A small bead of mass \( m \) is constrained to slide without friction inside a circular vertical hoop of radius \( r \) which rotates about a vertical axis at angular speed \( \omega \).

(a) Show that the angle \( \theta \), where the bead will have no tendency to move up or down along the hoop, is given by the following expression:

\[
\theta = \cos^{-1}\left(\frac{g}{\omega^2 r}\right).
\]

(b) If \( \omega = 8.0\pi \text{ rad/s} \) and \( r = 0.20 \text{ m} \), what is \( \theta \)?

(c) Can the bead ride as high as the center of the circle (\( \theta = 90^\circ \))?
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