Principal stresses

$$[\underline{\underline{\sigma}}] = \begin{pmatrix} 2 & 10 & 0 \\ 10 & 0 & 8 \\ 0 & 8 & 0 \end{pmatrix}_{(\underline{e}_1, \underline{e}_2, \underline{e}_3)} \rightarrow$$ Matrix-like representation of tensor $\underline{\underline{\sigma}}$ in the basis $(\underline{e}_1, \underline{e}_2, \underline{e}_3)$

Then:

▷ **Searching for eigenvalues:**

$$\det(\underline{\underline{\sigma}} - \lambda \underline{\underline{1}}) = 0 \rightsquigarrow \begin{vmatrix} 2-\lambda & 10 & 0 \\ 10 & -\lambda & 8 \\ 0 & 8 & -\lambda \end{vmatrix} = 0$$

solve for the characteristic equation:

Make sure you know how to calculate a characteristic equation by hand:

$$(2-\lambda)(\lambda^2 - 64) + 100\lambda = 0 \rightsquigarrow \boxed{-\lambda^3 + 2\lambda^2 + 164\lambda - 128 = 0}$$

$$\boxed{3 \text{ eigenvalues: } \lambda_I = -12{,}246 \,/\, \lambda_{II} = 0{,}776 \,/\, \lambda_{III} = 13.470}$$

▷ **Searching for eigenvectors:**

Remember, $\underline{P}_I$ is associated with λ_I if $\underline{\underline{\sigma}} \cdot \underline{P}_I = \lambda_I \underline{P}_I$

so $\underline{P}_I$ is a solution of $(\underline{\underline{\sigma}} - \lambda_I \underline{\underline{1}}) \cdot \underline{P}_I = \underline{0}$.

and by convention we always take $\|\underline{P}\| = 1$.