WebAssign
CH11-HW03-SP12 (Homework)

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PHYS 172-SPRING 2012, Spring 2012
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Current Score : 23 / 23 **Due :** Tuesday, April 3 2012 11:59 PM EDT

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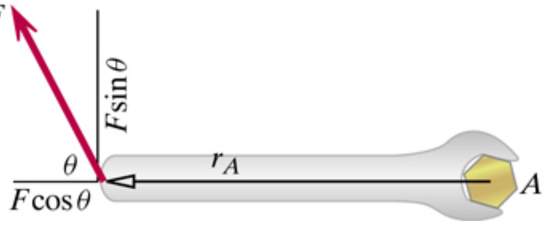
1. 2.5/2.5 points | Previous Answers MI3 11.4.X.044

Calculating torque in the figure:



(a) If r_A = 0.26 m, F = 16 N, and θ = 54°, what is the magnitude of the torque about location A, including units?

$|\vec{\tau}|$ = 3.3655

units are N m

(b) If the force were perpendicular to $\vec{r}_A$ but gave the same torque as in the preceding question, what would its magnitude be?

$|\vec{F}|$ = 12.944 N

- *Read the eBook*
- Section 11.4

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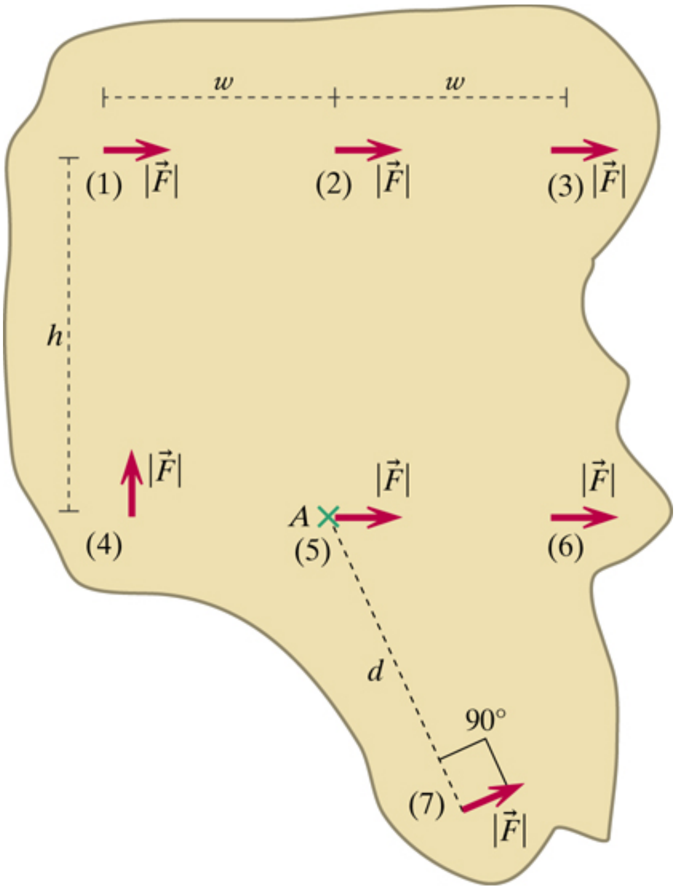
2. 4/4 points | Previous Answers MI3 11.4.X.047

As shown in the diagram below, seven forces all with magnitude $|\vec{F}|$ = 25 N are applied to an irregularly shaped object. Each force is applied at a different location on the object, indicated by the tail of the arrow; the directions of the forces differ. The distances shown in the diagram have these values: w = 13 m, h = 20 m, and d = 19 m.



For each force, calculate the z component of the torque due to that force, relative to location *A* (x to the right, y up, z out of the page). Make sure you give the correct sign.

(1) $\tau_{A,1,z}$ = -500 N · m

(2) $\tau_{A,2,z}$ = -500 N · m

(3) $\tau_{A,3,z}$ = -500 N · m

(4) $\tau_{A,4,z}$ = -325 N · m

(5) $\tau_{A,5,z}$ = 0 N · m

(6) $\tau_{A,6,z}$ = 0 N · m

(7) $\tau_{A,7,z}$ = 475 N · m

Relative to location *A*, what is the z component of the net torque acting on this object?

$\tau_{A,net,z}$ = -1350 N · m

- *Read the eBook*
- Section 11.4

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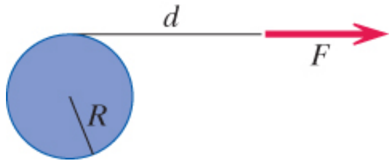
3. 7.5/7.5 points | Previous Answers MI3 11.6.X.018

A uniform solid disk with radius 8 cm has mass 0.5 kg (moment of inertia $I = ½MR^2$). A constant force 12 N is applied as shown. At the instant shown, the angular velocity of the disk is 25 radians/s in the $-z$ direction (where $+x$ is to the right, $+y$ is up, and $+z$ is out of the page, toward you). The length of the string d is 16 cm.



At this instant, what are the magnitude and direction of the angular momentum about the center of the disk?

$|\vec{L}_{CM}|$ = 0.04 kg · m^2/s Direction: -z

What are the magnitude and direction of the torque on the disk, about the center of mass of the disk?

$|\vec{\tau}_{CM}|$ = 0.96 N · m Direction: -z

The string is pulled for 0.3 s. What are the magnitude and direction of the angular impulse $\vec{\tau}_{CM}\Delta t$ applied to the disk during this time?

$|\vec{\tau}_{CM}|\Delta t$ = 0.288 N · m · s Direction: -z

After the torque has been applied for 0.3 s, what are the magnitude and direction of the angular momentum about the center of the disk?

0.328 kg · m^2/s Direction: -z

At this later time, what are the magnitude and direction of the angular velocity of the disk?

205 rad/s Direction: -z

- *Read the eBook*
- Section 11.6

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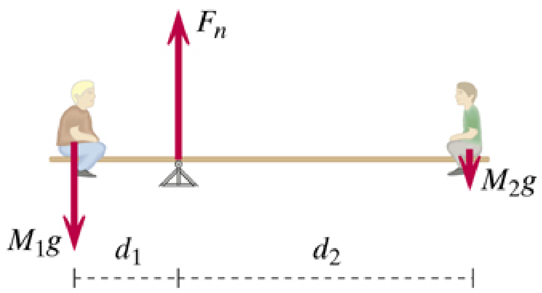
4. 7/7 points | Previous Answers MI3 11.8.X.071

Two people of different masses sit on a seesaw. M_1, the mass of person 1, is 91 kg, M_2 is 43 kg, d_1 = 0.8 m, and d_2 = 1.3 m. The mass of the board is negligible.



(a) What is the magnitude of the torque about the pivot (location *A*) due to the gravitational force on person 1?

$|\tau_{A,1}|$ = 713.44 ✓ N · m

(b) What is the direction of this torque?

- ○ ⊗ Into the screen
- ◉ ⊙ Out of the screen
- ○ The torque is zero - no direction

✓

(c) What is the magnitude of the torque about location *A* due to the gravitational force on person 2?

$|\tau_{A,2}|$ = 547.82 ✓ N · m

(d) What is the direction of this torque?

- ◉ ⊗ Into the screen
- ○ ⊙ Out of the screen
- ○ The torque is zero - no direction

✓

(e) Since at this instant the linear momentum of the system may be changing, we don't know the magnitude of the "normal" force exerted by the pivot. Nonetheless, it is possible to calculate the torque due to this force. What is the magnitude of the torque about location *A* due to the force exerted by the pivot on the board?

$|\tau_{A,\text{pivot}}|$ = 0 ✓ N · m

(f) What is the direction of this torque?

- ○ ⊗ Into the screen
- ○ ⊙ Out of the screen
- ◉ The torque is zero - no direction

✓

(g) What is the magnitude of the net torque on the system (board + people)?

$|\tau_{A,net}|$ = 165.62 N · m

(h) Because of this net torque, what will happen?

- ○ The seesaw will begin to rotate clockwise
- ● The seesaw will begin to rotate counterclockwise
- ○ The seesaw will not move.

(i) Person 2 moves to a new position, in which the magnitude of the net torque about location *A* is now 0, and the seesaw is balanced. What is the new value of d_2 in this situation?

d_2 = 1.693 m

- *Read the eBook*
- Section 11.8

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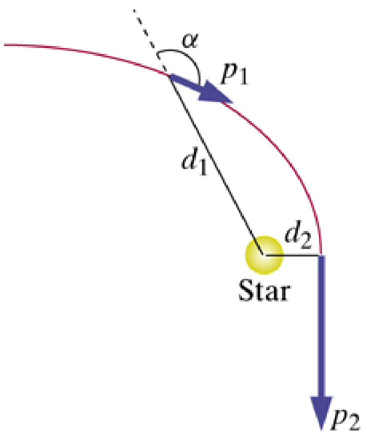
5. 2/2 points | Previous Answers MI3 11.4.P.050



A small rock passes a massive star, following the path shown in red on the diagram above. When the rock is a distance 3.6e+13 m (indicated as d_1 on the diagram) from the center of the star, the magnitude of its momentum p_1 is 1.2e+17 kg · m/s, and the angle α is 128 degrees. At a later time, when the rock is a distance d_2 = 1.08e+13 m from the center of the star, it is heading in the -*y* direction. There are no other massive objects nearby.

What is the magnitude of the momentum p_2?

p_2 = 3.152e17 kg · m/s

- *Read the eBook*

- Section 11.4