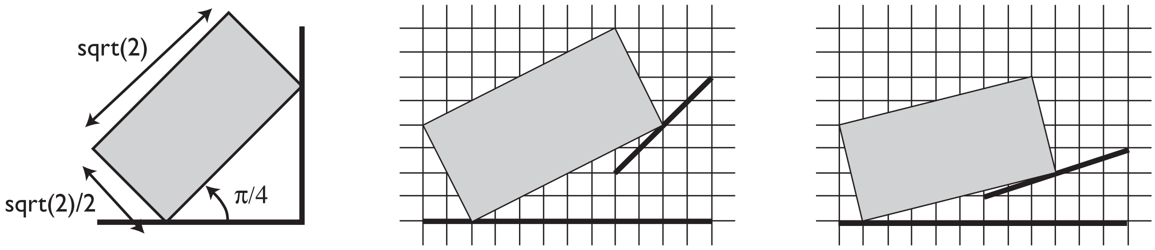
CSCI 4961/6961 Advanced robotics, Spring 2000
Assignment 1, out 1/12/00, due 1/19/00

1. Do exercise 1.2 and either 1.4 or 1.5 from Mason's *Mechanics of Manipulation*.

2. In the diagrams below, a rectangular block is tilted so that one corner contacts the support surface and the other corner contacts a wall (figure (a)) or a "palm" (figure (b)).

   (a) For figure (a), what is the minimum coefficient of friction (μ) required in order for the block to remain in equilibrium, i.e./ not slip? Although it is possible to solve this part using a free body diagram, you should use friction cones and arguments about resultant forces in order to develop insight that will make the rest of this problem simple.

   (b) For figure (b), assume that the coefficient of friction is $\frac{1}{4}$. Does the object slip or remain in equilibrium? Justify your answer.



(a) (b) (c)

3. Suppose you have a yoyo whose mass is 100 grams, moment of inertia (I) is 4×10^{-5} kg m^2, and whose axle is 1 cm in diameter. Suppose there is 1 meter of string wound on the yoyo (excluding the amount that you hold on to). Assume that there is no friction or other loss of energy; that the string is tied to the axle of the yoyo; and that the string pulls straight up from the axle.

   You tie the string to a fixed object and let the yoyo go. What is the period of the yoyo, i.e. how long does it take for it to unwind and then wind again.