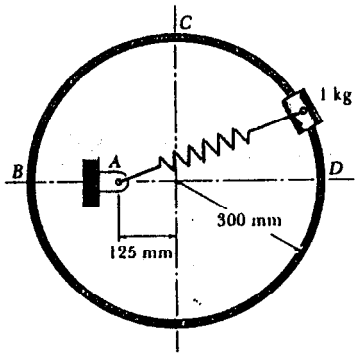
淡江大學九十三學年度碩士班招生考試試題

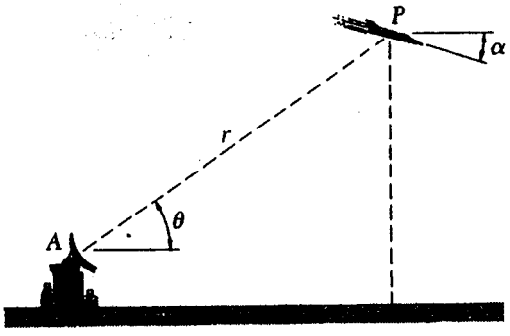
系別：航空太空工程學系　　科目：動　力　學

准帶項目請打「○」否則打「×」
簡單型計算機
○

1. A 1-kg collar is attached to a spring and slides without friction along a circular rod which lies in a horizontal plane. The spring has a constant $k = 500$ N/m and is undeformed when the collar is at B. Knowing that the collar passes through point D with a speed of 4.0 m/s, please determine the speed of the collar as it passes through (a) point C, (b) point B. (25%)



2. An airplane passes over a radar tracking station at A and continuous to fly due east. When the airplane is at P, the distance and angle of elevation of the plane are, respectively, $r = 3800$ m and $\theta = 31.5°$. Two seconds later the radar station sights the planet at $r = 4100$ m and $\theta = 28.6°$. Determine approximately the speed and the angle of dive α of the plane during the 2 seconds interval. (25%)



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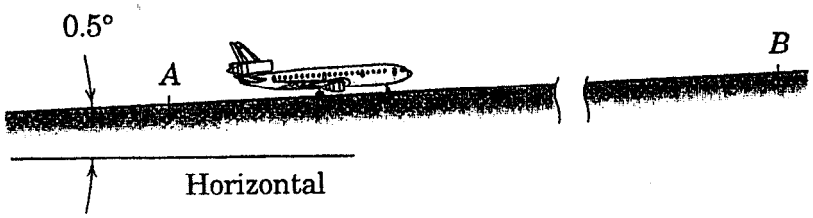
3. The 360-Mg jet airliner has four engines, each of which produces a nearly constant thrust of 210 kN during the takeoff roll. Determine the length s of runway required if the takeoff speed is 200 km/h. Compute s (a) for an uphill takeoff direction from A to B and (b) for a downhill takeoff from B to A on the slightly inclined runaway. Neglect air and rolling resistance. (25%)



4. During the design of the spring-support system for the 4,000-kg weighing platform, it is decided that the frequency of free vertical vibration in the unloaded condition shall not exceed 4 cycles per second. (a) Determine the maximum acceptable spring constant k for each of the three identical springs. (b) For this spring constant, what would be the natural frequency f_n of vertical vibration of the platform loaded by the 50,000-kg truck ? (25%)