一、A、C 為方矩陣，試證明下列關係
  1）$(AC)^{-1} = C^{-1}A^{-1}$
  2）$(A^2)^{-1} = (A^{-1})^2$　　　（10分）

二、計算積分式

$$\int_{-\pi}^{0} e^x \sin nx\, dx \qquad n：正整數 \quad（10分）$$

三、求解微分方程式
  $y''(x) + 9y(x) = 0$　　　$y(0) = 1$, $y'(0) = 1$　　　（10分）

四、An L-shape (2 m × 2 m) cantilever beam is designed to resist a vertical load W and horizontal load $\frac{1}{2}W$ at its free end as shown in Fig. 1. (Assume whatever constants needed)：　　　（40分）
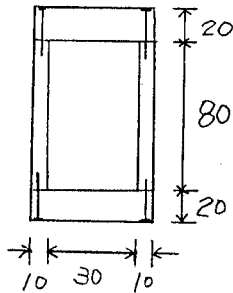
a) Find the maximum tensile stress caused by bending moment in the member.
b) What is the maximum torsion in the member? Discuss how to calculate the maximum tensile stress caused by torsion?
c) If this beam is made of reinforced concrete, discuss where you would expect to see tensile cracks?
d) If this beam is made of steel, discuss what kind of member section you would choose to resist induced internal forces so that economy and member sizes can both be appropriate. Draw your member layout.

Fig. 1 — UNIT: CM
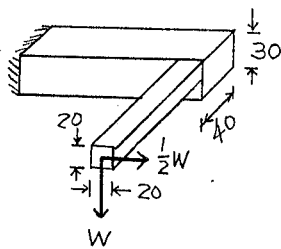
五、A hollow wood beam with plywood webs is shown in Fig. 2. The plywood is attached to the flange by means of small nails having an allowable load in shear of 130 N. Find the maximum allowable spacing s of the nails at cross sections where the shear force is 90 kgf.　　　（30分）

Fig. 2 — UNIT: mm