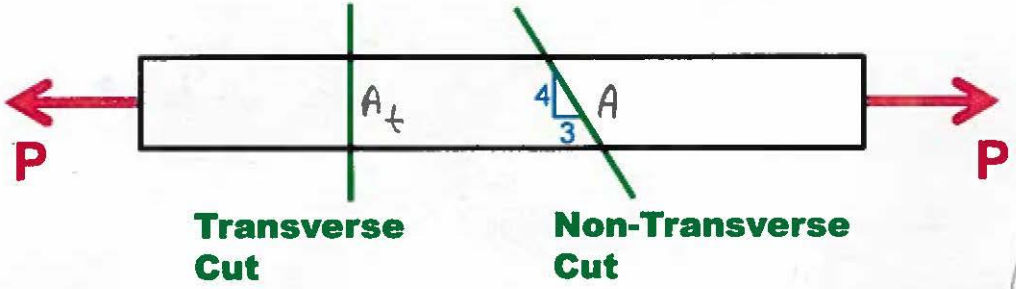
Worksheet Solution:

A flat steel alloy bar has an thickness of 10 mm and an width of 60 mm. It is subjected to an axial centric load in tension of 60 kN. Determine the normal stress and the shear stress in the bar on both the transverse plane and the inclined plane.

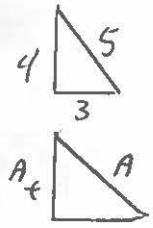


TRANSVERSE AREA

$A_t = (10\,mm)(60\,mm) = 600\,mm^2$

AREA ON INCLINED PLANE

BY SIMILAR TRIANGLES

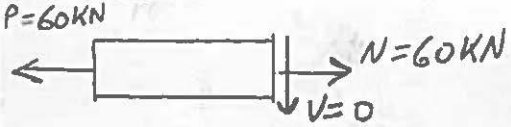


$\frac{4}{5} = \frac{A_t}{A}$

$\therefore A = \frac{5}{4}A_t$

$A = \frac{5}{4}(600\,mm^2) = 750\,mm^2$

TRANSVERSE PLANE



$\sigma = \frac{N}{A} = \frac{60\,KN}{600\,mm^2} = 0.1\,\frac{KN}{mm^2}\,(T)$

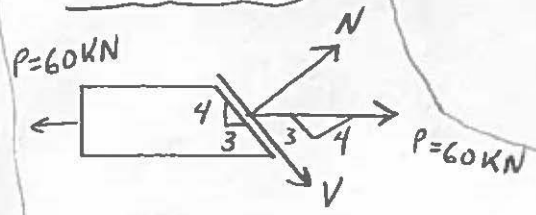
ANS

$\sigma = 100\,MPa\ (T)$ ANS

NOTE: $1\,KN/mm^2 = 1000$ Megapascals (MPa)

$\tau = \frac{V}{A} = 0$ ANS

INCLINED PLANE



PARALLEL (||) AND PERPENDICULAR (⊥) COMPONENTS

(SEE MODULE 3 FROM "INTRODUCTION TO ENGINEERING MECHANICS")

$N = \frac{4}{5}P = (\frac{4}{5})60\,KN = 48\,KN$

$V = \frac{3}{5}P = (\frac{3}{5})60\,KN = 36\,KN$

$\sigma = \frac{N}{A} = \frac{48\,KN}{750\,mm^2} =$ 64 Mpa (T)

ANS

$\tau = \frac{V}{A} = \frac{36\,KN}{750\,mm^2} = 48\,MPa$

ANS