SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

A cone with $\alpha = 40.0^\circ$ is rotating about the $y$ axis with an angular velocity of $\omega = 3.00$ rad/s. Calculate the range of heights ($y_{\text{min}}$, $y_{\text{max}}$) where you can place a block of mass $M = 3.50$ kg so that it would stay there (that is, it would not slide up or down).

$\mu_k = 0.41$
$\mu_s = 0.35$

\[
\begin{align*}
\Sigma F_x &= \sum m v^2 \div r = m r \omega^2 \\
\Sigma F_y &= 0 \\
(1) & \quad F_s \sin \theta - N \cos \theta = -m r \omega^2 \\
(2) & \quad F_s \cos \theta - m g + N \sin \theta = 0 \\
F_s &= N_\perp \\
(1) & \quad N = \frac{m g}{N_\perp \cos \theta + \sin \theta} \\
(2) & \quad N \left( \mu_s \sin \theta - \cos \theta \right) = -m r \omega^2 \\
\end{align*}
\]

For having not slide up $F_\perp \leq F_s$

\[
\begin{align*}
\Gamma = \frac{y}{\min} & \quad \frac{m g \sin \theta + \cos \theta}{N_\perp \cos \theta + \sin \theta} = \frac{g \times m^2}{(3.00)^2 \times \frac{0.41 \sin 40^\circ + 0.40 \cos 40^\circ}{0.41 \cos 40^\circ + 0.40 \sin 40^\circ}} \\
\Gamma \geq \frac{y}{\max} & \quad \frac{m g \sin \theta + \cos \theta}{N_\perp \cos \theta + \sin \theta} = 3.41 \\
2 \tan 40 & \leq \frac{y}{\min} \quad y_{\min} = \frac{r \tan 40}{\tan 40} = 2.68 \\
y_{\max} & \leq \frac{r \tan 40}{\tan 40} = 4.06 \\
\end{align*}
\]