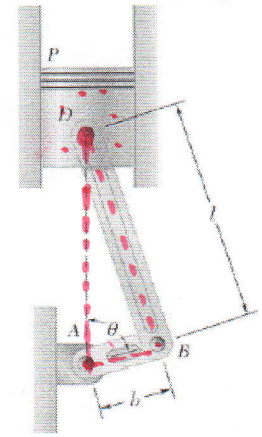
Quiz



PROBLEM 15.61

In the engine system shown, $l = 160$ mm and $b = 60$ mm. Knowing that the crank AB rotates with a constant angular velocity of 1000 rpm clockwise, determine the velocity of the piston P and the angular velocity of the connecting rod when (*a*) $\theta = 0$, (*b*) $\theta = 90°$.

หา $v_p = ?$ v_D

$\omega_{AB} = 1000 \text{ rpm} = 1000 \times \frac{2\pi}{60} = 104.72 \text{ rad/s}$

Piston ⇒ Translation

Crank AB ⇒ Rotation about A

Connecting Rod BD ⇒ General plane motion

พิจารณาการเคลื่อนที่ของ Rigid bodies แต่ละชิ้น

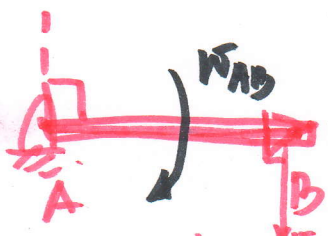
Piston

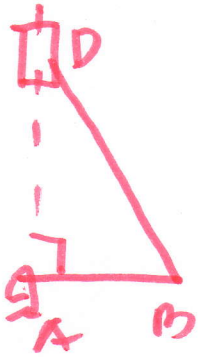
v_D สมมติให้มีทิศทางขึ้นบน ↑

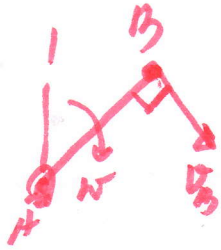
$\vec{v}_D = v_D \vec{j}$

Crank AB

$\theta = 90°$





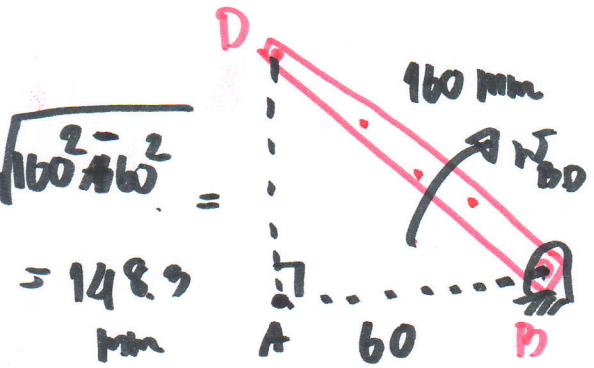


$+\circlearrowleft \quad \vec{v}_B = \vec{\omega}_{AB} \times \vec{r}_{B/A}$

$\vec{v}_B = -104.72\vec{k} \times [0.06\vec{i}]$

$$\vec{v}_B = -6.28\,\vec{j}$$

Connecting Rod BD (General plane motion)



$$\vec{v}_D = [\vec{v}_D]_{\text{Translation with B}} + [\vec{v}_D]_{\text{Rotation about B}}$$

$$\vec{v}_D = \vec{v}_B + \vec{v}_{D/B}$$

$$\vec{v}_D = \vec{v}_B + [\vec{\omega}_{BD} \times \vec{r}_{D/B}]$$

$$\vec{v}_D = \vec{v}_B + -\omega_{BD}\vec{k} \times (-0.06\vec{i} + 0.1483\vec{j})$$

$$v_D\vec{j} = -6.28\vec{j} - \omega_{BD}\vec{k}\,[-0.06\vec{i} + 0.1483\vec{j}]$$

$$v_D\vec{j} = -6.28\vec{j} + 0.06\omega_{BD}\vec{j} + 0.1483\omega_{BD}\vec{i}$$

เปรียบเทียบสัมประสิทธิ์หน่วย i และ j

i : $0 = 0.1483\,\omega_{BD}$

$\omega_{BD} = 0$

j : $v_D = -6.28 + 0.06(\omega_{BD})$ $=0$

$v_D = -6.28$ m/s

แสดงทิศทางได้ $\Rightarrow$ $v_D = 6.28$ ↓