

國立成功大學

112學年度碩士班招生考試試題

編 號： 116

系 所： 工程科學系

科 目： 工程力學

日 期： 0207

節 次： 第 1 節

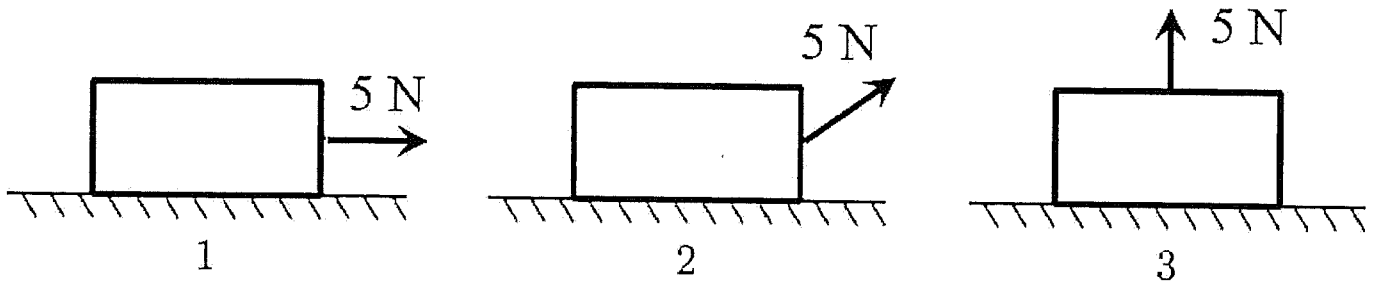
備 註： 可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

工程力學共有九題，請詳細條列計算或誘導過程。請考生將每題的答案（若有單位請包含單位）

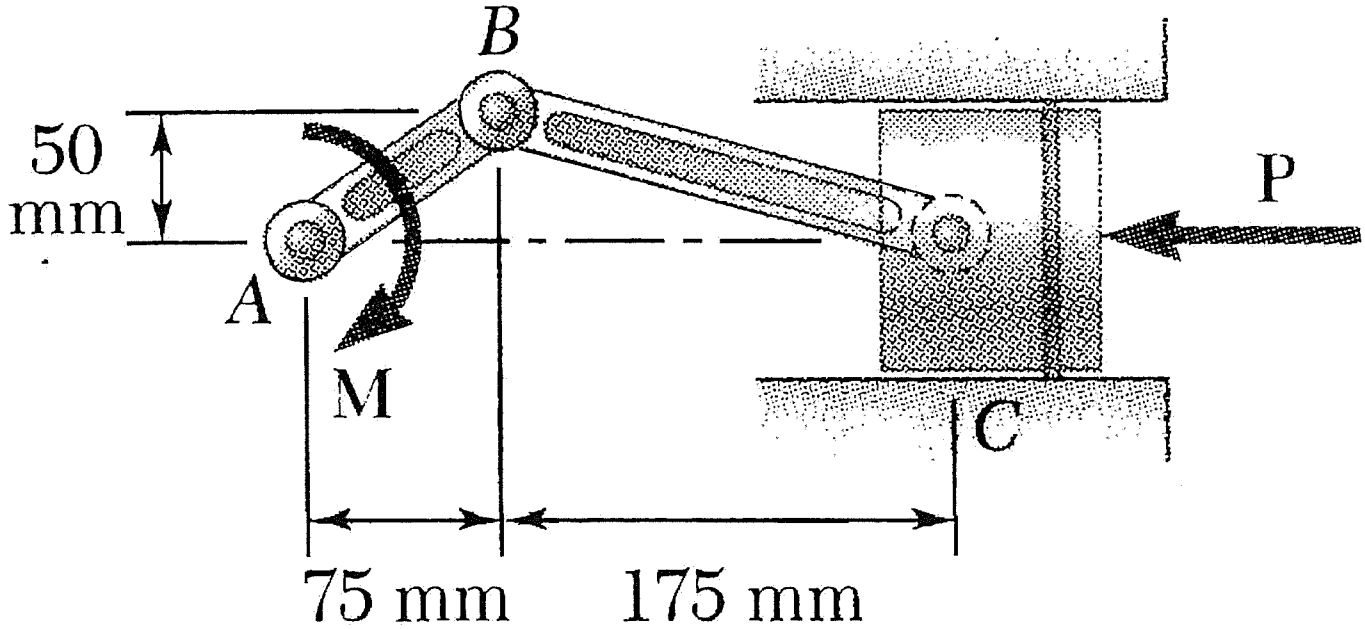
以方框標註出來，以利批改考卷。

- (4%) (a) What is the value of  $\hat{k} \cdot (\hat{k} \times \hat{i})$ ? (b) What is the value of  $\hat{i} \cdot (\hat{k} \times \hat{j})$ ? (Note:  $i, j, k$  are base vectors in the Cartesian coordinate system)
- (4%) A crate rest on a horizontal surface and a man pulls on it with a 5-N force. No matter what the orientation of the force, the crate does not move. Rank the situations shown below according to the magnitude of the frictional force of the surface on the crate, least to greatest.

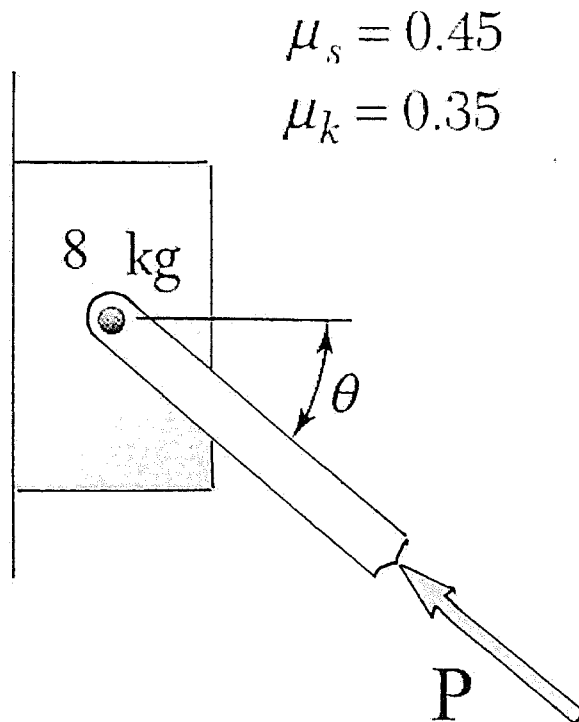


- (4%) A massless rope passes over a massless pulley suspended from the ceiling. A 4 kg block is attached to one end and a 5 kg block is attached to the other end. What is the acceleration of the 5 kg block?
- (4%) A car travels 50 kilometers at an average speed of 100 km/h and then travels 50 kilometers at an average speed of 50 km/h. What is the average speed of the car for this 100-km trip?
- (4%) Over a short interval, starting at time  $t = 0$ , the coordinate of an automobile in meters is given by  $x(t) = 75t - 1.0t^3$ , where  $t$  is in seconds. What are the magnitudes of the initial (at  $t = 0$ ) velocity and acceleration of the auto respectively?

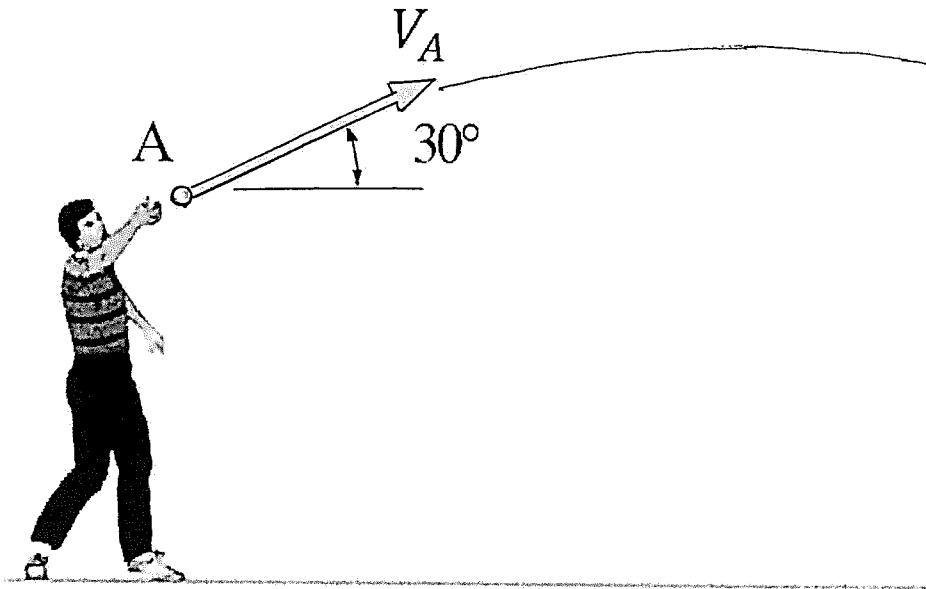
6. (20%) A couple  $M$  of magnitude  $2.0 \text{ kN}\cdot\text{m}$  is applied to the crank of the engine system shown. Determine the force  $P$  required to hold the system in equilibrium. (Assume  $A$  is fixed.)



7. (20%) Knowing that  $\theta = 40^\circ$ , determine the smallest force  $P$  for which equilibrium of the  $8.0 \text{ kg}$  block is maintained on the vertical wall without falling down due to gravity.



8. (20%) A man throws a ball from point A with an initial velocity  $V_A$  of 10 m/s at an angle of  $30^\circ$  with the horizontal. Determine the velocity of the ball at the points of the trajectory described by the ball where the radius of curvature is equal to three-quarters of its value at A.



9. (20%) Collar C weighs 10 kg and is attached to a spring of constant 1000 N/m and of undeformed length equal to 450 mm. The system is set in motion with  $r = 300$  mm,  $v_\theta = 5$  m/s, and  $v_r = 0$ . Neglecting the mass of the rod and the effect of friction, determine the radial and transverse components of the velocity of the collar when  $r = 500$  mm.

