A 0.250 kg ball is tied to a tall pole with a 1.40 rope. The ball is then thrown so it rotates in a horizontal circle, i.e., the plane of the circle is parallel to the ground at constant speed. The rope make an angle of 40.0° with respect to the pole. See figure.

A. \[ \mathbf{F} \] On the figure to the right, draw all the visual forces the ball feels.

B. \[ \text{What is the radius of the circular path in which the ball travels?} \]
\[ R = L \sin 40° = (1.40 \text{ m}) \sin 40° = 0.890 \text{ m} \]

C. \[ \text{What is the speed of the ball?} \]
\[ \begin{align*}
\frac{T \cos 40°}{m} &= \frac{m v^2}{R} \\
v &= \sqrt{\frac{8T}{\cos 40°}} = \sqrt{\frac{8 \times 2.785 \text{ N}}{0.707}} \quad \text{Tan 40°} \\
v &= 2.73 \text{ m/s}
\end{align*} \]

D. \[ \text{What is the tension in the rope?} \]
\[ \begin{align*}
\frac{T}{\cos 40°} &= \frac{m v^2}{R} \\
T &= \frac{m v^2}{R \cos 40°} = \frac{(0.250 \text{ kg})(2.73 \text{ m/s})^2}{(0.890 \text{ m}) \cos 40°} \\
T &= 3.00 \text{ N}
\end{align*} \]

E. \[ \text{How much work is done by the tension the ball feels during one complete rotation of the ball?} \]

Since \( T \cdot L \cdot 3 \) and each tiny displacement of ball around circumference is parallel to \( q \), it is also along \( L \) in all the way around.

\[ W_T = 0 \]