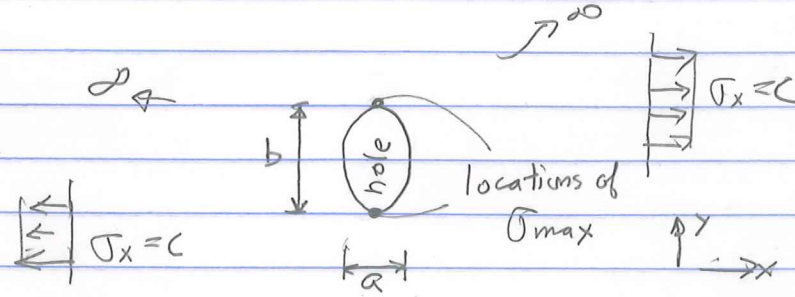
6. Stress concentrations in flat plates (plane stress)
Results below are for linearly elastic, homogeneous, isotropic material. How are these results obtained?

a. Infinite plate with eliptical hole. Uniform far-field stress $\sigma_x = C$.

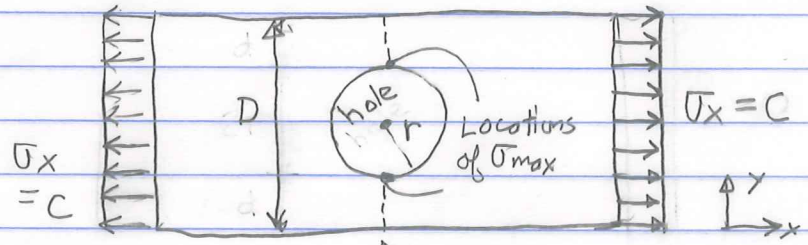


$\sigma_{max} = C\left(1 + 2\frac{b}{a}\right)$

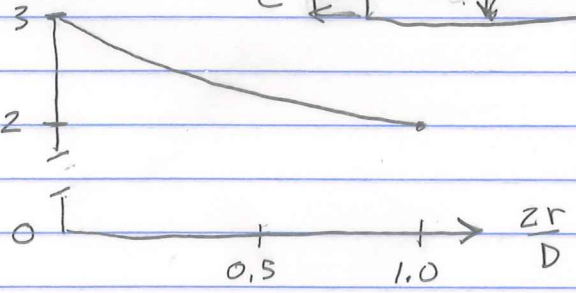
Stress concentration factor $= \frac{\sigma_{max}}{C} = 1 + 2\frac{b}{a} = 3$ for circular hole
↑ K

$\to \infty$ as $a \to 0$ (sharp crack)

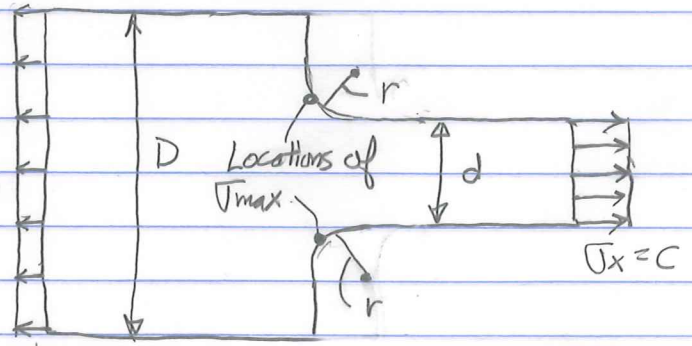
b. Finite width plate with circular hole. Uniform far-field stress $\sigma_x = C$.



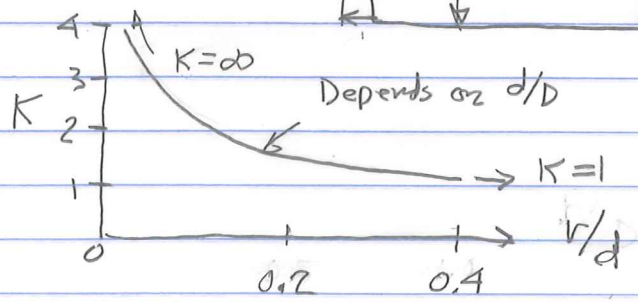
$K = \frac{\sigma_{max}}{\sigma_{av}}$



c. Plate with width variation and fillets. Uniform far-field stresses to the right ($\sigma_x = C$ and to the left ($\sigma_x = C\frac{d}{D}$).



$K = \frac{\sigma_{max}}{C}$



K=∞ occurs for a sharp transition (r = 0)