1)A rigid beam AB is pin-connected at end A and carries a load P at end B, as shown in Fig. 1. The beam is supported at C and D by two identical pinned-end columns of length L. Each column has flexural rigidity EI. What is the critical load Q_{cr} (In other words, at what load Q_{cr}, does the system collapse because of Euler buckling of the columns?) (20 分)
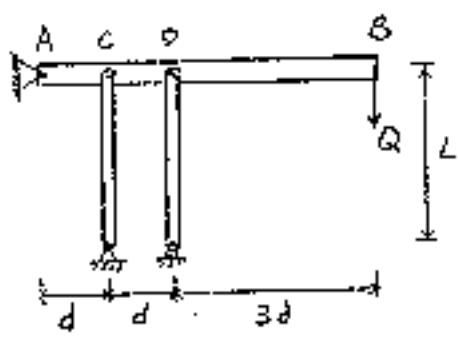

Fig. 1

2)Use Mohr circle to calculate the stress state of the stress element in Fig. 2 if it is turned 55° counterclockwise. (20 分)
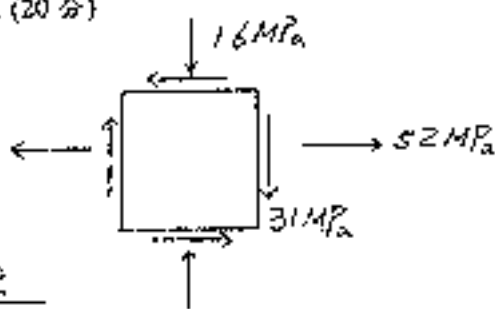

Fig. 2

3) 簡答題（每題以 100 字以內的文詞說明）(40 分)

a. Elastoplastic behavior

b. Curvature

c. Fatigue strength

d. Catenary Cables

e. Give a real life example in architecture of "plane stress state" behavior.

4)求解下列數學題目：(20 分)

a. Find the value of the determinant '

$$\begin{vmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 4 & 2 & 1 \\ 4 & 3 & 1 & 2 \end{vmatrix}$$

b. Calculate the particular solution for $y' + y = e^x$ when x=0 y=2.