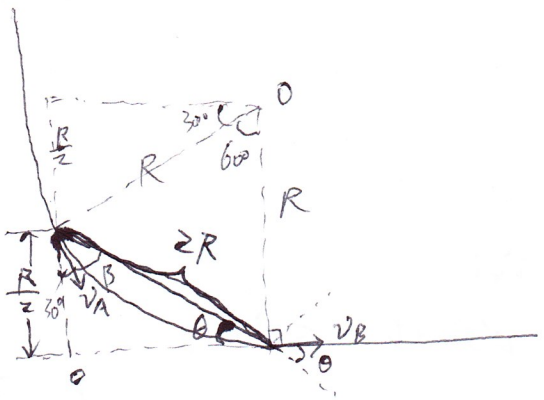
HW 4

2/218



$$\sin\theta = \frac{\frac{R}{2}}{2R} = \frac{1}{4} \qquad \theta = 14.4775°$$

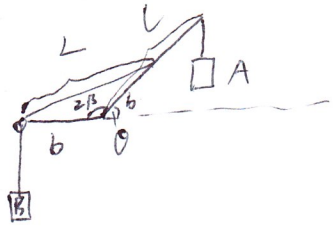
$$v_B\cos\theta = v_{AB} = v_A\cos\beta$$

$$\beta = (90°-\theta) - 30° = 60°-\theta = 45.5225°$$

($\angle OAB$)

$$\therefore v_A = \frac{v_B\cos\theta}{\cos\beta} = \frac{2\,m/s \times \cos 14.4775°}{\cos 45.5225°} = 2.76393\ m/s.$$

2/224.



$$L = 2b\sin\beta$$

$$\dot{L} = 2b\cos\beta\,\dot{\beta} = v_B \Rightarrow \dot{\beta} = \frac{v_B}{2b\cos\beta}$$

$$(l\sin\theta)' = l\cos\theta\,\dot{\theta} = v_{Ay}.$$

$$\theta + 2\beta = 180° \Rightarrow \dot{\theta} + 2\dot{\beta} = 0.$$

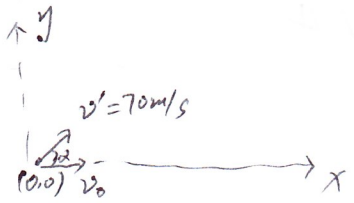
$$\therefore \dot{\theta} = -2\dot{\beta} = -2\times\frac{v_B}{2b\cos\beta} = \frac{-2\times v_B}{2b\cos\left(\frac{\pi-\theta}{2}\right)}$$

$$\therefore v_{Ay} = l\cos\theta\,\frac{-v_B}{b\cos\left(\frac{\pi-\theta}{2}\right)} = l\cos\theta\,\frac{-v_B}{b\sin\frac{\theta}{2}}$$

$$|v_{Ay}| = l\cos\theta\,\frac{v_B}{b\sin\frac{\theta}{2}} = l\cos\theta\,\frac{v_B}{b\times\sqrt{\frac{1+\cos\theta}{2}}} = l\,\frac{\sqrt{1-\cos^2\theta}}{\tan\theta}\,\frac{v_B}{b\sqrt{\frac{1+\cos\theta}{2}}} = l\,\frac{\sqrt{1+\cos\theta}\sqrt{1+\cos\theta}}{\tan\theta}\times\frac{v_B\sqrt{2}}{b\sqrt{1+\cos\theta}}$$

$$= l\,\frac{\sqrt{1+\cos\theta}}{\tan\theta}\times\frac{\sqrt{2}v_B}{b}.$$

2/198



$v_x = v'\cos\alpha + v_0$ $\quad x(t) = v_x t$

$v_y = v'\sin\alpha$ $\quad y(t) = v'\sin\alpha\, t - \frac{1}{2}gt^2$

$$y = v'\sin\alpha \frac{x}{v_x} - \frac{1}{2}g\left(\frac{x}{v_x}\right)^2 = \frac{x}{\cot\alpha + \frac{v_0}{v'\sin\alpha}} - \frac{g}{2}\left(\frac{x}{v'\cos\alpha + v_0}\right)^2$$

$x = 350$ $\quad y = 60 - 2.5 = 57.5$

$$\therefore \quad 57.5 = \frac{350}{\cot\alpha + \frac{0.1190}{\sin\alpha}} - 4.9x\left(\frac{350}{70\cos\alpha + 8.333}\right)^2$$

$\therefore \alpha = 74.3°$ or $31.28°$.

Stationary:

$y = 70(\sin\alpha)t - \frac{1}{2}gt^2$.

$x = 70(\cos\alpha)t$.

$$\therefore y = x\tan\alpha - \frac{g}{2}\left(\frac{x}{70\cos\alpha}\right)^2$$

plug $x=350$ $y=57.5$ into above equation, solve it, got $\alpha = 65.4°$ or $33.9°$.