A. [20 pts.] Two large crates (m₁ = 120 kg, m₂ = 180 kg) are hung by strong massless cables as shown in the drawing. A tension applied to the upper cable of T = 3.60 x 10³ N accelerates this load upward. Find (1) the upward acceleration of the two-crate load, and (2) the tension in the cable between the upper and lower crates.

\[ W₁ = m₁g = 1176 N \]
\[ W₂ = m₂g = 1764 N \]

For \( m₁ \)
\[ T - W₁ - T₁₁ = m₁a \] (1)

For \( m₂ \)
\[ T₁₁ - W₂ = m₂a \] (2)

Add Equations
\[ T - (W₁ + W₂) = (m₁ + m₂)a \]
\[ a = \frac{3.6 \times 10^3 N - (1176 N + 1764 N)}{3002} \]
\[ a = 2.30 m/s² \] - use Eq. (2)

\[ T₁₁ = m₂a + W₂ = \left( \frac{180 Lb}{2.3 m/s²} \right) + 1764 N \]
\[ T₁₁ = 2160 N \]

B. A youngster is twirling a 0.110 kg ball on a string in a horizontal circle of radius 0.360 m. The ball travels once around the circle in 1.24 s.

1. [6 pts.] What is the constant speed of the ball as it travels around the circle?
\[ v = \frac{2\pi R}{T} = \frac{(2\pi)(0.36 m)}{1.24 s} = 1.82 m/s \]

2. [6 pts.] Find the centripetal force on the ball.
\[ F_c = \frac{mV^2}{R} = \frac{(0.110)(1.82 m/s)^2}{0.36 m} = 1.02 N \]

3. [10 pts.] What is the tension on the string? 
Couple or ways to do this or
\[ T \cos \theta = mgs \]
\[ T \sin \theta = \frac{F_c}{m} \]
\[ T \cos \theta = \frac{1.02 N}{110 Lb} = 0.368 m/s² \]
\[ \tan \theta = \frac{1.02 N}{110 Lb} = 0.434 \]
\[ \theta = \tan^{-1} (0.434) = 24.2° \]