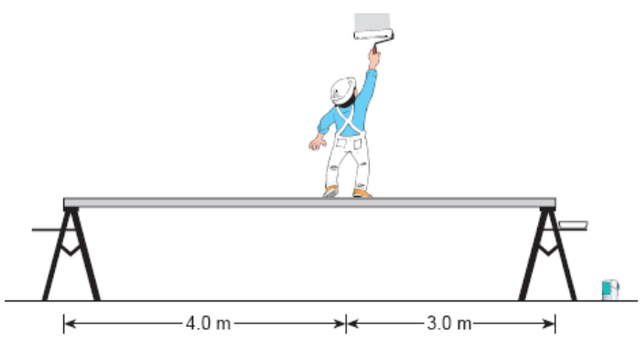
A. 1
B. 2
C. 3
D. 4

4. Two forces are acting at a single point on an object. Force 1 has a magnitude of 8000 N and is directed due W. Force 2 has a magnitude of 6000 N and is directed at 40° N of E. Determine the magnitude of the third force which must act at the same point so that the object will be in translational equilibrium.



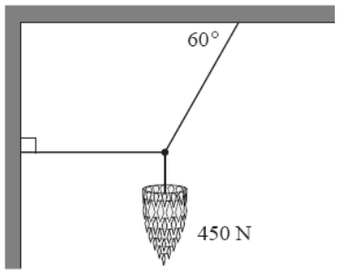
A. 2000 N
B. 3400 N
C. 5100 N
D. 6200 N

5. An 840 N painter stands on a 7.0 m board of negligible weight. The board is supported by two step-ladders as shown. What is the force exerted on the board by the left step-ladder?



A. 360 N
B. 420 N
C. 630 N
D. 840 N

6. A 450 N chandelier is supported by three cables as shown in the diagram. What is the tension in the horizontal cable?

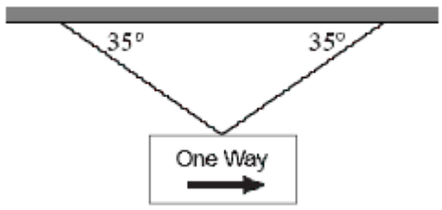


A. 46 N
B. 260 N
C. 450 N
D. 520 N

7. A 4.00×10^3 N force is applied on one end of a 5.00 m lever. If an object on the other end of the lever is 1.00 m from the pivot point, what is the maximum weight that the object can be to balance the lever?

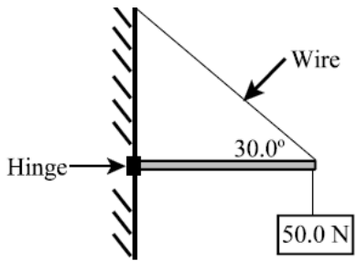
A. 8.00×10^1 N
B. 1.00×10^2 N
C. 1.60×10^4 N
D. 2.00×10^4 N

8. A traffic sign hangs from two cables as shown. If the tension in each cable is 220 N, what is the weight of the sign?



A. 130 N
B. 250 N
C. 360 N
D. 440 N

9. The wire below supports a horizontal massless beam. What is the tension in the wire?



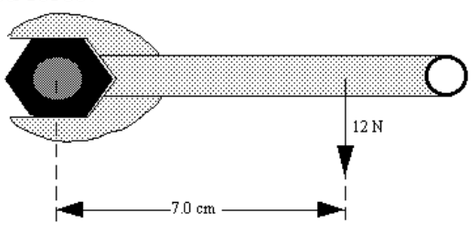
A. 2.89×10^1 N
B. 5.00×10^1 N
C. 5.77×10^1 N
D. 1.00×10^2 N

10. The structure shown below is in static equilibrium. What is the mass of object X? (Assume beam to be of negligible mass.)

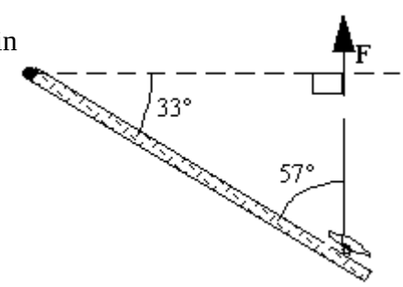
A. 408 kg
B. 1630 kg
C. 2040 kg
D. 4080 kg

11. A wrench is used to tighten a nut as shown in the figure. A 12-N force is applied 7.0 cm from the axis of rotation. What is the torque due to the applied force?

A. 0.58 N • m
B. 0.84 N • m
C. 1.71 N • m
D. 14 N • m



12. A string is tied to a door knob 0.79 m from the hinge as shown in the figure. At the instant shown, the force applied to the string is 5.0 N. What is the torque on the door?

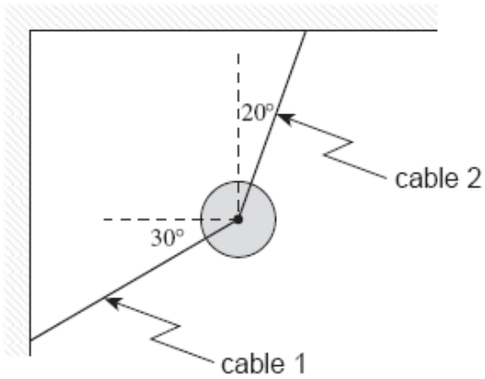


A. 3.3 N • m
B. 2.2 N • m
C. 1.1 N • m
D. 0.84 N • m

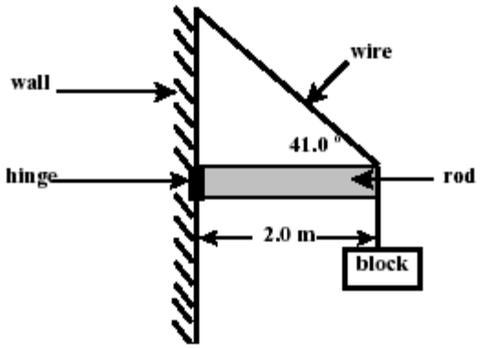
13. A meter stick is pivoted at the 0.50 m line. A 3.0-kg object is hung from the 0.10 m line. Where should a 5.0-kg object be hung to achieve equilibrium?

A. 0.06 m line
B. 0.24 m line
C. 0.56 m line
D. 0.74 m line

14. A wrecking ball is suspended by two cables as shown below. If the mass of the wrecking ball is 1200 kg, what is the tension in each cable?



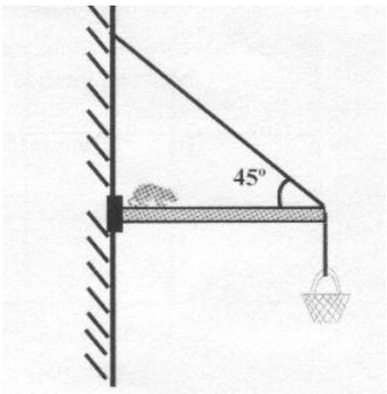
15. A Sketch the free body diagram for the rod in the diagram below. Label all forces.



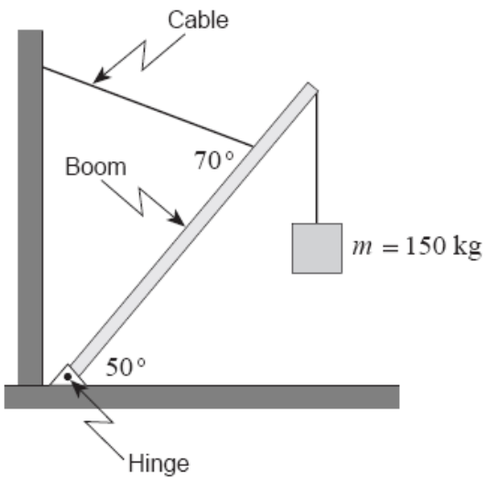
B If the mass of the block is 5.0 kg and the rod is uniform with a mass of 0.40 kg, what is the magnitude of the tension in the wire?

C Determine the vertical and horizontal components of the force acting on the hinge.

16. In the diagram below, a 1.5 kg rat walks on a 2.0 kg uniform beam that is 2.2 m long. It wants to reach a 1.3 kg food basket hanging at the end. A cord that can withstand 45.5 N is used to support the beam at the end. What is the maximum distance the rat can walk before the cord breaks?



17. A uniform 6.0 m-long boom has a mass of 55 kg. It is kept in position by a restraining cable attached three-quarters of the way along the boom. What is the tension in this cable when the boom supports a 150 kg mass as shown?



18. A long platform is holding your physics teacher in the air above some hungry alligators. Your physics teacher has a mass of 75 kg and is located 2.0 m from one end. The 10.0 m platform has a mass of 10.0 kg and its center of gravity is located 4.0 m from the same end. The platform is being held up by two students, one at either end. What force is required by each student to hold the platform up?