1. Two power screws are parallel to each other and used to lift a car with a mass of *M*, as shown in Fig 1. The Power screw possesses the following dimensional parameters

Acme thread form	Double-start screw	Pitch *P*
Major diameter *Do*	Pitch diameter *Dp*	Minor diameter *Di*
Thread angle θ	Coefficient of friction μ	

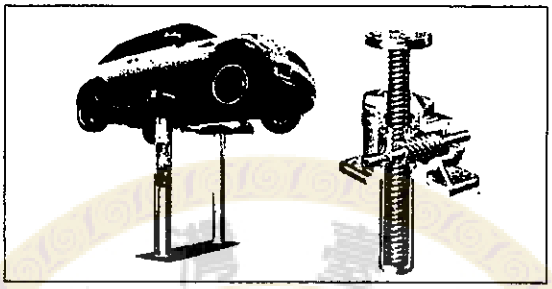

Fig. 1 : Car lift and power screw

Please derive the following parameters with the above-mentioned dimensional parameters.

(1) Please draw the Acme thread form (2 分)	(2) the angle of friction ρ (2 分)
(3) the lead angle λ (3 分)	(4) the axial force *F* is acted on one power screw (2 分)
(5) the torque *To* of one frictionless power screw is needed to lift the car (frictionless → μ=0) (3 分)	(6) the torque *T* of one frictional power screw is needed to lift the car (frictional → $\mu \neq 0$) (3 分)
(7) the efficiency η of the power screw (3 分)	

2. Two sheets S1 and S2 have the same size L × W × t, Young's Modulus *E*, but different thermal expansion coefficient α and $\beta = 1.3\alpha$, as shown in Fig.2. They are firmly attached together.

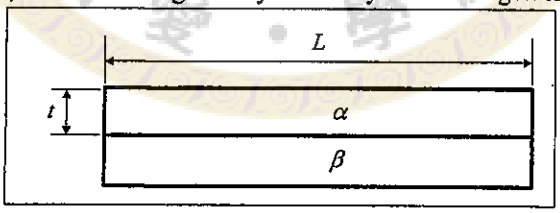

Fig.2 Bi-sheet

When the temperature rise from *To* to *T*，please derive the following parameters with the above-mentioned dimensional parameters

(1) The thermal expansion deflections *Δls1* and *Δls2* of the both unattached sheets (4 分)

(2) According to the force equilibrium condition, how is the longitudinal forces *Fs1* and *Fs2* inside the attached sheets. (4 分)

(3) The bending moment *M* and its distribution along the Bi-Sheet. (6 分)

(4) Please draw the deflected form. (2 分)

見背面

3. The slider ***B*** can slide along the fixed rod ***A*** vertically as shown in Fig. 3 below. The flexible chain ***D*** of total length ***L*** having a weight per unit length of w_0 is attached to the slider ***B*** horizontally and passes over a small fixed pulley ***C***. The mass ***E*** of weight ***W*** is hung at the right end of the chain ***D***. The maximum load that can be carried between the chain ***D*** and the slider ***B*** is F_0. Neglecting the effect of friction, determine (a) the maximum weight W_{max} of the mass ***E***; and (b) the value of distance ***b*** under the condition in (a), for which the chain ***D*** is in equilibrium.

[Hint: $\frac{d}{dz}(\sinh^{-1} z) = \frac{1}{\sqrt{1+z^2}}$, $\cosh z = \frac{e^z + e^{-z}}{2}$, $\sinh z = \frac{e^z - e^{-z}}{2}$]　(18 分)

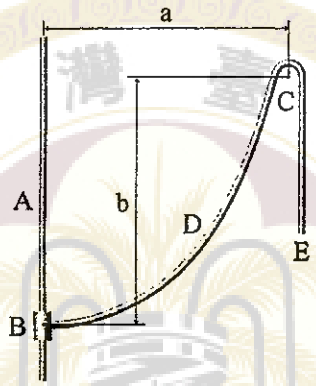

Fig. 3

4. Consider a flat belt passing over a fixed cylindrical drum along the arc P_1P_2 as shown in Fig. 4. We propose to determine the relation existing among the values T_1, T_2, β and μ_s when the belt is just about to slide toward the right. The tension in the left and right sides of the belt are T_1 and T_2. The angle of the arc P_1P_2 is β. The static friction coefficient between the belt and drum is μ_s. [Hint: $\frac{d}{dT}(\ln T) = \frac{1}{T}$]　(15 分)

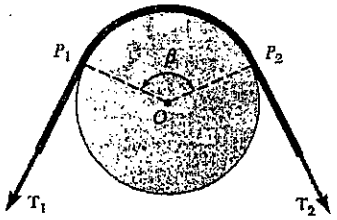

Fig. 4

接次頁

5. Fig. 5 所示有一桿件 AB 之一端 A 固定於具有球窩關節(ball and socket)之牆面上，另一端 B 支撐重量 100kg 之物體，此桿件在 yz 平面上且與 y 軸傾斜15°，桿件上另有兩條鋼絲(BE、FD)固定於牆面上，桿件長度為 16m 且 F 點位於桿件之中點。假設桿件及鋼絲之重量可以忽略不計，求鋼絲 BE 及 FD 所受之張力。 (15 分)

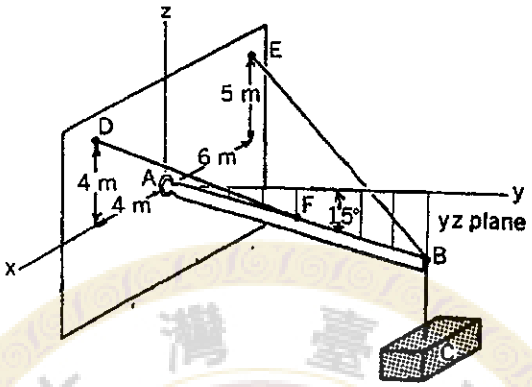

Fig. 5

6. Fig.6 所示垂掛於滑軌之桿件結構接點均為銷接點(Pin joint)，作用力 P=100 kg，若忽略各桿件之重量，為了維持桿件結構在 $\theta = 60°$ 之平衡位置，求所需作用力 F 之大小。(18 分)

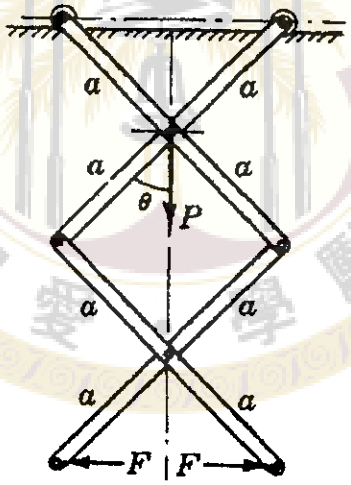

Fig. 6

試題隨卷繳回