1. A wooden box to be filled with sand sits on a flat concrete floor. Once the box is filled it will be moved with a cable attached to its side. The cable is reliable for tensions upto 1100N but may snap if the tension in it exceeds this value. The coefficent of static friction between wood and concrete is 0.62.
   (a) The amount that can be pulled will depend on the angle the cable is pulled at. What is the best angle to pull this crate at? That is what angle will allow the most sand to be pulled safely?
   (b) What is the most the crate/sand combination can weigh?
2. Because of your physics background, you have been able to get a job with a company devising stunts for an upcoming adventure movie being shot in Pittsburgh.
   In the script, the hero has been fighting the villain on the top of the locomotive of a train going down a straight horizontal track at 20 mph. He has just snuck on the train as it passed over a river so he is wearing his rubber wet suit. During the fight, the hero slips and hangs by his fingers on the top edge of the front of the locomotive. The locomotive has a smooth steel front face sloped at 20^o from the vertical so that the bottom of the front is more forward that the top. Now the villain stomps on the hero's fingers so he will be forced to let go and slip down the front of the locomotive and be crushed under its wheels. Meanwhile, the hero's partner is at the controls of the locomotive trying to stop the train. To add to the suspense, the brakes have been locked by the villain. It will take her 10 seconds to open the lock. To her horror, she sees the hero's fingers give way before she can get the lock off. Since she is the brains of the outfit, she immediately opens the throttle causing the train to accelerate forward. This causes the hero to stay on the front face of the locomotive without slipping down giving her time to save the hero's life. The movie company wants to know what minimum acceleration is necessary to perform this stunt. The hero weighs 180 lbs in his wet suit. The locomotive weighs 100 tons. You look in a book giving the properties of materials and find that the coefficient of kinetic friction for rubber on steel is 0.50 and its coefficient of static friction is 0.60.