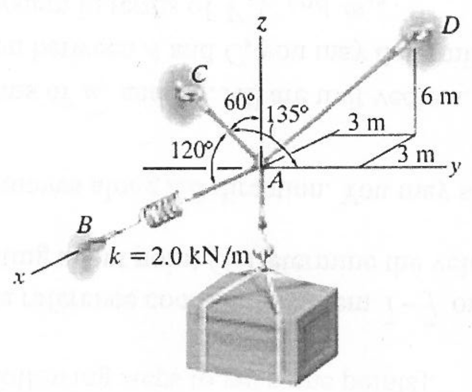
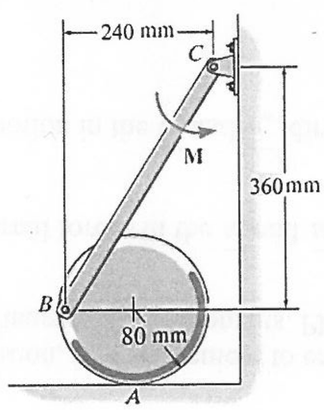
[25]
1. Determine the tension in each cord used to support the 250-kg crate shown in the figure.
[Note: Plot the free body diagram of joint A first.]

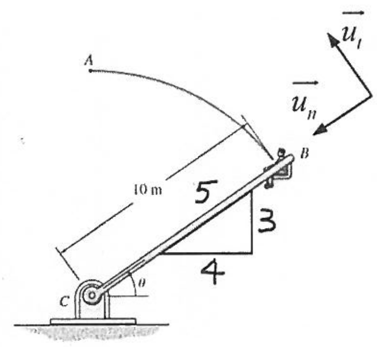


[25]
2. The 85-kg disk rests on the surface for which the coefficient of static friction is $\mu_A = 0.2$. If $M = 100\ \text{N} \cdot \text{m}$, determine the friction force at A.
[Note: Plot the free body diagrams of the disk and bar first.]



[25]

3. A man having a mass of 50 kg sits in the chair which is pin-connected to the fame BC. If the man is always seated in an upright position, determine the horizontal (R_x) and vertical (R_y) reactions of the chair on the man at the instant as shown in the picture. At this instant he has a speed of 3 m/s which is increasing at 1 m/s^2. (use $g = 10$ m/s^2)



[5] (1) For the given speed and acceleration, it is convenient to express acceleration in terms of normal/tangential components. Please determine a_t and a_n (scalar).

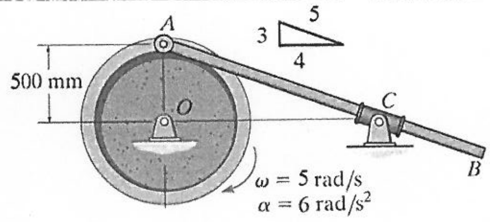
[10] (2) Express the summation of external forces in the $\vec{u}_t$ and $\vec{u}_n$ directions, respectively, in terms of R_x, R_y, and mg.

[10] (3) Use Newton's second law of motion in the $\vec{u}_t$ and $\vec{u}_n$ directions, respectively to solve R_x and R_y, in N.

[25]

4. The wheel is rotating with the angular velocity and angular acceleration at the instant shown. Determine the angular velocity and angular acceleration of the rod at this instant. The rod slides freely through the smooth collar.

[NOTE: You may use any method you like to get the point. If you don't know how to start, try the following steps to get some points].



O is a fixed point, set an inertia reference coordinate system $\vec{i}-\vec{j}$ on the point O.

[2] (1) For the wheel, A is rotating about point O. Determine the velocity of point A.

The rod AB is rotating, and A moves along AB direction. You may set a rotating reference frame $\vec{u_1}-\vec{u_2}$ fixed on C.

[3] (2) Express $\vec{i}$ and $\vec{j}$ in terms of $\vec{u_1}$ and $\vec{u_2}$. All are unit vectors.

[4] (3) From the relative motion between A and C, you may determine the velocity of point A in the $\vec{u_1}-\vec{u_2}$ coordinate system in terms of $V_{A/C}$ and ω_{AB}.

[2] (4) Based on the results of (1)~(3), determine $\vec{V}_{A/C}$ and $\vec{\omega}_{AB}$. (Hint: $|V_{A/C} \cdot \omega_{AB}| = 3.6$)

Using the similar method, you may determine the angular acceleration of rod AB

[4] (5) For the wheel, determine the acceleration of point A in the $\vec{i}-\vec{j}$ coordinate system.

[5] (6) From the relative motion between A and C, you may determine the acceleration of point A in the $\vec{u_1}-\vec{u_2}$ coordinate system in terms of $a_{A/C}$ and α_{AB}.

[5] (7) Solve for $\vec{a}_{A/C}$ and $\vec{\alpha}_{AB}$. (Hint: $\left|\dfrac{a_{A/C}}{\alpha_{AB}}\right| = 6$)