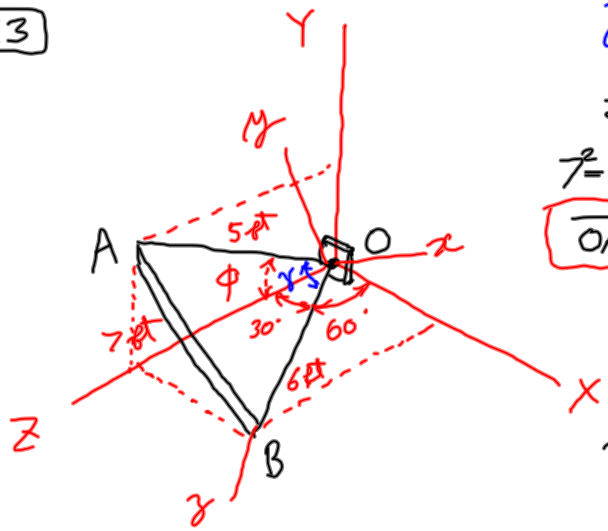
$\boxed{9.13}$



$\vec{\omega}_{OB} = 2\vec{J}$ rad/s $\quad \vec{\Omega} = ? \quad \vec{v}_A = ?$

Let $\angle AOB = \gamma$.

$7^2 = 5^2 + 6^2 - 2(5)(6)\cos\gamma, \quad \gamma = 78.463041°$

$\boxed{\vec{OA}\cdot\vec{OB} = 5(6)\cos\gamma}$

$\vec{OA} = 5(\sin\phi\,\vec{J} + \cos\phi\,\vec{K})$

$\vec{OB} = 6(\cos 60°\,\vec{I} + \sin 60°\,\vec{K})$

$30\sin 60°\cos\phi = 5(6)\cos\gamma$

$\therefore \phi = \boxed{}$

Let $Oxyz$ be embedded in the plate OAB as shown.

$\vec{v}_B = \vec{v}_{B/Oxyz} + \vec{v}_{B'} = \vec{0} + \vec{\Omega}\times\vec{OB} = (\Omega_x\vec{I} + \Omega_Y\vec{J} + \Omega_Z\vec{K})\times 6(\cos 60°\,\vec{I} + \sin 60°\,\vec{K})$

$\vec{v}_B = 2\vec{J}\times 6(\cos 60°\,\vec{I} + \sin 60°\,\vec{K})$

$\vec{I}$: .....

$\vec{J}$: .....

$\vec{K}$: .....

$\Omega_x = \dfrac{\Omega_z}{\sqrt{3}}, \quad \Omega_Y = 2$

Note that $\vec{v}_A\cdot\vec{I} = 0$:

$\therefore \Omega_z = \Omega_Y\cot\phi = \boxed{}$

$\vec{v}_A = \vec{\Omega}\times\vec{OA}$

$\boxed{\vec{\Omega} = \boxed{}} \qquad \boxed{\vec{v}_A = \boxed{}}$

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$\omega_{D/M} = 2$ rad/s $\quad \alpha_{D/M} = 3$ rad/s^2

$\omega_{M/B} = 1.5$ rad/s $\quad \alpha_{M/B} = 2.5$ rad/s^2

$\omega_B = 4$ rad/s $\quad \alpha_B = 5$ rad/s^2

$\boxed{\text{See Fig. P19.15}}$

$\vec{\omega}_D = ? \quad \vec{\alpha}_D = ?$

$\vec{\omega} = \vec{\omega}_D = \vec{\omega}_{D/M} + \vec{\omega}_{M/B} + \vec{\omega}_B = \cdots\cdots \qquad \boxed{\vec{\omega}_D = \boxed{}}$

$\vec{\alpha} = \vec{\alpha}_D = \vec{\alpha}_{D/M} + \vec{\alpha}_{M/B} + \vec{\alpha}_B + \vec{\omega}_M\times\vec{\omega}_{D/M} + \vec{\omega}_B\times\vec{\omega}_{M/B}$

$= \cdots\cdots \qquad \boxed{\vec{\alpha}_D = \boxed{}}$