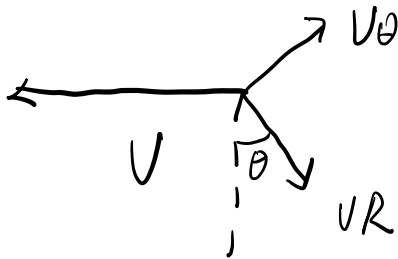


以 Fig.5 中 O 点为坐标轴原点,  $\theta$  角正方向为逆时针  
极坐标系中基矢量正方向已在上图中 标出

(1) A 点速度可分解为下图:



$$\sin \theta = \frac{4}{5} \quad \cos \theta = \frac{3}{5}$$

$$\tan \theta = \frac{4}{3}$$

$$V_R = \dot{R} = -V_B = -8 \text{ m/s} \quad \tan \theta = \frac{V_R}{V_\theta} = \frac{4}{3}$$

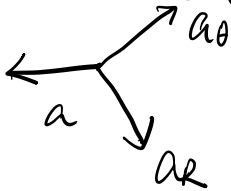
$$V_\theta = \frac{V_R}{\tan \theta} = R\dot{\theta} = -6 \text{ m/s} \quad R = \sqrt{3^2 + 4^2} = 5 \text{ m}$$

$$\dot{\theta} = \frac{V_\theta}{R} = -1.2 \text{ rad/s}$$

$$\vec{V} = V_R \vec{e}_R + V_\theta \vec{e}_\theta = -8 \vec{e}_R - 6 \vec{e}_\theta \text{ m/s}$$

$$V = \sqrt{V_R^2 + V_\theta^2} = 10 \text{ m/s}$$

(2) A 点加速度可分解如下图:



$$\ddot{R} = -a_B = -3 \text{ m/s}^2$$

$$a_\theta = \frac{a_R}{\tan \theta} = R\ddot{\theta} + 2\dot{R}\dot{\theta} = -7.65 \text{ m/s}^2$$

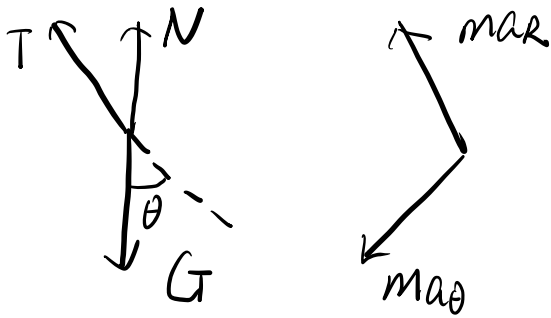
$$a_R = \ddot{R} - R\dot{\theta}^2 = -10.2 \text{ m/s}^2 + 5 \times 1.2^2 = -7.65 \text{ m/s}^2$$

$$\ddot{\theta} = -5.31 \text{ rad/s}^2$$

$$\vec{a} = a_r \vec{e}_r + a_\theta \vec{e}_\theta = -10.2 \vec{e}_r - 7.65 \vec{e}_\theta \text{ m/s}^2$$

$$a = \sqrt{a_r^2 + a_\theta^2} = 12.75 \text{ m/s}^2$$

(3)



$$\text{FBD} = \text{MAD}$$

$$\Sigma F_r = m a_r = 5.1 \text{ N}$$

$$\Sigma F_\theta = m a_\theta = 3.825 \text{ N}$$

$$G = mg = 5 \text{ N}$$

$$T + N \cos \theta - G \cos \theta = \Sigma F_r = 5.1 \text{ N}$$

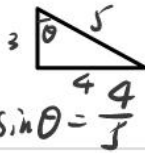
$$G \sin \theta - N \sin \theta = \Sigma F_\theta = 3.825 \text{ N}$$

$$N = 0.2188 \text{ N}$$

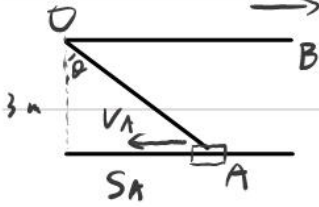
$$T = 7.969 \text{ N}$$

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Q5/



11) when  $\sin \theta = \frac{3}{5}$   $\cos \theta = \frac{4}{5}$   $\tan \theta = \frac{3}{4}$



$$R = \frac{3}{\cos \theta} = 5 \text{ m}, \quad v_R = -v_B = -8 \text{ m/s}$$

$$v_R = \dot{R} = \frac{3 \sin \theta}{\cos^2 \theta} \dot{\theta} = 6.7 \dot{\theta} \Rightarrow \dot{\theta} = -1.2 \text{ rad/s} \text{ Answer}$$



$$v_{\theta} = R \dot{\theta} = 5 \times (-1.2) = -6 \text{ m/s} \text{ (or } \frac{v_R}{v_{\theta}} = \tan \theta)$$

$$v_A = \sqrt{v_{\theta}^2 + v_R^2} = 10 \text{ m/s}, \leftarrow \text{ Answer}$$

(2)  $\ddot{R} = -a_R = -3 \text{ m/s}^2$

$$\ddot{R} = \ddot{\theta} \frac{3 \sin \theta}{\cos^2 \theta} + \frac{3 \cos^3 \theta + 6 \sin^2 \theta \cos \theta}{\cos^4 \theta} \dot{\theta}^2 = 6.7 \ddot{\theta} + 32.8 \text{ m/s}^2$$

$$\ddot{\theta} = -5.37 \text{ rad/s}^2 \text{ Answer}$$

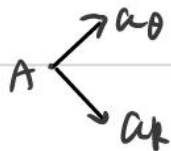
$$a_R = \ddot{R} - R \dot{\theta}^2 = -3 - 5 \times (-1.2)^2 = -10.2 \text{ m/s}^2$$

$$a_{\theta} = R \ddot{\theta} + 2 \dot{R} \dot{\theta} = 5 \ddot{\theta} + 2 \times (-8) \times (-1.2) = -7.65 \text{ m/s}^2$$

$$\text{(or } \frac{a_R}{a_{\theta}} = \tan \theta)$$

$$a = \sqrt{a_R^2 + a_{\theta}^2} = 12.75 \text{ m/s}^2, \leftarrow \text{ Answer}$$

(3)



$$\sum F_R = m a_R$$

$$+ \uparrow : -T - N_A \cos \theta + G_A \cos \theta = m a_R$$

$$\sum F_{\theta} = m a_{\theta}$$

$$+ \checkmark : -G_A \sin \theta + N_A \sin \theta = m a_{\theta}$$

FBD = MAD

$$\Rightarrow \begin{cases} -T - 0.6 N_A + 0.5 \times 10 \times 0.6 = 0.5 \times (-10.2) \\ -0.5 \times 10 \times 0.8 + 0.8 N_A = 0.5 \times (-7.65) \end{cases}$$

can solve:  $N_A = 0.21875 \text{ N}$   $T = 7.96875 \text{ N}$  Answer