

本試題是否可以使用計算機:  可使用,  不可使用 (請命題老師勾選)

1. (20%) The double disk (Figure 1, inner radius  $r = 120$  mm, outer radius  $R = 200$  mm,  $m = 125$  kg, Radius of Gyration  $k = 125$  mm) starts from rest and rolls on a flat surface without sliding. The cord, wrapped about inner radius  $r$ , is pulled to the right by force  $F = 500$  N. Determine
- the angular acceleration of the disk.
  - the acceleration,  $a_G$ , of the mass center  $A$  of the disk.

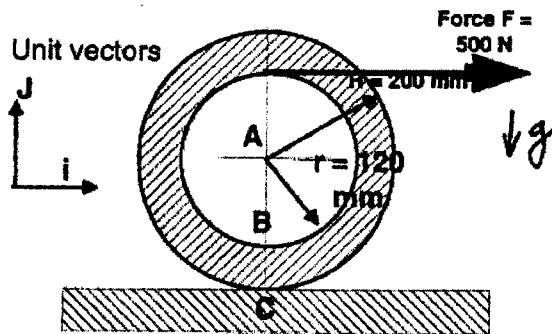


Fig. 1

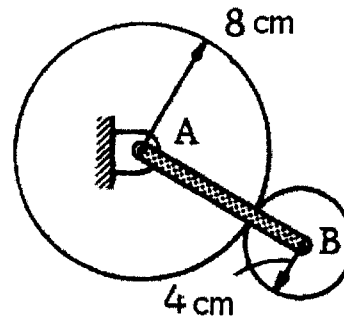


Fig. 2

- (20%) Gears A and B (Figure 2, gear teeth not shown) are connected by arm AB. Given  $\omega_A = 60$  rpm clockwise. Find  $\omega_B$  if a)  $\omega_{AB} = 40$  rpm counterclockwise, b)  $\omega_{AB} = 40$  rpm clockwise.
- (15%) Design a method to weigh a body part of human, one lower limb, with the board and scale apparatus.
- (15%) Explain a) Principle of impulse and momentum; b) Principle of work and energy.
- (20%) When a two-dimensional rigid body is moving freely in a plane, it can have both translation and rotation. At any instance of time, an approximate center of rotation can be determined which is defined as the *instantaneous center of rotation (ICR)*. What is the velocity at the ICR? Describe a method of determination of ICR.
- (10%) Describe the definitions of *moments of inertia* and *products of inertia* in three-dimensional Cartesian system. What are their physical meanings?