※ 注意：本科考試共有4大題，均為「計算題」，每大題配分25分，請詳列計算過程，無計算過程者不予計分。

1. Please see Fig. 1. The small car, which has a mass of 25 kg, rolls freely on the horizontal track and carries the 5-kg sphere mounted on the light rotating rod with $r = 0.5$ m. A geared motor drive maintains a constant angular speed = 4 rad/s of the rod. If the car has a velocity $v = 0.5$ m/s when $\theta = 0°$, calculate v when $\theta = 60°$. Neglect the mass of the wheels and any friction. (25%)
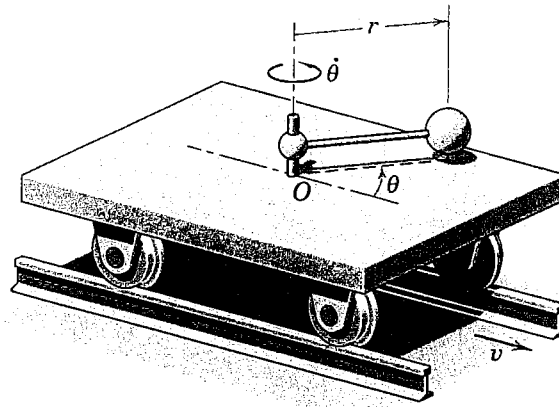

Fig. 1

2. Please see Fig. 2. The nozzle discharges water at the rate of 1.3 m^3/min. Knowing that the velocity of the water at both A and B has a magnitude of 20 m/s and neglecting the weight of the vane, determine the components of the reactions at C and D. Note that water has a density of 1000 kg/m^3. (25%)
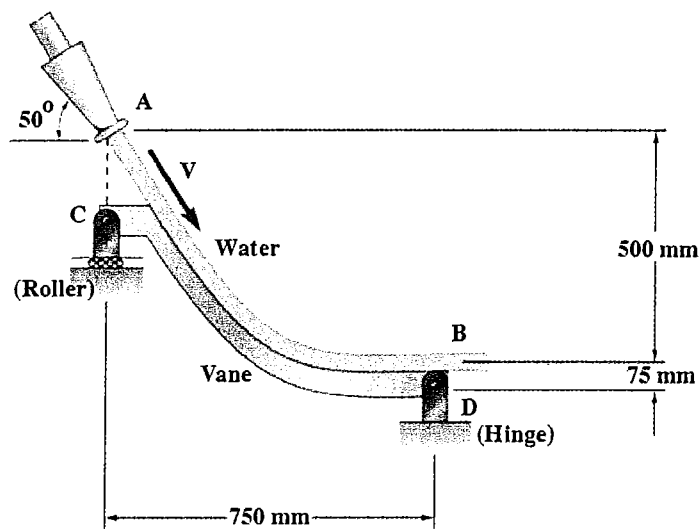

Fig. 2

注意：背面有試題

所別： 機械工程學系 碩士班 固力與設計組(一般生)

科目： 動力學

本科考試可使用計算器，廠牌、功能不拘

＊請在答案卷(卡)內作答

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3. Please see Fig. 3. The motion of the slender uniform rod AB is guided by the two wheels rolling in the slots. Assume that the mass of the two small wheels are negligible, and the two wheels roll without friction in the slots. Given that the mass of the rod is m, its length is L, and the gravitation acceleration is g. If the rod is released from rest in the position shown, please derive the following (in terms of m, L, g, and θ) immediately after release: (a) the angular acceleration of the rod (15%), (b) the reaction force at B (10%).
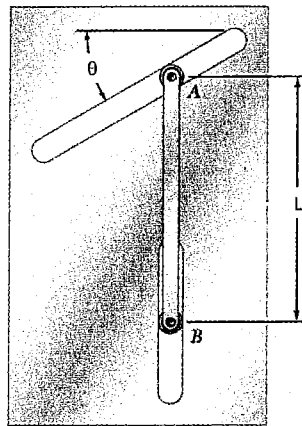

Fig. 3

4. Please see Fig. 4. The vertical plunger has a mass of 2.0 kg and is supported by the two springs, which are always in compression. Calculate the natural frequency f_n of vibration of the plunger if it is deflected from the equilibrium position and released from rest. Friction in the guide is negligible. (25%)
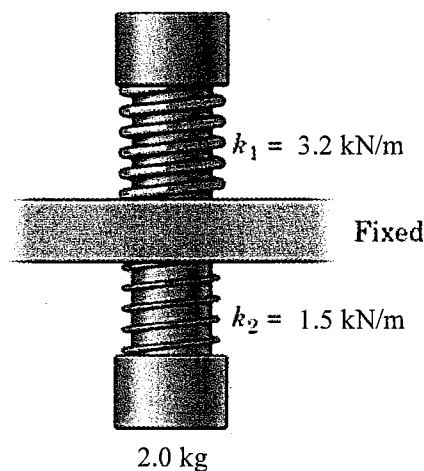

$k_1 = 3.2$ kN/m

Fixed

$k_2 = 1.5$ kN/m

2.0 kg

Fig. 4

參考用

注意：背面有試題