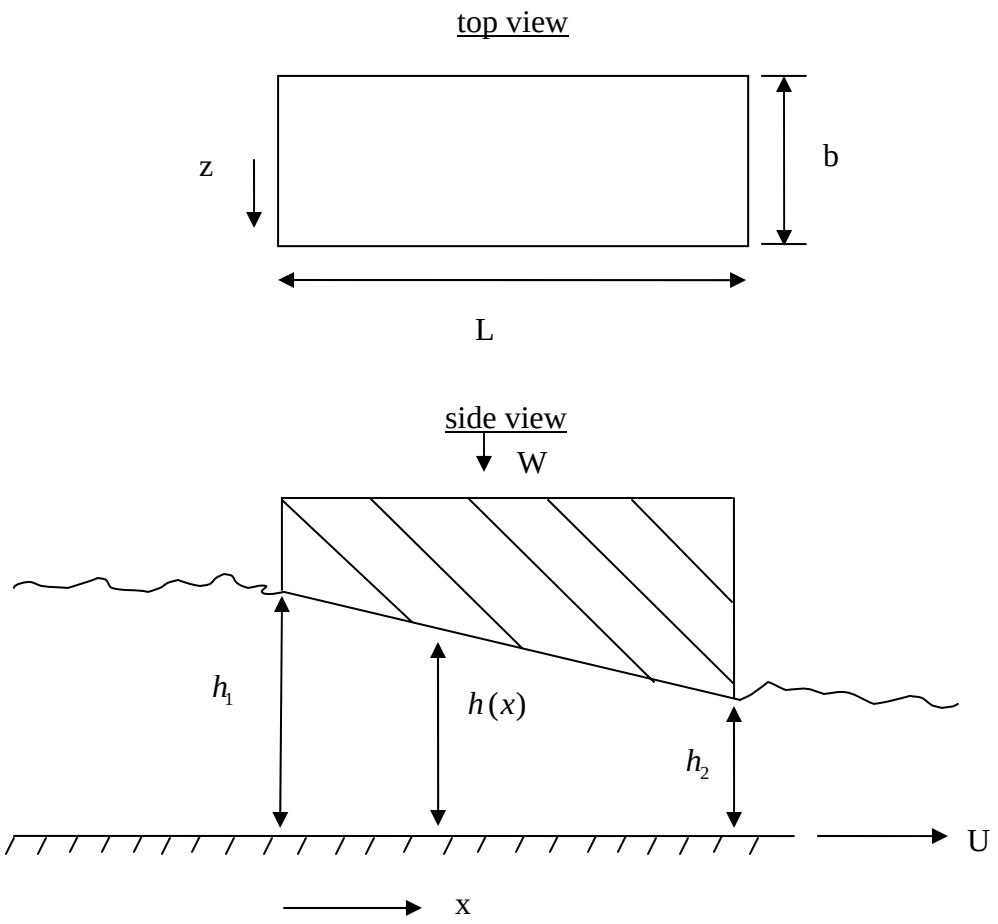
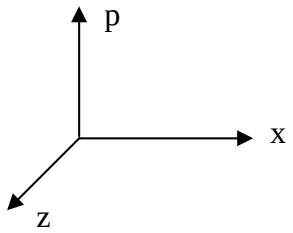
Problem #1



Consider the slider bearing, shown above. The width b is very small compared to length L, so the narrow bearing approximation can be used. Note that the slope of the lower slider surface, $\frac{dh}{dx} = h'$, is a constant.

Starting from the Reynolds equation, find the pressure distribution under the slider as a function of the significant parameters of the problem.

Qualitatively, draw the pressure distribution



Find an expression for the load W supported by the bearing in terms of $m, U, h_1, h_2,$ and b.

Problem #2

One key result of Hertzian contact theory is that

$$a^2 = R\delta \tag{1}$$

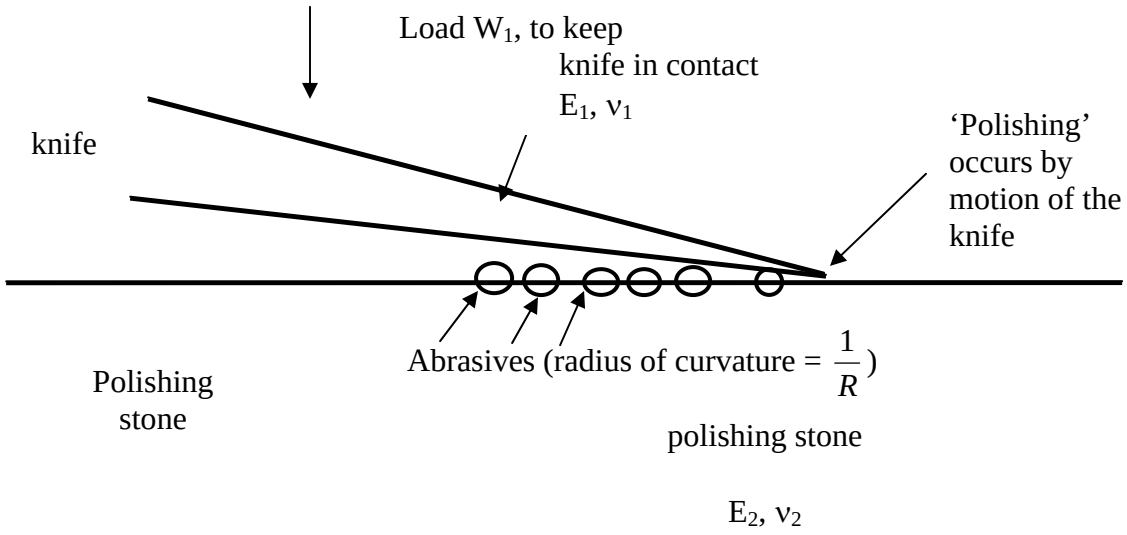
In the Greenwood-Williamson model of rough surface contact, the real area of contact is given by:

$$A_r = \eta A_n \int_d^\infty \pi R(z-d)\phi(z)dz \tag{2}$$

a) Define all parameters in the two equations above.
b) Derive Eq. (2).

Problem #3

This problem asks you to use your knowledge of friction and wear to describe the everyday engineering problem to sharpening a knife. Consider the figure below of a knife being slid on a sharpening stone.



a) First assume no motion and describe the contact pressure.

b) By sliding the knife edge over the stone, the knife is 'polished'. Estimate the amount of material removal by a single spherical abrasive particle.