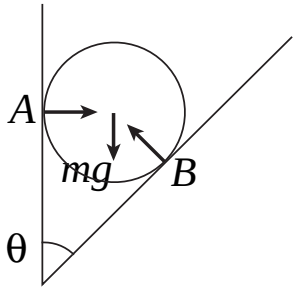
This print-out should have 10 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

Consider a solid sphere of radius R and mass m placed in a wedge, where one wall is vertical and the other wall has an angle θ with respect to the vertical wall.



Assuming that the walls are smooth, which expression is appropriate if you consider a free body diagram for the ball which involves F_A and F_B, the forces acting on the contact points A and B, respectively, and the weight $m\,g$?

1. $m\,g = F_A \cos\theta$

2. $m\,g = 2\,F_A \tan\theta$

3. $m\,g = F_A \tan\theta$

4. $m\,g = \dfrac{1}{2}\,F_A \sin\theta$

5. $m\,g = \dfrac{1}{2}\,F_A \cos\theta$

6. $m\,g = F_A \sin\theta$

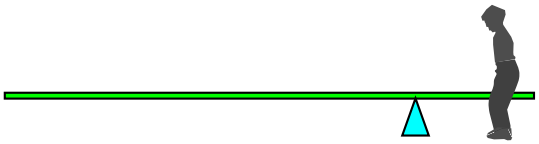
7. $m\,g = 2\,F_A \sin\theta$

8. $m\,g = \dfrac{1}{2}\,F_A \tan\theta$

9. $m\,g = 2\,F_A \cos\theta$

002 10.0 points

Nobody at the playground wants to play with an obnoxious boy, so he fashions a seesaw as shown so he can play by himself.



Explain how this is done.

1. The fulcrum is very far from the boy.

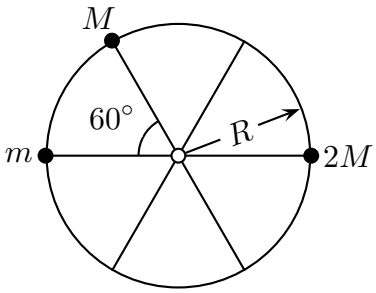
2. The weight of the boy is balanced by the weight of the board.

3. The weight of the boy is balanced with an unknown heavy metal.

4. The angular velocity of the boy is cancelled with that of the board.

003 10.0 points

A wheel of radius R and negligible mass is mounted on a horizontal frictionless axle so that the wheel is in a vertical plane. Three small objects having masses m, M, and $2\,M$, respectively, are mounted on the rim of the wheel, as shown.



If the system is in static equilibrium, what is the value of m in terms of M?

1. $m = 2\,M$

2. $m = \dfrac{M}{2}$

3. $m = M$

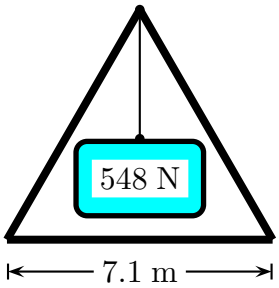
4. $m = \dfrac{5\,M}{2}$

5. $m = \dfrac{3\,M}{2}$

004 10.0 points

Three hollow metal rods, of equal length

and negligible mass, are connected by pins to form an triangular frame as shown. The frame stands upright, and a weight is hung from the vertex of the triangle frame.



What is the tension in the horizontal rod which forms the base of the triangular frame?

Answer in units of N.

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005 10.0 points

If you walk along the top of a fence, why does holding your arms out help you to balance?

1. Your momentum is decreased.

2. Your momentum is increased.

3. Your rotational inertia is increased.

4. Your rotational inertia is decreased.

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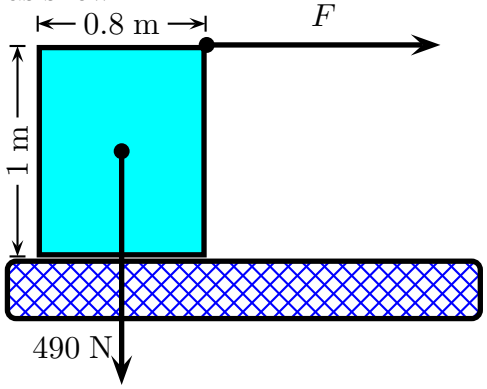
006 10.0 points

A string provides a horizontal force which acts on a 490 N rectangular block at top right-hand corner as shown.



If the block slides with constant speed, find the tension in the string required to start to tip the block over.

Answer in units of N.

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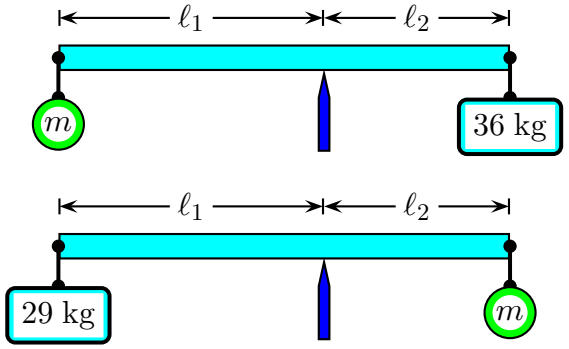
007 10.0 points

A rod of negligible mass is pivoted at a point that is off-center, so that length ℓ_1 is different from length ℓ_2. The figures show two cases in which masses are suspended from the ends of the rod. In each case the unknown mass m is balanced so that the rod remains horizontal.



What is the value of m ?

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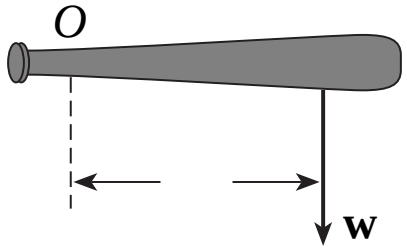
008 (part 1 of 2) 10.0 points

A baseball player holds a 49.5 oz bat (13.75 N) with one hand at the point O. The bat is in equilibrium. The weight of the bat acts along a line 65.7 cm to the right of O.



Determine the force exerted on the bat by the player.

Answer in units of N.

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009 (part 2 of 2) 10.0 points

Determine the torque exerted on the bat by the player.

Answer in units of $\mathrm{N \cdot m}$.

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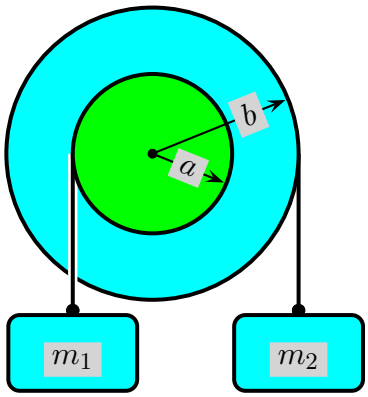
010 10.0 points

Consider the wheel-and-axle system shown below.



Which of the following expresses the condition required for the system to be in static equilibrium?

1. $a\, m_2 = b\, m_1$

2. $m_1 = m_2$

3. $a^2\, m_1 = b^2\, m_2$

4. $a\, m_1 = b\, m_2$

5. $b^2\, m_1 = a^2\, m_2$