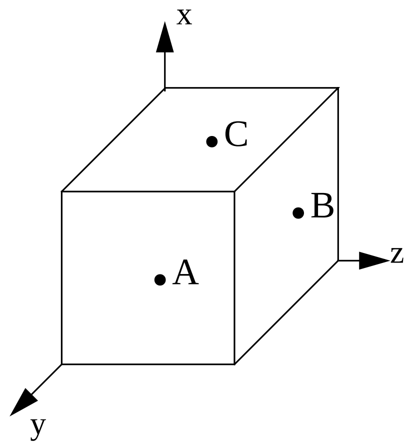
EXAM 1 MEEM2150 Feb. 26th, 2003

To get Full credit you must draw free body diagram any time you use equilibrium equations to determine forces or moments.

1.

(a) Show the following stress components on the faces A, B and C of the cube shown. Use the coordinate system that is given only.

	$\tau_{xy} = 30$ MPa	$\tau_{xz} = -70$ MPa
$\tau_{yx} = 30$ MPa	$\sigma_{yy} = 80$ MPa (C)	
$\tau_{zx} = -70$ MPa		$\sigma_{zz} = 40$ MPa (T)

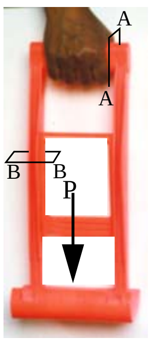


(b) The displacement in x-direction is given as: $u(x) = (7 - 5x + 2x^2)(10^{-3})$, where x and u have units of inches. Determine the normal strain ε_{xx} at x = 2 in. ε_{xx} = -----------

(c) What is the difference between proportional limit and yield point?
(d) What is the difference between brittle material and ductile material?
(e) What is the difference between isotropic and homogenous material?
(f & g) The normal stresses at a point were found to be $\sigma_{xx} = 20$ ksi (T), $\sigma_{yy} = 40$ ksi (T). The material has a modulus of elasticity of E = 10,000 ksi and Poisson's ratio $\nu = 0.25$.
(f) Determine ε_{xx} assuming *Plane Stress*: ε_{xx} = -----------
(g) Determine ε_{xx} assuming *Plane Strain*: ε_{xx} = -----------

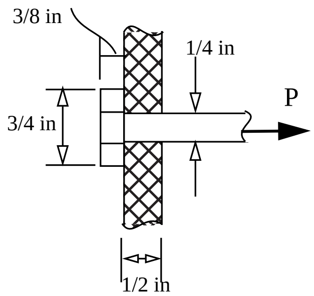
2. In the following problems draw free body diagram. Arrows and labels on forces and moments must be clearly indicated.

(a) A plastic carrier for dry-wall panels is shown. Draw the free body diagram that you would use to calculate the average shear stress at section AA.



(b) Draw the free body diagram that you would use to calculate the average normal stress at section BB in the plastic panel shown above.
(c) A bolt passing through a piece of wood is being pulled as shown below. Draw the free body diagram that you would use to calculate shear stress in the bolt head. What is the area of the imaginary cut?

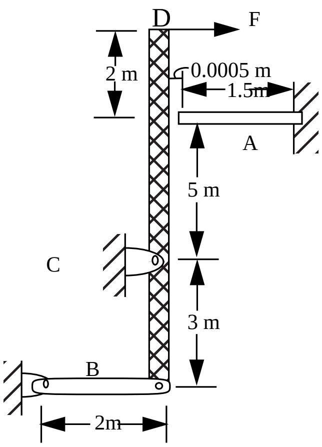
A=----------------------



(d) Draw the free body diagram you would use to calculate the shear stress in the wood shown in the figure above. What is the area of the imaginary cut.

A=----------------------

3. Bar A and bar B have a cross-sectional area of 400 mm^2 and a modulus of elasticity E = 200 GPa. A gap exists between bar A and the rigid bar before the force F is applied. Point D is seen to move by 0.00091 m. Determine: (a) the applied force F and (b) the axial stress in bar B. To get full credit deformed geometry and free body diagram must be drawn.



F = -----------------

σ_B = -----------------(   )

Answers:

1b	$\varepsilon_{xx} = 3000\mu$
1f	$\varepsilon_{xx} = 1000\mu$
1g	$\varepsilon_{xx} = 625\mu$
2c	A=0.2945 in^2
2d	A=1.178 in^2
3a	F = 12400 N
3b	σ_B = 39 MPa(C)