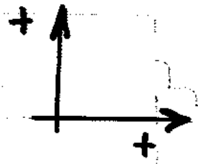
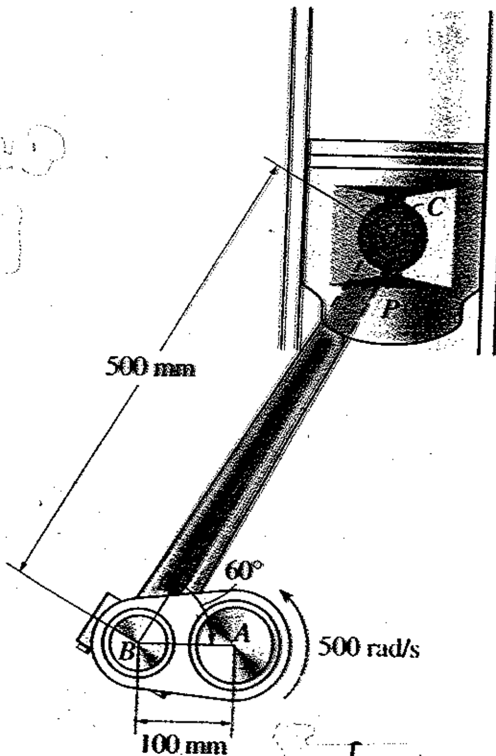
Problem 16.51 (Page 327)

The crankshaft AB shown is rotating at 500 rad/sec about a fixed axis passing through A. Determine the speed of the piston P at the instant it is in the position shown.





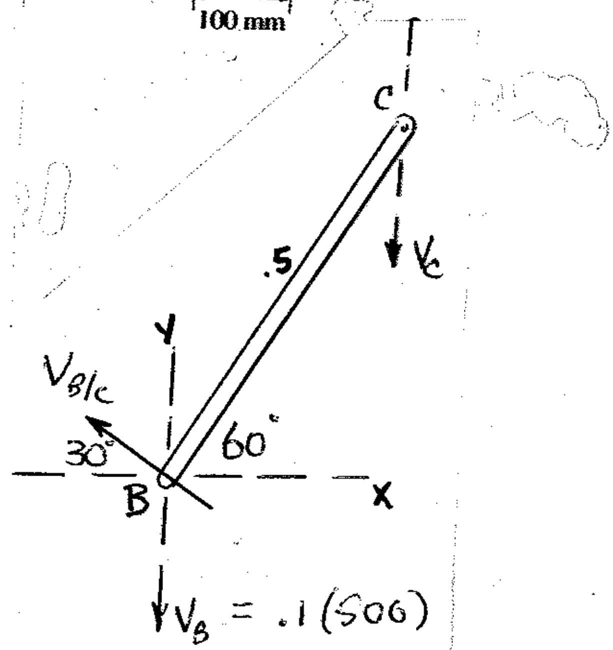
$$\bar{V}_B = \bar{V}_c + \bar{V}_{B/c}$$

$$-.1(500)\bar{j} = V_c\bar{j} + .5\omega \sin 30^\circ \bar{j} - .5\omega \cos 30\, \bar{i}$$

$$X: \quad 0 = -.5\omega \cos 30^\circ \qquad \omega = 0$$

$$Y: \quad -50\,\frac{m}{s} = V_c + \underbrace{.5\omega \sin 30^\circ}_{0}$$

$$V_c = 50\ m/s \downarrow$$



Problem 16.78 (Page 339)

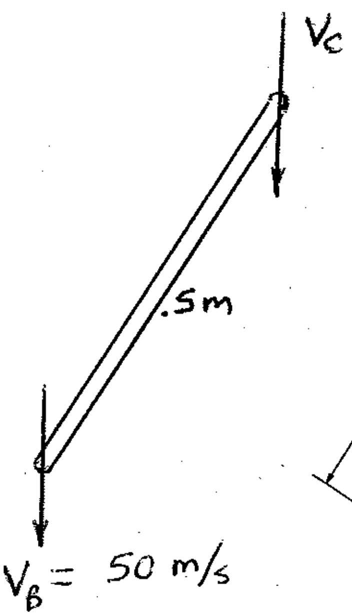
The crankshaft AB shown is rotating at 500 rad/sec about a fixed axis passing through A. Determine the speed of the piston P using the method of instantaneous center of zero velocity (Method of IC) at the instant it is in the position shown.

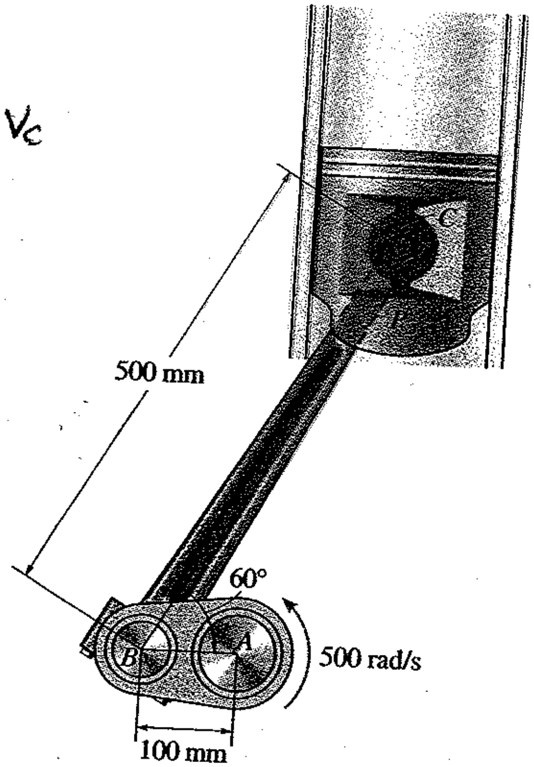
Since I.C. = ∞

$\omega = 0$

$V_B = 500(.1) = 50 \text{ m/s}$

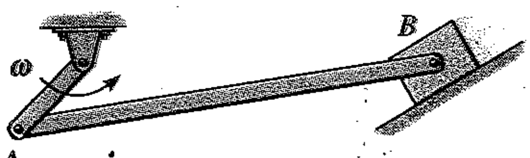
$V_c = V_B = 50 \text{ m/s}$



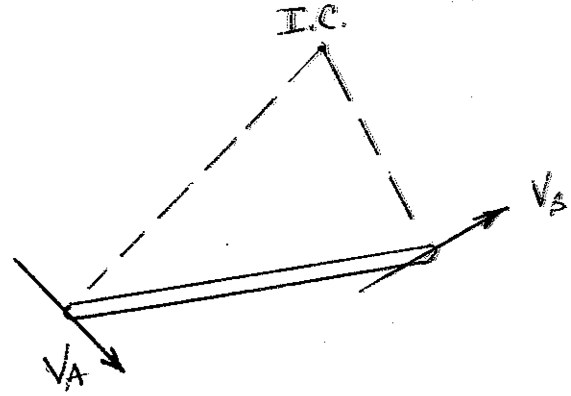


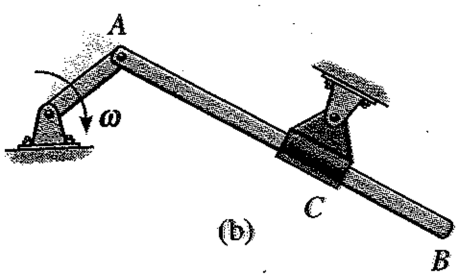
Problem 16.86 (Page 339)

In each case, show graphically how to locate the I.C. of link AB. Assume that the geometry is known.

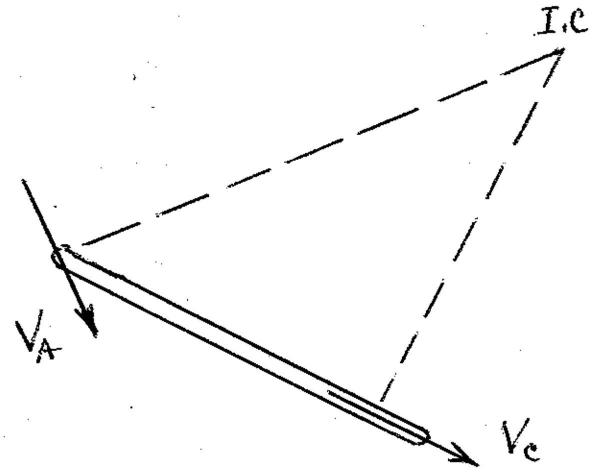


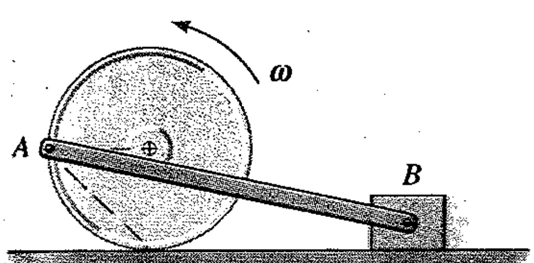
(a)





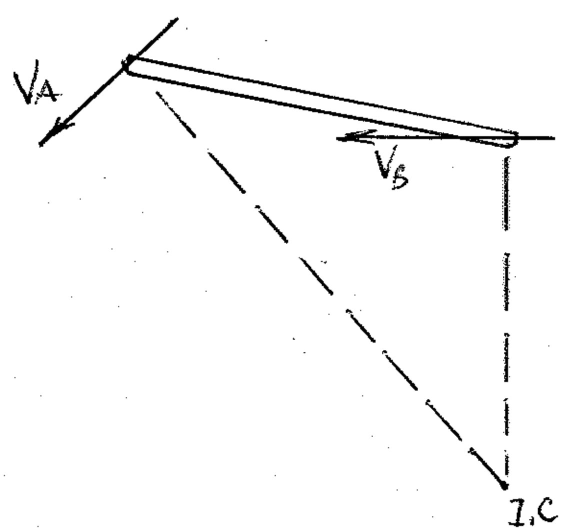
(b)





(c)

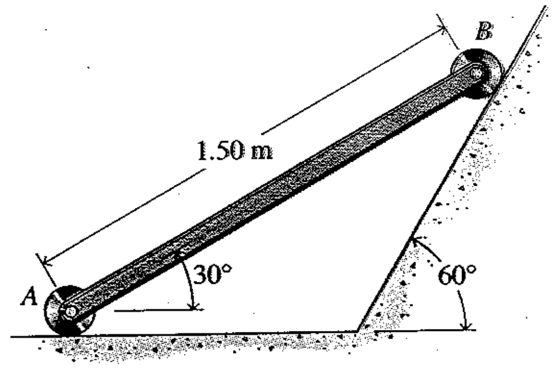
Ic of the wheel



The slender bar AB shown is attached to small wheels that roll on the horizontal and inclined surfaces. At the instant shown, the angular velocity of the bar is ω_{AB} = 0.2 rad/sec clockwise. For this instant

a) locate the I.C. of the bar AB, and

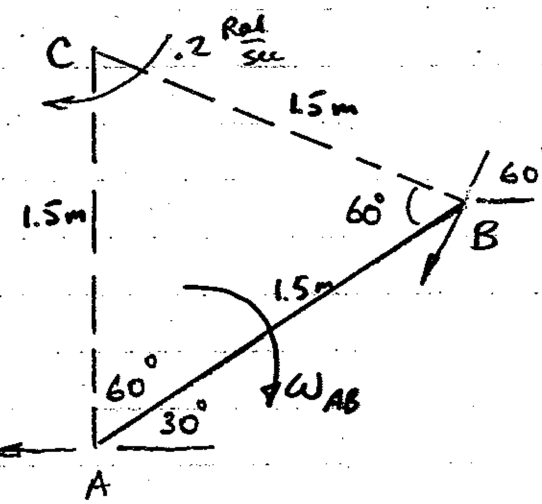
b) Determine the velocities of the pins at A and B.



$$V_A = V_C + V_{A/C}$$

$$= 0 + 1.5\,m\,(.2)\,\frac{rad}{sec}$$

$$= \overleftarrow{0.3\ m/s}$$



$$V_B = V_C + V_{B/C}$$

$$= 0 + 1.5\,(.2)$$

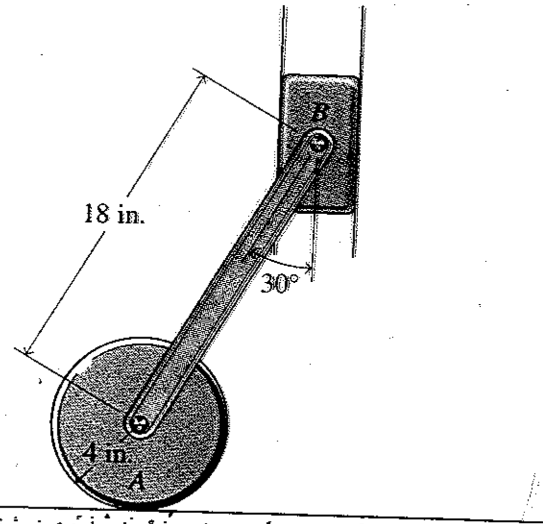
$$= 0.3\ m/s\ \ 60°$$

One end of the 18-in-long bar AB as shown is attached to a slider that moves in a vertical slot. The other end is attached to a wheel which rolls on a horizontal surface. At the instant shown, the center of the wheel is moving to the right at a speed of 5 in/sec.

a) Locate the I.C. of the bar AB

b) Determine the angular velocity ω_{AB} of the bar, and

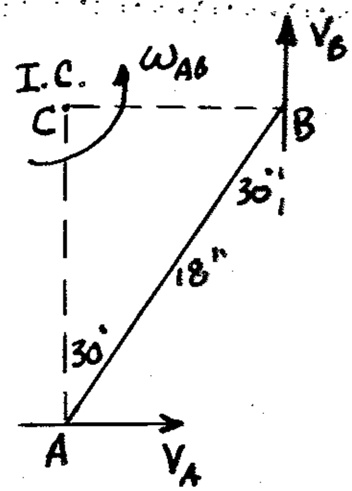
c) Determine the velocity v_B of the slider B.



$$V_A = V_C + V_{A/C} = 5 \text{ in/sec}$$

$$= 0 + (18 \cos 30^\circ)\,\omega_{AB}$$

$$\omega_{AB} = 0.321 \ \frac{\text{rad}}{\text{sec}} \ \circlearrowleft$$



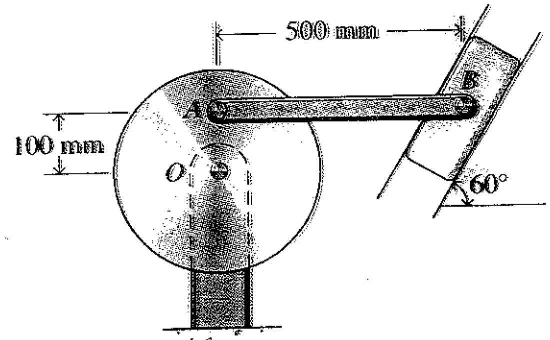
$$V_B = V_C + V_{B/C}$$

$$= 0 + (18 \sin 30^\circ)\,\omega_{AB}$$

$$= 2.89 \text{ in/sec}$$

The crank wheel OA as shown is rotating counterclockwise at a steady angular velocity of 180 rev/min. For the position shown,

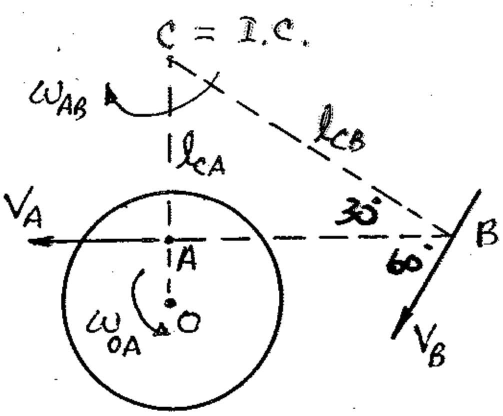
a) Locate the I.C. of bar AB
b) Determine the angular velocity ω_{AB} of the bar, and
c) Determine the velocity v_B of the slider B.



$$\omega_{OA} = 180 \frac{rev}{min} = 6\pi \ rad/sec \ \circlearrowleft$$

$$V_A = r_{OA}\,\omega_{OA} = 100\ mm\,(6\pi)\frac{rad}{sec}$$

$$= 600\pi \ mm/sec \ \leftarrow$$



$$l_{CB} = 500/\sin 60^\circ = 577.35\ mm$$

$$l_{CA} = l_{CB}\cos 60^\circ = 288.675\ mm$$

$$V_A = l_{CA}\,\omega_{AB} = 600\pi\ mm/sec$$

$$\omega_{AB} = 600\pi/288.675 = 6.53\ rad/sec \ \circlearrowright$$

$$V_B = l_{CB}\,\omega_{AB} = 3770\ mm/sec \ \angle 60^\circ$$