Take-home Quiz 5--Equilibrium

Problem

1. (20 pts) A 5-meter ladder has a mass of 10 kg. You lean it against a wall so that the base of the ladder is 2.0 m from the wall. The coefficient of friction between the ladder and wall is 0.5. What is the minimum coefficient of friction between the ladder and ground to keep the ladder from sliding? Assume the static frictional are just enough to keep the ladder from sliding. (Let g=10 m/s².)
2. (15 pts) A drawbridge is set up as in this figure. The mass of the actual bridge is 1000 kg, and it is 30 m long. The counterweight, located 3 m from the left end of the bridge, has a mass of 500 kg. The pivot point of the bridge is 10 meters from the left end. The cable, a 50 m long and 5-cm diameter steel cable that runs through a system of pulleys as shown, is connected to the bridge at a point 5 m from the right end.

What is the tension in the cable if the bridge is elevated 20° from the horizontal?
What force is on the bridge at the pivot point?
By what amount does the cable stretch from its original length?
(Let g = 10 m/s².)
3. (15 pts) Consider this bar, which has a mass of 100 kg and a length of 10 m. The bar is suspended by 2 cables, attached as shown to each end. There is a mass (10 kg) hanging 3 m from the left end of the bar. What is the tension in each cable? What is $\theta$?

(Let $g=10 \text{ m/s}^2$.)