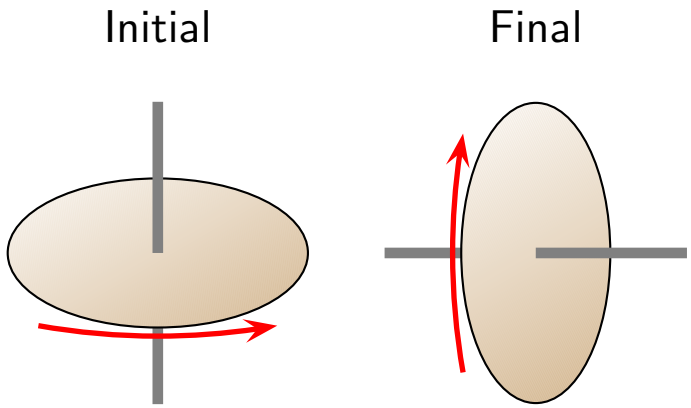
Question 1

A wheel rotates at a constant rate but the axis of rotation changes. The arrows indicate the motion of the edge closest to the viewer.



Which of the following best describes the angular velocity vectors?

1. $\vec{\omega}_i \rightsquigarrow \uparrow \quad \vec{\omega}_f \rightsquigarrow \uparrow$
2. $\vec{\omega}_i \rightsquigarrow \rightarrow \quad \vec{\omega}_f \rightsquigarrow \uparrow$
3. $\vec{\omega}_i \rightsquigarrow \uparrow \quad \vec{\omega}_f \rightsquigarrow \rightarrow$
4. $\vec{\omega}_i \rightsquigarrow \uparrow \quad \vec{\omega}_f \rightsquigarrow \leftarrow$
5. $\vec{\omega}_i \rightsquigarrow \downarrow \quad \vec{\omega}_f \rightsquigarrow \rightarrow$
6. $\vec{\omega}_i \rightsquigarrow \downarrow \quad \vec{\omega}_f \rightsquigarrow \leftarrow$

Question 2

Let $\hat{\mathrm{i}}$ denote a unit vector along the x axis, $\hat{\mathrm{j}}$ a unit vector along the y axis, and $\hat{\mathrm{k}}$ denote a unit vector along the z axis. Suppose that

$$\vec{\mathrm{A}} = 3\hat{\mathrm{i}}$$
$$\vec{\mathrm{B}} = 2\hat{\mathrm{j}}$$

Which of the following is true?

1. $\vec{\mathrm{A}} \times \vec{\mathrm{B}} = 0.$
2. $\vec{\mathrm{A}} \times \vec{\mathrm{B}} = 6\hat{\mathrm{i}}.$
3. $\vec{\mathrm{A}} \times \vec{\mathrm{B}} = 6\hat{\mathrm{i}} + 6\hat{\mathrm{j}}.$
4. $\vec{\mathrm{A}} \times \vec{\mathrm{B}} = 6\hat{\mathrm{k}}.$
5. $\vec{\mathrm{A}} \times \vec{\mathrm{B}} = -6\hat{\mathrm{k}}.$

Question 3

Let $\hat{\mathrm{i}}$ denote a unit vector along the x axis, $\hat{\mathrm{j}}$ a unit vector along the y axis, and $\hat{\mathrm{k}}$ denote a unit vector along the z axis. Suppose that

$$\vec{\mathrm{A}} = 3\hat{\mathrm{i}}$$

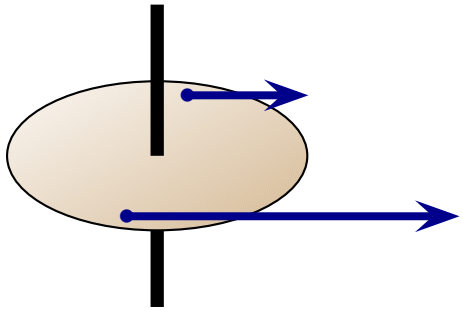
$$\vec{\mathrm{B}} = 2\hat{\mathrm{j}}$$

Which of the following is true?

1. $\vec{\mathrm{B}} \times \vec{\mathrm{A}} = \vec{\mathrm{A}} \times \vec{\mathrm{B}}$
2. $\vec{\mathrm{B}} \times \vec{\mathrm{A}} = -\vec{\mathrm{A}} \times \vec{\mathrm{B}}$
3. $\vec{\mathrm{B}} \times \vec{\mathrm{A}}$ and $\vec{\mathrm{A}} \times \vec{\mathrm{B}}$ have different magnitudes.
4. None of the above.

Question 4

A circular wheel is oriented as illustrated. Two forces, with vectors drawn to scale act on opposite sides of the wheel.



Which of the following best describes the net torque (about the center) on the disk?

1. Positive.
2. Negative.
3. $\rightarrow$
4. $\uparrow$
5. $\downarrow$