A. A 10.0 kg block and a 20.0 kg block are sitting on a horizontal surface and are connected by a massless string as shown in the drawing. The coefficient of kinetic friction between both blocks and the surface is $\mu_k = 0.650$. A force of $\vec{F} = 238.0 \, \text{N}$ is applied to the right block as shown.

1. [16 pts.] What is the acceleration of this two-body system?

   For $m_1$: $T - f_{k1} = m_1 a$
   For $m_2$: $F - T - f_{k2} = m_2 a$

   Add $F - f_{k1} - f_{k2} = (m_1 + m_2) a$

   
   $a = \frac{F - f_{k1} - f_{k2}}{m_1 + m_2} = \frac{238 \, \text{N} - 63.7 \, \text{N} - 13 \, \text{N}}{30 \, \text{kg}}$

   $a = 1.50 \, \text{m/s}^2$

2. [8 pts.] What tension exists in the string connecting the two blocks?

   $T = m_1 a + f_{k1} = (10 \, \text{kg})(1.50 \, \text{m/s}^2) + 63.7 \, \text{N}$

   $T = 78.7 \, \text{N}$

B. A "swing" ride at Lagoon consists of chairs that are swinging in a circle by 15.0 m cables which are attached to a vertical rotating pole. Take the mass of the chair and its contents to be 88.0 kg.

1. [12 pts.] What is the tension in the cable?

   $T \cos 60^\circ = mg$

   $T = \frac{(88 \, \text{kg})(9.8 \, \text{m/s}^2)}{\cos 60^\circ} = 1720 \, \text{N}$

   $T = 1720 \, \text{N}$

2. [12 pts.] What is the speed of the chair?

   $T \sin \theta = \frac{mv^2}{R}$

   $v = \sqrt{\frac{R \sin 60^\circ}{m}}$

   $v = \sqrt{\frac{15 \, \text{m}}{88 \, \text{kg}}} \sin 60^\circ$

   $v = 14.9 \, \text{m/s}$