

- (20pts) A 500-N concrete block is to be lifted by the pair of tongs shown in Fig. 1. Determine the smallest allowable value of the coefficient of static friction between the block and the tongs at F and G .
- (15pts) Prove the following relation of the V-belt (Fig. 2):

$$\frac{T_2}{T_1} = e^{\mu_s \beta / \sin(\alpha/2)}$$

where T_1 and T_2 are the tensions, μ_s is the coefficient of static friction, β is the angle of belt contact, and α is angle of the V-shape.

- (15pts) The square-threaded worm gear shown in Fig. 3 has a mean radius of 30 mm and a lead of 7.5 mm. The large gear is subjected to a constant clockwise couple of 700 N·m. Knowing that the coefficient of static friction between the two gears is 0.12, determine the couple that must be applied to the shaft AB in order to rotate the large gear counterclockwise. Neglect friction in the bearings at A , B , and C .
- (20pts) Determine the moment of inertia \bar{I}_x of the area shown in Fig. 4 with respect to the centroidal axis parallel to side AB .
- (30pts) Determine by direct integration the mass moment of inertia with respect to the x axis of the pyramid shown in Fig. 5, assuming that it has a uniform density and a mass m .

