

Diagram of a rectangular object B. The object is a rectangle with width L and height L . It is pivoted at the top-left corner, labeled "Pivot". A coordinate system is shown with the origin O at the bottom-left corner of the rectangle. The x -axis is horizontal and the y -axis is vertical. The pivot is at the top-left corner, so its coordinates are $(0, L)$. The width L is indicated by a horizontal arrow from the y -axis to the right edge. The height L is indicated by a vertical arrow from the x -axis to the pivot point.

(b) Determine the following for the given coordinate system shown in the figure.

- ii. The y-coordinate of the center of mass of object B

Use a pencil or pen with black or dark blue ink only. Do NOT write your name. Do NOT write outside the box.

Object B has a rotational inertia of I_B about its pivot.

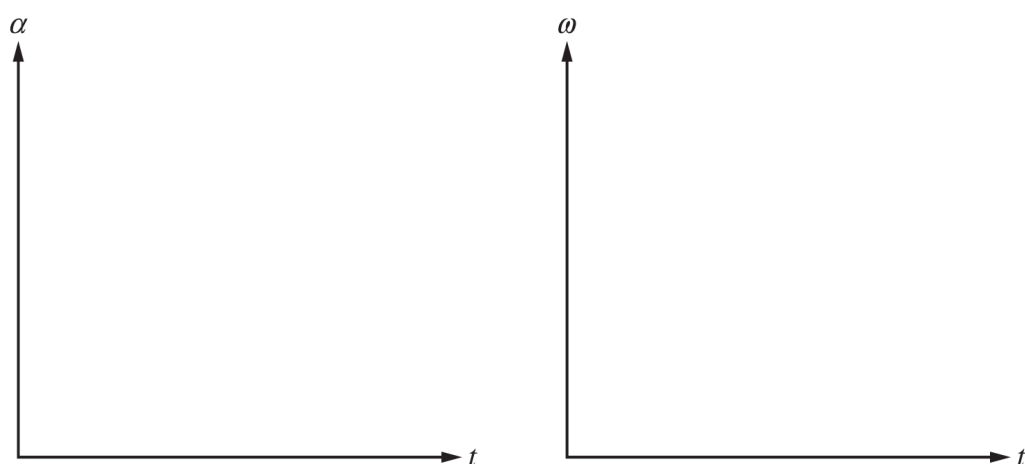
(c) Is the value of I_B greater than, less than, or equal to I_A ?

_____ Greater than _____ Less than _____ Equal to

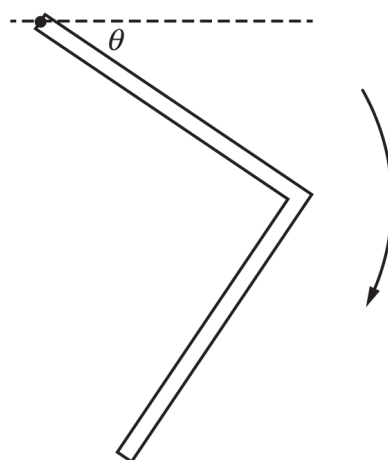
Justify your answer.

Object B is released from rest and begins to rotate about its pivot.

(d) On the axes below, sketch graphs of the magnitude of the angular acceleration α and the angular speed ω of object B as functions of time t from the time it is released to the time its center of mass reaches its lowest point.



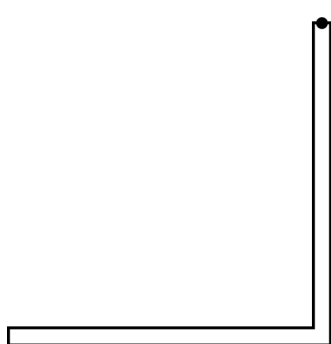
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(e) While object B rotates from the horizontal position down through the angle θ shown above, is the magnitude of its angular acceleration increasing, decreasing, or not changing?

_____ Increasing _____ Decreasing _____ Not changing

Justify your answer.



Object B rotates through the position shown above.

(f) Derive an expression for the angular speed of object B when it is in the position shown above. Express your answer in terms of M , L , I_B , and physical constants, as appropriate.

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