# STRUCTURAL GEOLOGY
Final Exam Questions
25th May 2012

1) The orientation of two conjugate faults are: 85/67NW and 110/58SW
   a) Plot the faults on a stereographic projection as great circles (β-diagram).
   b) Show the principal stress directions σ_1, σ_2 and σ_3 on the projection.
c) Find out the trend and plunge of σ_1, σ_2 and σ_3.
d) What is the type of faulting? Give reasons for your choice.

2) Answers the following questions with the help of diagrams:
a) What is mineral lineation? What is the relation between the finite strain ellipse the mineral streching lineation.
b) What is transtension. Show faults in map view, where transtension will occur.
b) What controls whether a rock behaves in a ductile or brittle manner?
c) What is strain rate, how is it described? Ayşe Güven had a height of 128 cm when she was 6.5 years old, she is now 13 years old and has a height of 162 cm. What has been the strain rate between those years?
d) Draw a fold showing the locations of fold limbs, fold axis, fold axial plane, hinge zone, amplitude and wave-length.
e) What are cataclasite and mylonite, how are they formed and what are their differences?
f) Draw a block diagram of a normal fault and label the footwall and hangingwall block.

3. The diagram (I) below shows three deformation stages of a circle by simple shear.
a) Find out the extension (e), angular shear strain (ψ) and shear strain (γ) along the radius AB.
b) Calculate the ellipticity R for each ellipse.
c) Using the diagram (II) find out the shear strain and angular shear strain for each ellipse. 2
d) Draw two graphs showing the relation between extension and angular shear strain versus applie shear strain.
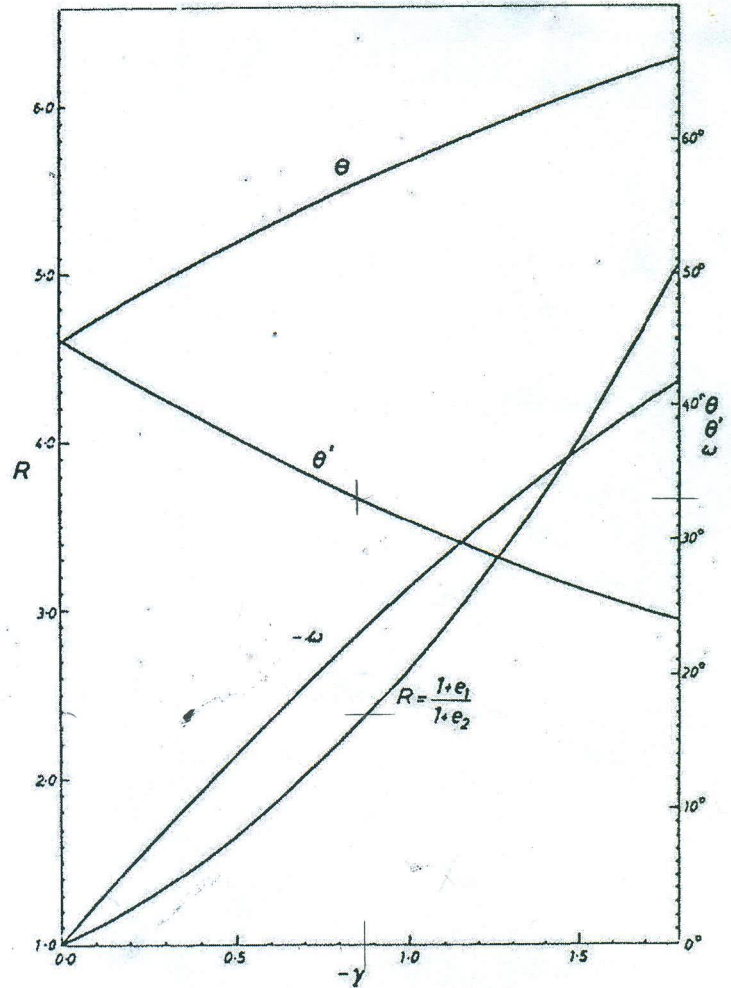
(I)
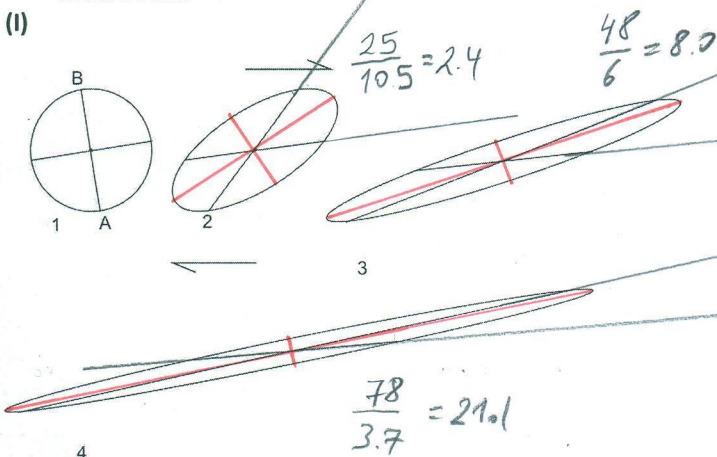
$$e = \frac{162-128}{128} = 0.266$$

$$t = 6.5 \times 365 \times 24 \times 60 \times 60$$
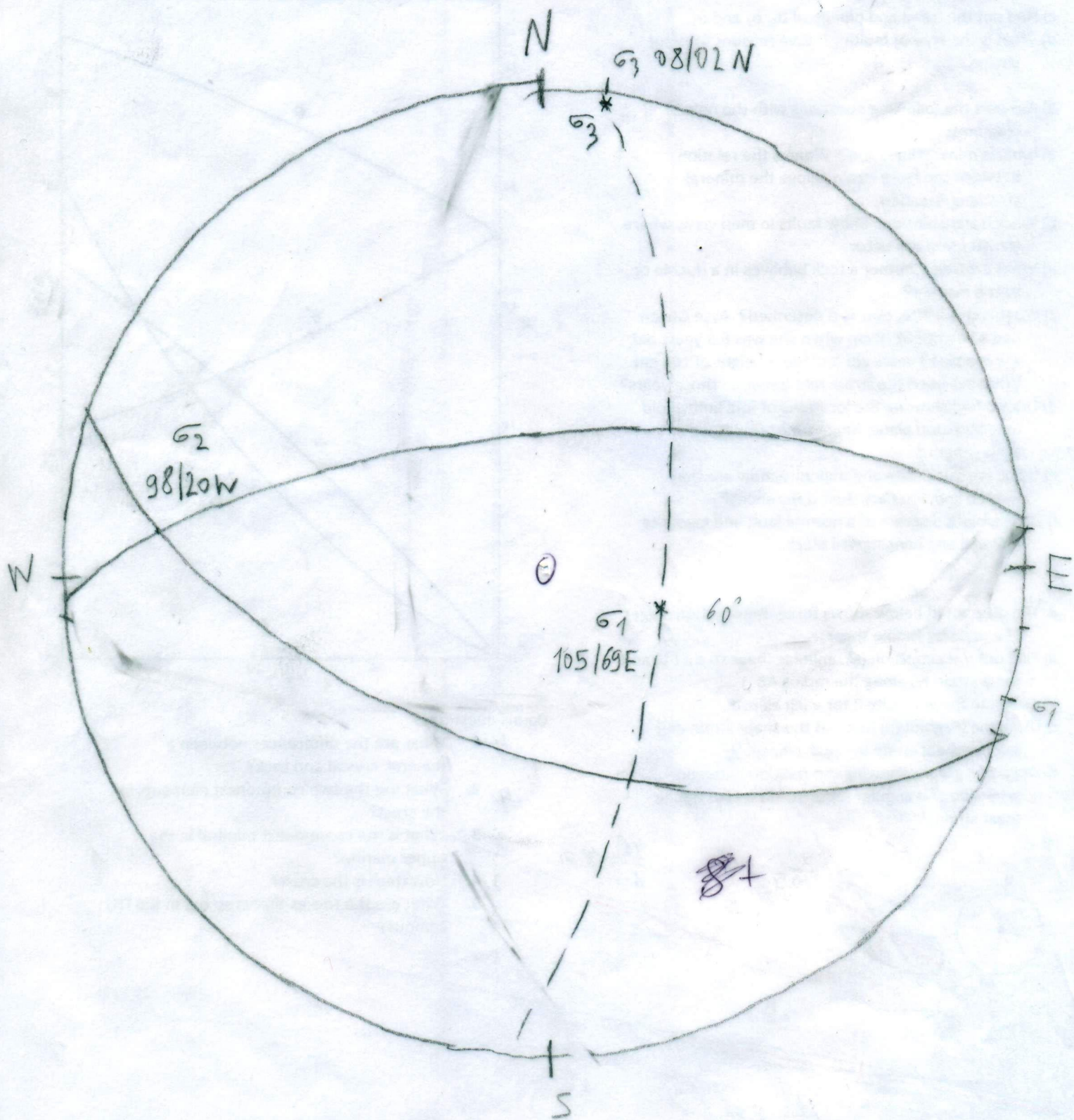$$= 56\,940 \times 60 \times 60$$
$$= 0.205 \times 10^9$$

$$\dot{E} = 1.3 \times 10^{-9}$$

(II)

$$R = \frac{1+e_1}{1+e_2}$$

$$\frac{25}{105} = 2.4$$

$$\frac{48}{6} = 8.0$$

$$\frac{78}{3.7} = 21.1$$

Bonus questions:
  4 1. What are the differences between a mineral, crystal and rock?
  4 2. What are the two commonest elements in the crust?
  3 3. What is the commonest mineral in the upper mantle?
  2 4. How thick is the crust?
  5 5. What are the rockas that crop out in the İTÜ campus?

σ₃ 08/02N

N

σ₃

σ₂
98/20W

W

O

σ₁
105/69E

60°

E

S

Question 3

	1	2	3	4
ℓ_{AB}	~~16~~ 14mm	20mm	43mm	73mm
e	0	~~0.82~~ 0.25	~~2.91~~ 1.69	~~5.64~~ 3.56
ψ	0	48°	73°	82°
γ	0	1.11	3.27	7.11
R	0	2.4	8.0	21.1
applied γ	0	0.88		
ψ	0	41°		
θ'		33°		