共六大題，每大題20分，任選五大題作答。

1. (a) State clearly the contents of Newton's three laws of motion. (試詳細敘述 Newton 三大定律)
(b) State clearly the contents of the principle of virtual work. (試詳細敘述虛功原理)

2. 一質點自半徑R的固定光滑大球形頂，以初速v₀滑下，設v₀² < gR，則離地多高時H = ？，質點恰滑離球面？

3. 假設任何接觸面皆無摩擦力，F力剛好使質量m₁與質量m₂，對車子而言，是靜止的，求
(A) F的大小
(B) 質量m₁與質量m₂間連接繩子之張力
4. A rectangular plate is acted upon by three forces, as shown in Fig. 1.
For \( \alpha = 36.87^\circ \) (\( \cos 36.87^\circ = 0.8 \), \( \sin 36.87^\circ = 0.6 \)),
(a) Replace the system with an equivalent force-couple system at D.
(b) Replace the equivalent force-couple system at D with a single equivalent force. Specify the magnitude of the equivalent force and the point where the line of action of the equivalent force intersects the line \( CD \).

![Fig. 1](image1.png)

5. A force \( \mathbf{P} \) of magnitude \( 1200 \text{ N} \) is applied to member \( ABCD \), as shown in Fig. 2., which is supported by a frictionless pin at A and by the cable \( CED \). Since the cable passes over a small pulley at E, the tension may be assumed to be the same in portions \( CE \) and \( ED \) of the cable. For the case when \( a = 30 \text{ mm} \), determine the tension in the cable and the reaction at A.

![Fig. 2](image2.png)
6. The hydraulic cylinder, as shown in Fig. 3, exerts a force of $899 \, N$ directed to the right on Point $B$ and to the left on Point $E$. Determine the magnitude of the couple $M$ required to rotate the drum clockwise at a constant speed. ($\mu_k = 0.1$)