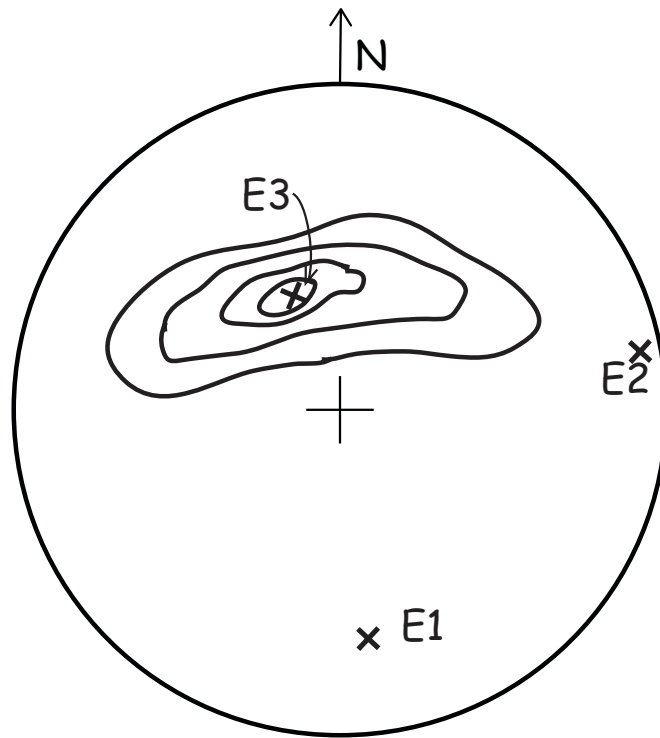


Answers to sample questions

1 a Sketch



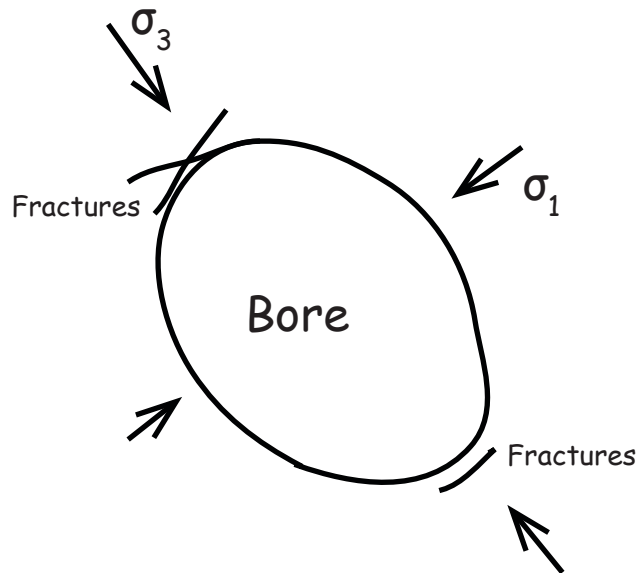
b The distribution might be obtained from sedimentary beds that had been folded into open folds plunging about an axis 30 - 178

2 The boundary between plates A and B is a ridge, spreading at 40 mm/yr (20 mm/yr half rate). The boundary between B and C is a transform fault, moving at 50 mm/yr parallel to the boundary, sinistral (left-lateral). The boundary between A and C is a trench; the constraint line is fixed to plate A in velocity space so this must be a trench at which plate C is subducted below plate A; the rate of subduction is 30 mm/yr due south. (This question could also be answered graphically, by adding labels and symbols for the different rates and types of motion to the diagram.)

- 3 a Stress is a dynamic concept. Stress measures concentration of force on a surface, represented by force per unit area. The stress tensor is the total of stresses acting on all possible planes through a point. Strain is a kinematic concept. It describes the changes in shape (distortions) and size (dilations) that a rock has undergone.
- b Normal stress is the component of stress that acts perpendicular to a surface
Shear stress is the component of stress that acts parallel to a surface.
- c Mean stress is the average of the three principal stresses acting at a point. It is roughly equivalent to pressure, and is the part of the stress system that acts to reduce volume.
The deviatoric stress is the part of the stress system that remains when the mean stress is subtracted from each of the normal stresses. It represents the part of the stress system that acts to change shape.

(This last question could also be answered with equations; however, because the relevant equations are actually given on the formula sheet, it is important to demonstrate understanding in your answer by explaining in words what the equations mean!)

- 4 Breakouts are structures that develop in wells. In a typical breakout, the well bore becomes elliptical. The maximum horizontal compressive stress direction is estimated from the short axis of the ellipse and the minimum is parallel to the long axis. At the ends of the largest diameter it is common to find conjugate fractures at an acute angle to σ_1 and/or extension fractures parallel to σ_1



In the overcoring method, a narrow hole is drilled at the bottom of a well and a strain gauge is embedded in the hole. Then the hole is deepened with a bit that leaves the strain gauge and surrounding rock sticking up from the bottom of the borehole, surrounded by an annular empty space, removing the stress from the surrounding rock. The change of shape of the gauge is recorded (typically a very small change) and the stress is calculated from the elastic properties of the rock (which can be measured if the core is recovered to the surface).

