## Honors Project 0: The Surface Area and Volume of a Manufacturing Tool[1]

A part is to be manufactured by a die casting machine. Molten metal will be injected into a cylinder (see the figure to the right). A piston will push the molten metal up through a small hole in the top of the cylinder into the mold. After the metal cools, the piston will be withdrawn. The piston is to have a dovetailed slot cut in it, so that when it is withdrawn it will cause the newly-formed metal part to break off at the neck of the dovetail. The scrap piece will then be slid out of the dovetailed slot and discarded.
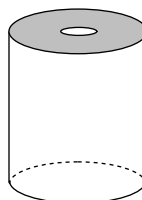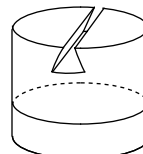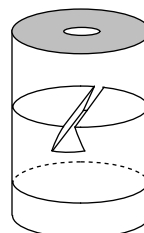
The Cylinder   The Piston

The manufacturing process requires the dimensions of the dovetailed slot to be coordinated with the physical properties of the metal part after it has set (in order that an appropriate force is applied to make the break, and that the break is clean). This coordination requires you to compute the surface area and volume of the dovetailed slot as a function of its dimensions.

Compute:

1. the volume of the dovetailed slot,

2. the surface area of the bottom face of the dovetailed slot,

3. the surface area of each side of the dovetailed slot, and

4. the surface area of each of the two "trapezoidal" areas of the cylinder wall exposed at each end of the dovetailed slot.

as functions of relevant parameters.
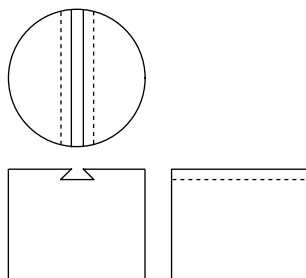
A Schematic of the Piston

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[1]The problem posed in this project was a real problem addressed by its contributor.