F8. A wing is to have an elliptic circulation distribution.

$$\Gamma(y) = \Gamma_0 \sqrt{1 - \left(\frac{2y}{b}\right)^2}$$

The planform is to be a straight taper, with root and tip chords defined in terms of the average chord c_{avg} and the *taper ratio* $r = c_t/c_r$.

$$c_r = c_{\text{avg}} \frac{2}{1+r} \qquad\qquad c_t = c_{\text{avg}} \frac{2r}{1+r}$$

a) Define the chord distribution $c(y)$ in terms of c_{avg} and r. Assuming $c_{\text{avg}}/b = 0.125$, draw the planforms for $r = 0.75, 0.5, 0.25$.

b) Determine the spanwise $c_\ell(y)$ distribution, and plot for $r = 0.75, 0.5, 0.25$.
Note: Only the <u>shape</u> of the $c_\ell(y)$ curve is of interest. All scaling constants like Γ_0, c_{avg}, etc. can be set to <u>unity</u> for plotting purposes.

c) Local stall is obviously undesirable. If the airfoil is the same across the span, which taper ratio appears to be most attractive for the purpose of giving the largest stall margin everywhere on the wing?