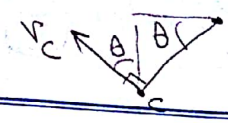
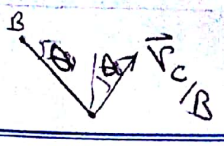




محل مهر آموزش

$$\vec{v}_B = \vec{v}_A = +10\hat{i}\ \frac{m}{s} \Rightarrow v_A = 10 \qquad \vec{v}_C = v_C(+\sin\theta\,\hat{i} + \cos\theta\,\hat{j})$$

$$\vec{v}_C = \vec{v}_B + \vec{v}_{C/B} \quad (1) \qquad \vec{v}_{C/B} = v_{C/B}(-\sin\theta\,\hat{i} + \cos\theta\,\hat{j})$$

$$+v_C\sin\theta\,\hat{i} + v_C\cos\theta\,\hat{j} = +v_A\hat{i} + (-v_{C/B}\sin\theta\,\hat{i} + v_{C/B}\cos\theta\,\hat{j}) \Rightarrow$$

$$\hat{i}: \; -v_C\sin\theta = +v_A + v_{C/B}\sin\theta$$

$$\hat{j}: \; v_C\cos\theta = v_{C/B}\cos\theta \Rightarrow v_C = v_{C/B}$$

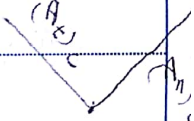
$$+2v_C\sin\theta = v_A \Rightarrow$$

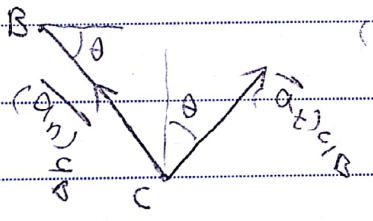
$$v_C = v_{C/B} = \frac{v_A}{2\sin\theta} \Rightarrow v_C = v_{C/B} = \frac{10}{2\sin 60} = 5.773502692\ \frac{m}{s}$$

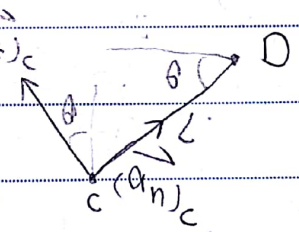
$$\omega_{BC} = \frac{v_{C/B}}{L} = \frac{5.7735}{0.3} = 19.24500897\ \frac{rad}{s} \Rightarrow \boxed{\omega_{BC} = 19.245\ \frac{rad}{s}}$$

$$\vec{v}_C = 5.7735[-\sin\theta\,\hat{i} + \cos\theta\,\hat{j}) \xrightarrow{\theta = 60^\circ} \boxed{\vec{v}_C = -5\hat{i} + 2.88675\hat{j}}$$

$$\vec{a}_C = \vec{a}_B + \vec{a}_{C/B}, \quad \vec{a}_B = \vec{a}_A = -16\hat{i}\ \frac{m}{s^2}$$







$$\vec{a}_C = L\alpha_{CD}[\sin\theta\,\hat{i} + \cos\theta\,\hat{j}] + \frac{v_C^2}{L}[-\cos\theta\,i + \sin\theta\,\hat{j}]$$

$$\vec{a}_{C/B} = L\alpha_{BC}[-\sin\theta\,\hat{i} + \cos\theta\,\hat{j}] + \frac{v_{C/B}^2}{L}[\cos\theta\,\hat{i} + \sin\theta\,\hat{j}]$$

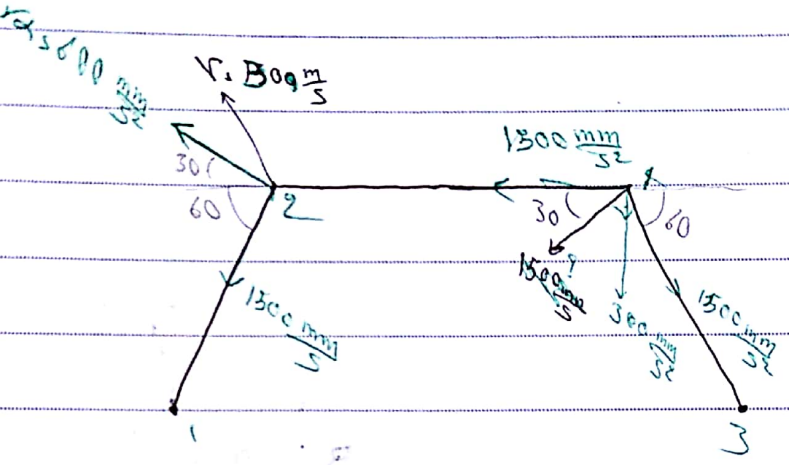
$$L\alpha_{CD}[\sin\theta\,\hat{i} + \cos\theta\,\hat{j}] + \frac{v_C^2}{L}[-\cos\theta\,i + \sin\theta\,\hat{j}] = -a_A\hat{i}$$

$$+L\alpha_{BC}[-\sin\theta\,\hat{i} + \cos\theta\,\hat{j}] + \frac{v_{C/B}^2}{L}[\cos\theta\,\hat{i} + \sin\theta\,\hat{j}]$$

$$\begin{cases} +1500\cos 60 - (A_4)_t \cos 30 = -1500\cos 60 - 600\cos 30 - 1500 i \\ -1500\sin 60 - (A_4)_t \sin 30 = -1500\sin 60 + 600\sin 30 - (A_{4/2})_t \end{cases}$$

$$(A_4)_t = \frac{+1500\cos 60 + 1500\cos 60 + 600\cos 30 + 1500}{\cos 30} = +4064.101615 \ \frac{mm}{s^2}$$

$$(A_{4/2})_t = 1500\sin 60 + (+4064.101615)\sin 30 - 1500\sin 60 + 600\sin 30 = 2332.050808 \ \frac{mm}{s^2}$$

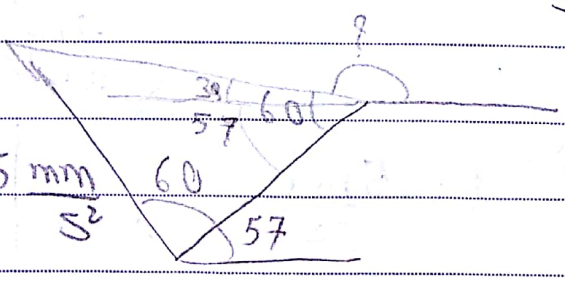


$$\vec{V}_C = \vec{V}_B + \vec{V}_{C/B} \qquad \vec{V}_{C/B} = \vec{V}_C - \vec{V}_B$$

$$|\vec{A}_4| = \sqrt{(A_4)_n^2 + (A_4)_t^2} = \sqrt{1500^2 + 4064.101615^2} = 4332.080555 \ \frac{mm}{s^2}$$

$$|\vec{A}_{C/B}| = \sqrt{1500^2 + 2332.050808^2} = 2772.807417 \ \frac{mm}{s^2}$$

$$|A_2| = \sqrt{1500^2 + 600^2} = 1615.549442 \ \frac{mm}{s^2}$$



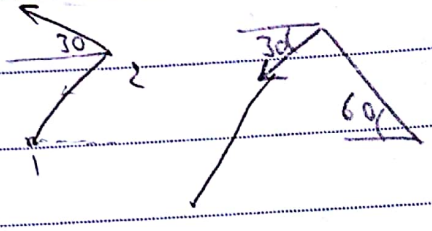
$$|\vec{A}_3| = 4121.185 \ \frac{mm}{s^2}$$

$$\vec{A}_4 = \vec{A}_2 + \vec{A}_{4/2} \qquad \vec{A}_4 = \vec{A}_2 + \vec{A}_{4/2}$$

$$(\vec{A}_4)_n + (\vec{A}_4)_t = (\vec{A}_2)_n + (\vec{A}_2)_t + (\vec{A}_{4/2})_n + (\vec{A}_{4/2})_t$$

$$(A_4)_n = \frac{V_4^2}{r} = \frac{(300)^2}{60} = 1500 \ \frac{mm}{s^2}$$

$$(\vec{A}_4)_t = -(A_4)_t \cos 30\,\hat{i} - (A_4)_t \sin 30\,\hat{j}$$



$$(A_4)_n = 1500\,[+\cos 60\,\hat{i} - \sin 60\,\hat{j}]$$

$$(A_2)_n = \frac{V_2^2}{r} = \frac{300^2}{600} = 1500 \ \frac{mm}{s^2} \Rightarrow (A_2)_n = 1500\,(-\cos 60\,\hat{i} - \sin 60\,\hat{j})$$

$$(A_2)_t = r\alpha = 60 \times 10 = 600 \ \frac{mm}{s^2} \Rightarrow (A_2)_t = 600\,[-\cos 30\,\hat{i} + \sin 30\,\hat{j}]$$

$$(A_{4/2})_n = \frac{V_{4/2}^2}{r} = \frac{300^2}{60} = 1500 \ \frac{mm}{s} \Rightarrow (A_{4/2})_n = -1500\,\hat{i}$$

$$(\vec{A}_{4/2})_t = -(A_{4/2})_t\,\hat{j}$$

$$[+1500\cos 60\,\hat{i} - 1500\sin 60\,\hat{j}] + [-(A_4)_t \cos 30\,\hat{i} - (A_4)_t \sin 30\,\hat{j}] =$$

$$= [-1500\cos 60\,\hat{i} - 1500\sin 60\,\hat{j}] + [-600\cos 30\,\hat{i} - 600\sin 30\,\hat{j}]$$

$$+ [-1500\,\hat{i} - (A_{4/2})_t\,\hat{j}]$$