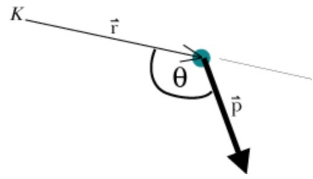
What are the magnitude and direction of the angular momentum about location K, for the object shown below? The magnitude of the object's momentum $|\vec{p}| = 9$ kg · m/s, the distance $|\vec{r}| = 0.3$ m, and the angle $\theta = 150$ degrees.



$|\vec{L}_K| =$ ______ kg · m²/s

$$\vec{L}_{trans\,K} = \vec{r}_K \times \vec{p}$$

$$|\vec{L}_{trans\,K}| = |\vec{r}_K||\vec{p}|\sin(\theta)$$

$$= 1.35\ kg\,\frac{m^2}{s}$$

At a particular instant the location of an object relative to location A is given by the vector $\vec{r}_A = \langle 7, 8, 0\rangle$ m. At this instant the momentum of the object is $\vec{p} = \langle -12, 12, 0\rangle$ kg · m/s. What is the angular momentum of the object about location A? (Express your answer in vector form.)

$\vec{L}_A =$ ______ kg · m²/s

$$\vec{L}_{trans\,K} = \vec{r}_K \times \vec{p}$$

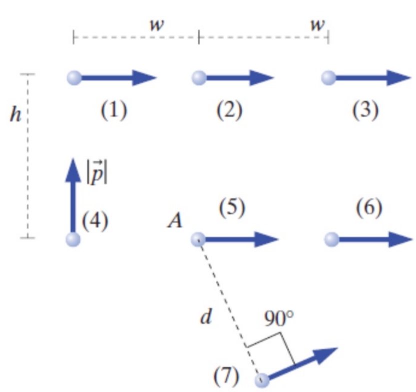
Use the vector cross product full equation

$$= \langle 0, 0, 180\rangle$$

The figure below shows seven particles, each with the same magnitude of momentum $|\vec{p}| = 26$ kg · m/s but with different directions of momentum and different positions relative to location A. The distances shown in the diagram have these values: $w = 15$ m, $h = 30$ m, and $d = 25$ m.

Calculate the z component of angular momentum L_{Az} for each particle (x to the right, y up, z out of the page). Make sure you give the correct sign.

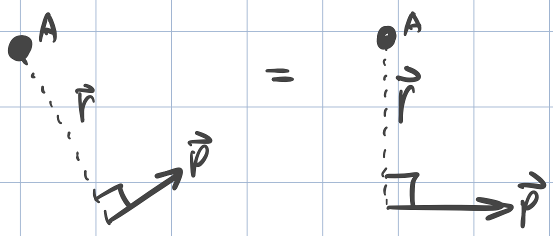
$L_{Az,1} =$ ______ kg · m²/s
$L_{Az,2} =$ ______ kg · m²/s
$L_{Az,3} =$ ______ kg · m²/s
$L_{Az,4} =$ ______ kg · m²/s
$L_{Az,5} =$ ______ kg · m²/s
$L_{Az,6} =$ ______ kg · m²/s
$L_{Az,7} =$ ______ kg · m²/s



$L_{trans\,A\,z} = r_x p_y - r_y p_x$

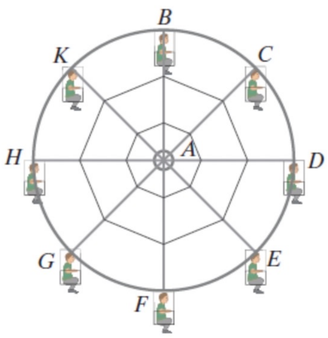
1.) -780
2.) -780
3.) -780
4.) -390
5.) 0
6.) 0

7.)



650

A common amusement park ride is a Ferris wheel (see figure below, which is not drawn to scale). Riders sit in chairs that are on pivots so they remain level as the wheel turns at a constant rate. A particular Ferris wheel has a radius of 26 meters, and it makes one complete revolution around its axle (at location *A*) in 21 s. In all of the following questions, consider location *A* (at the center of the axle) as the location around which we will calculate the angular momentum. At the instant shown in the diagram, a child of mass 32 kg, sitting at location *F*, is traveling with velocity ⟨7.9, 0, 0⟩ m/s. (Assume that the +*x* axis is to the right, the +*y* axis is up along the page, and the +*z* axis is out of the page.)



(a) What is the linear momentum of the child? (Express your answer in vector form.)

$\vec{p}$ = ______ kg · m/s

(b) In the definition $\vec{L} = \vec{r} \times \vec{p}$, what is the vector $\vec{r}$? (Express your answer in vector form.)

$\vec{r}$ = ______ m

(c) What is $\vec{r}_\perp$? (Express your answer in vector form.)

$\vec{r}_\perp$ = ______ m

(d) What is the magnitude of the angular momentum of the child about location *A*?

______ kg · m^2/s

(e) What is the plane defined by $\vec{r}$ and $\vec{p}$ (that is, the plane containing both of these vectors)?

- the yz plane
- the xz plane
- the xy plane

(f) Use the right-hand rule to determine the z component of the angular momentum of the child about location A.

[ ] $kg \cdot m^2/s$

(g) You used the right-hand rule to determine the z component of the angular momentum, but as a check, calculate in terms of position and momentum: What is xp_y? What is yp_x? Therefore, what is the z component of the angular momentum of the child about location A?

xp_y = [ ] $kg \cdot m^2/s$

yp_x = [ ] $kg \cdot m^2/s$

L_z = [ ] $kg \cdot m^2/s$

(h) The Ferris wheel keeps turning, and at a later time, the same child is at location E, with coordinates $\langle 18.385, -18.385, 0 \rangle$ m relative to location A, moving with velocity $\langle 5.586, 5.586, 0 \rangle$ m/s. Now what is the magnitude of the angular momentum of the child about location A?

[ ] $kg \cdot m^2/s$

Part A

$$\vec{p} = m\vec{v}$$

$$= \langle 252.8, 0, 0 \rangle \, kg \frac{m}{s}$$

Part B

$$\vec{r} = \langle 0, -26, 0 \rangle \, m$$

Part C

$$\vec{r}_\perp = \langle 0, -26, 0 \rangle \, m$$

Part D

$$|\vec{L}| = |\vec{p}||\vec{r}| \sin(\theta)$$

$$= pr$$

$$= 6572.8 \, kg \frac{m^2}{s}$$

Part F

$$\vec{L}_z = 6572.8 \text{ kg} \frac{m^2}{s}$$

Part G

$$x p_y = 0$$

$$y p_x = -6572.8 \text{ kg} \frac{m^2}{s}$$

$$L_z = 6572.8 \text{ kg} \frac{m^2}{s}$$

Part H

$$|\vec{L}| = 6572.8 \text{ kg} \frac{m^2}{s}$$