Class Exercise #26   1.050 Solid Mechanics
Fall 2004

Here are 4 problems of the same type, drawn from past years' final exams.

i) What do they have in common? What's different?

ii) What must you know in order to do the common part of the problem?

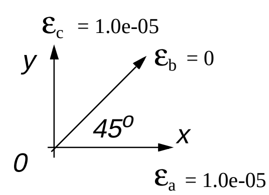
iii) Which is the most difficult problem? Why? Which is the easiest?

iv) Formualte a new problem - a variation on the common theme - that I might assign on this year's final.

98 - Problem 4.

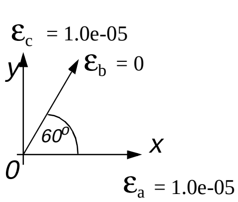
A student on last year's final exam, when asked to determine the state of strain at a point given the extensional strain values shown in the figure, reported that

$$\varepsilon_x = 1.e-05$$
$$\gamma_{xy} = 0$$
$$\varepsilon_y = 1.e-05$$



then went on to say this represented a "hydrostatic" state of strain. What grade would you give the student on this problem? Justify.

00 - Problem 2.



Three strain gages are mounted in the directions shown on the surface of a thin plate. The values of the extensional strain each measures is also shown in the figure.

2a) Determine the shear strain component γ_{xy} at the point with respect to the *xy* axes shown.

2b) What orientation of axes gives extreme values for the extensional strain components at the point.

2c) What are these values.

02 - Problem 3.

A piece of chalk, a very brittle material, is thought to fracture in tension at a stress of 400 psi.

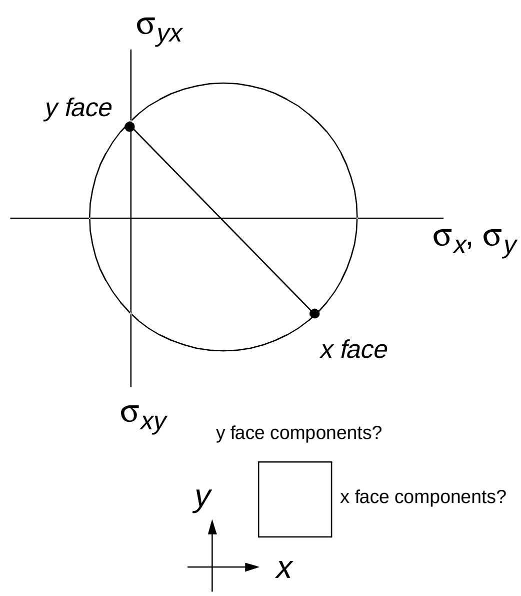
Estimate the diameter of the ordinary, cylindrical piece of chalk.

Estimate the tensile load you must apply *in the direction of the axis* of the cylinder to break the chalk.

Estimate the torque you must apply *about the axis* of the cylinder to break the chalk

03-Problem 2

The figure at the right shows a Mohr's circle representation of the transformation of a two dimensional state of stress.



Show the approximate relative magnitudes and directions of the components of stress acting on the *x* and *y* faces, i.e, as arrows on a square as shown in the lower right corner.

What rotation of axis, again approximately, will orient the *x'y'* faces and show maximum and minimum normal stress components? What are the approximate values of those "principle stresses" relative to the original normal stress component acting on the *x* face.