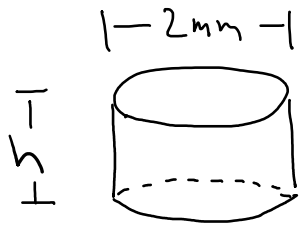
Problem 3

You are using a hole punch to create a hole in multiple sheets of paper at once. It will be a circular hole, 2mm in diameter. Each sheet of paper is .1mm thick, and the paper has a shear strength of 1.5 MPa. If the die can exert a force of 20N on the paper, how many sheets of paper would you expect to be able to punch through at once?

Public Domain Image, no author listed



$$A = \pi d h = \pi (.002m)(h)$$

$$\tau = \frac{V}{A}$$

$$1.5 \times 10^6 \frac{N}{m^2} = \frac{20\,N}{\pi (.002m)(h)}$$

$$h = .00212\,m = 2.12\,mm \rightarrow \boxed{21 \text{ sheets of paper}}$$

.1mm per sheet