$$A-\lambda I=\begin{bmatrix}3 & -1\\ 4 & -2\end{bmatrix}-\begin{bmatrix}\lambda & 0\\ 0 & \lambda\end{bmatrix}=\begin{bmatrix}3-\lambda & -1\\ 4 & -2-\lambda\end{bmatrix}$$

$$A\vec{x}=\lambda\vec{x}$$
$$(A-\lambda I)\vec{x}=\vec{0}$$
$$B\vec{x}=\vec{0}$$

$$\det(A-\lambda I)=(3-\lambda)(-2-\lambda)-(4)(-1)$$
$$=-6-\lambda+\lambda^2+4$$
$$=\lambda^2-\lambda-2$$
$$=(\lambda-2)(\lambda+1)$$

$\det(A-\lambda I)=0$ implies

$\lambda=2,-1$

$\lambda_1=2,\ \lambda_2=-1$

$$A-\lambda I=\begin{bmatrix}3 & -1\\ 4 & -2\end{bmatrix}-\begin{bmatrix}\lambda & 0\\ 0 & \lambda\end{bmatrix}=\begin{bmatrix}3-\lambda & -1\\ 4 & -2-\lambda\end{bmatrix}$$

$\lambda_1=2$: $A-\lambda I$ is $\begin{bmatrix}1 & -1\\ 4 & -4\end{bmatrix}$ solve $(A-\lambda I)\vec{x}=\vec{0}$

$$\begin{bmatrix}1 & -1\\ 4 & -4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}=\begin{bmatrix}0\\ 0\end{bmatrix} \quad \vec{x}_1=\begin{bmatrix}1\\ 1\end{bmatrix}$$

$\lambda_2=-1$: $A-\lambda I=\begin{bmatrix}4 & -1\\ 4 & -1\end{bmatrix}$

$$\begin{bmatrix}4 & -1\\ 4 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}=\begin{bmatrix}0\\ 0\end{bmatrix} \quad \vec{x}_2=\begin{bmatrix}1\\ 4\end{bmatrix}$$

$$P = \begin{bmatrix} 1 & 1 \\ 1 & 4 \end{bmatrix} \Longrightarrow P^{-1} = \frac{1}{3}\begin{bmatrix} 4 & -1 \\ -1 & 1 \end{bmatrix} \quad A = \begin{bmatrix} 3 & -1 \\ 4 & -2 \end{bmatrix}$$

$$P^{-1}AP = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$$

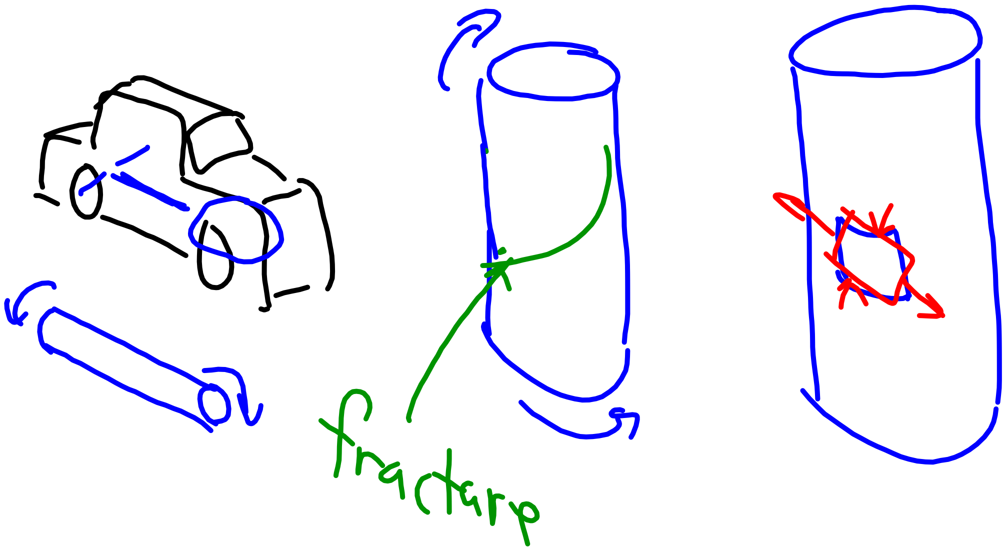
$$\boxed{D = P^{-1}AP}$$

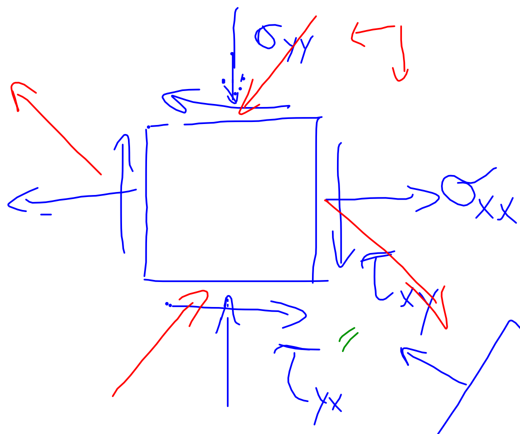
$$PD = PP^{-1}AP$$

$$PD = AP$$

$$PDP^{-1} = APP^{-1}$$

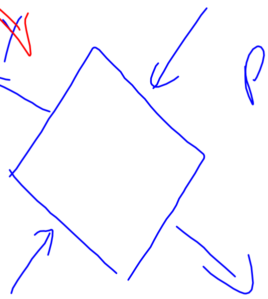
$$\boxed{PDP^{-1} = A}$$


fractarp

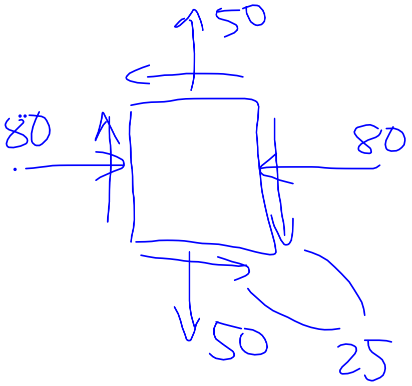


$$\begin{bmatrix}\sigma_{xx} & \tau_{xy}\\ \tau_{yx} & \sigma_{yy}\end{bmatrix}$$

Principal stresses



shear

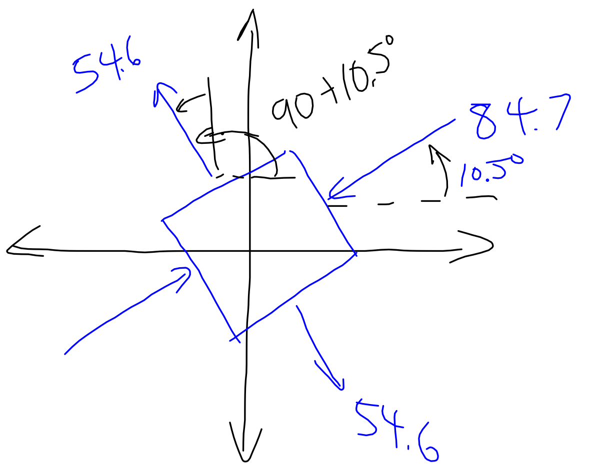


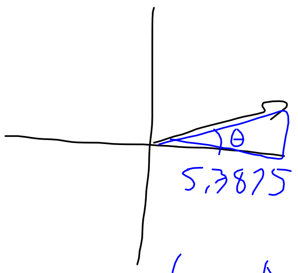
$$\begin{bmatrix} -80 & -25 \\ -25 & 50 \end{bmatrix} = A$$

Eigenvalues/vectors:

$\lambda = -84.66$, $\vec{x} = \begin{bmatrix} 5.3857 \\ 1 \end{bmatrix}$

$\lambda = 54.6$, $\vec{x} = \begin{bmatrix} -0.1857 \\ 1 \end{bmatrix}$





$$\begin{bmatrix} 5.3857 \\ 1 \end{bmatrix}$$

$$\tan\theta = \frac{1}{5.3875}$$

$$\theta = \tan^{-1}\left(\frac{1}{5.3875}\right)$$

$$= 10.5°$$

$$\begin{bmatrix} \sigma_{xx} & \tau_{xy} & \tau_{xz} \\ \tau_{yx} & \sigma_{yy} & \tau_{yz} \\ & & \sigma_{zz} \end{bmatrix}$$