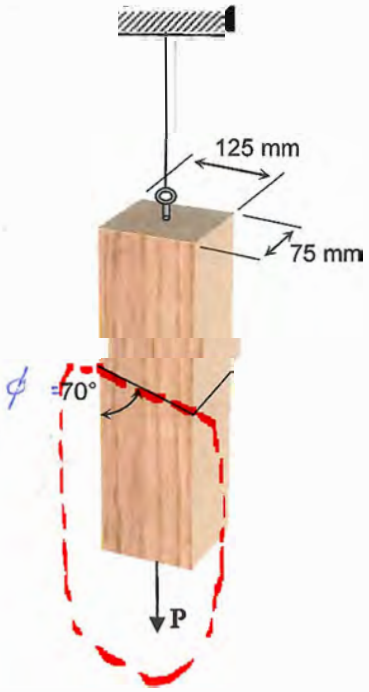
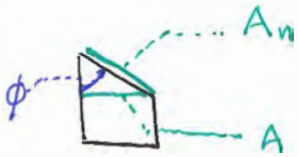
Example

A 6-kN load **P** is applied to two wooden members with a rectangular cross section. The two members are joined by a glued scarf splice as shown in the figure. Find the normal and shearing stresses in the splice.





FBD SECTION BELOW SPLICE

$\nearrow \sum F_x = 0$

$N - P\sin\phi = 0$

$N = P\sin\phi$

$= 6\,kN \cdot \sin(70°)$

$= 5.638\,kN$

$\nwarrow \sum F_y = 0$

$V - P\cos\phi = 0$

$V = P\cos\phi$

$= 6\,kN \cdot \cos(70°) = 2.052\,kN$

STRESSES:

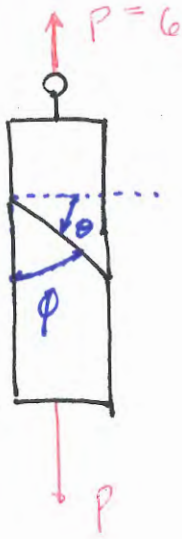
$$\sigma = \frac{N}{A_n} = \frac{N}{A/\sin\phi} = \frac{N\cdot\sin\phi}{A} = \frac{(5.638)\sin(70°)}{(.125)(.075)\,m^2}$$

$= 565\ kN/m^2 = \boxed{565\ kPa}$

$$\tau = \frac{V}{A_n} = \frac{V}{A_n/\sin\theta} = \frac{V\cdot\sin\phi}{A} = \frac{(2.052)\sin(70°)}{(0.125)(0.075)\,m^2}$$

$= \boxed{206\ kPa}$

Alternate sol'n:



$\theta = 90° - \phi = 90° - 70° = 20°$

USE DERIVED FORMULAE

$$\sigma = \frac{P\cos^2\theta}{A}$$

$$= \frac{(6\ kN)(\cos 20°)^2}{(0.125\ m)(0.075\ m)} = 565\ \frac{kN}{m^2}$$

$$= \boxed{565\ kPa}$$

$$\tau = \frac{P\sin\theta\cos\theta}{A}:$$

$$= \frac{(6\ kN)\sin(20°)\cos(20°)}{(0.125m)(0.075\ m)} = 206\ \frac{kN}{m^2} = \boxed{206\ kPa}$$