----- Problem 1 -----  A block slides down a 27° incline. It is observed to be speeding up. The coefficient of kinetic friction between block and incline is $\mu_k = 0.14$. What is the magnitude of the block’s acceleration?

----- Problem 2 -----  A cord pulls an 8.0 kg block across a floor at constant velocity. The cord makes an angle of 34° to the horizontal. The coefficient of kinetic friction between block and floor is $\mu_k = 0.21$. What is the tension in the cord?

----- Problem 3 -----  A cord pulls on a block of mass $m$ that is at rest on a floor. The tension $F_T$ is not sufficient to initiate sliding. The coord makes an angle of $\theta$ above the horizontal.

- Develop expressions for the static friction force $f_s$ in terms of $F_T$, $m$, $\theta$, and $g$.
- Suppose instead that $F_T$ is at a maximum beyond which the block would slide. Develop an expression for the mass of the crate $m$ in terms of $F_T$, $\theta$, $\mu_s$, and $g$.

→ Heads up for when you tackle the homework problems! This is the setup for problem 6.21. You can view your expression for $m$ as a function of $\theta$ and then use differential calculus to determine which $\theta$ gives the largest $m$.

----- Problem 4 -----  A large 16 kg block rests on a frictionless floor. On top of this block rests a medium 12 kg block. The coefficient of static friction between the blocks is $\mu_s = 0.45$.

- What is the maximum horizontal force that can be applied to the large block where the blocks stay “stuck together” accelerating as one?
- What is the resulting acceleration of the blocks?

Answers
1. $a = 3.227 \text{ m/s}^2$
2. $F_T = 17.40 \text{ N}$
3. $f_s = F_T \cos(\theta)$, $m = F_T \left(\sin(\theta) + \cos(\theta)/\mu_s\right)/g$
4. $F_{app} = 123.5 \text{ N}$, $a = 4.41 \text{ m/s}^2$