Problem 4. midterm #2. EMA202, spring 2015

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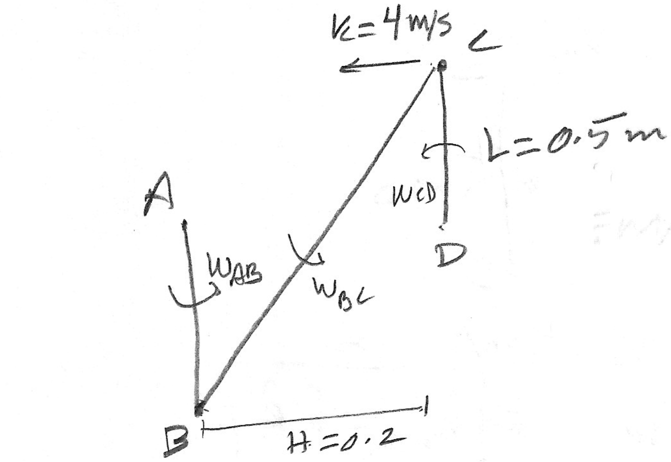
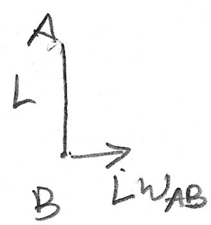
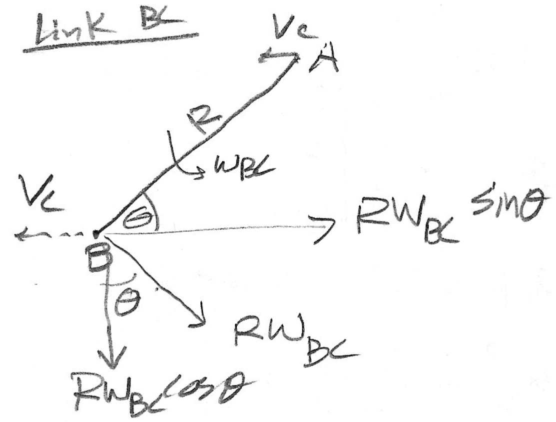






equating speed of B at Both sides.

$$X: \quad LW_{AB} = -V_C + RW_{BC}\sin\theta \quad (1)$$

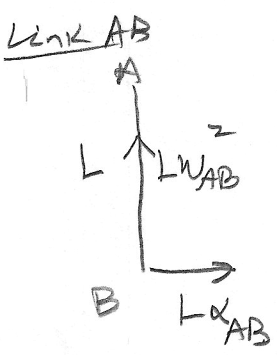
$$y: \quad 0 = -RW_{BC}\cos\theta \quad (2)$$

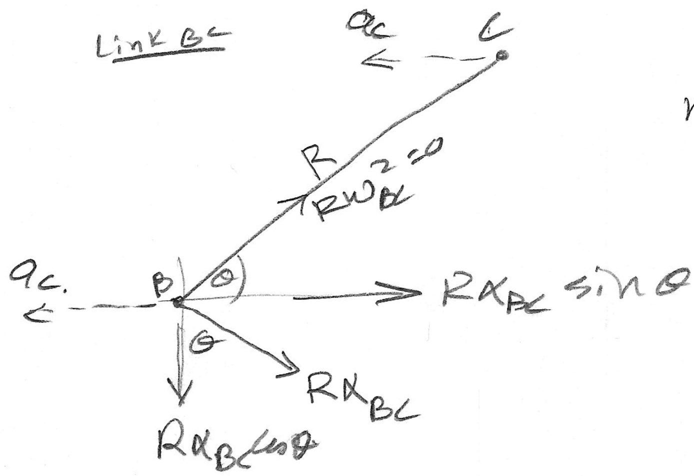
From (2) $\Rightarrow W_{BC} = 0$. From (1) $\Rightarrow LW_{AB} = -V_C$

but $V_C = 4$ m/s. $\Rightarrow W_{AB} = -\frac{V_C}{L} = \frac{-4}{0.5} = -8$ rad/sec.

So $\boxed{\overline{W}_{AB} = -8\hat{k}}$ clockwise rotation.

acceleration

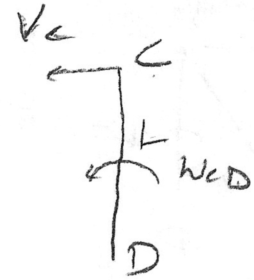




now we need to find a_C.

$\rightarrow$

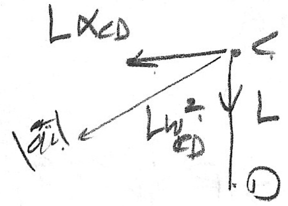
looking at Link $\underline{CD}$



so $V_c = L w_{CD}$. we are given $V_c = 4\ m/s$. so

$$w_{CD} = \frac{V_c}{L} = \frac{4}{0.5} = 8\ rad/se. \quad \text{so } \boxed{\overline{w_{CD}} = 8\hat{k}}$$

$\underline{acc}$



we are given that $|a_c| = 55$. Then.

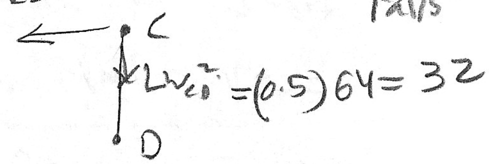
$$\text{Then } |a_c|^2 = L^2\alpha_{CD}^2 + (Lw_{CD}^2)^2$$

$$55^2 = 0.5^2\alpha_{CD}^2 + 0.5^2 \cdot (8)^4$$

$$\alpha_{CD}^2 = \frac{55^2 - 0.5^2(8^4)}{0.5^2} = (89.465)^2$$

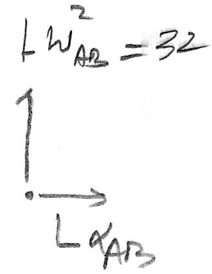
$$\boxed{\alpha_{CD} = 89.465\ rad/s^2}$$

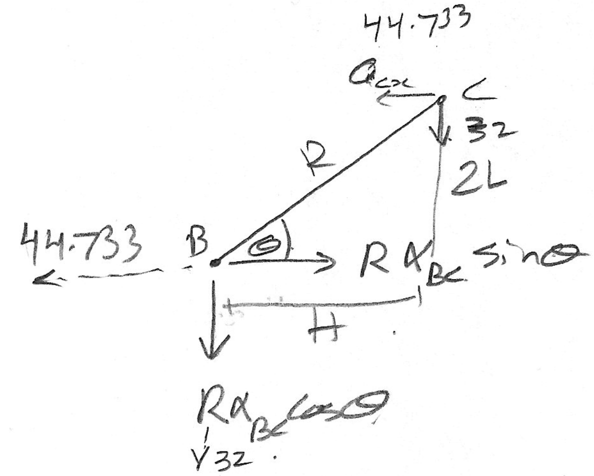
$L\alpha_{CD} = (0.5)(89.465) = 44.733$ rad/s^2



so at point C we have

now we go to last diagram.





comparing x, y at point B

$$X: \quad L\alpha_{AB} = -44.733 + R\alpha_{BC}\underbrace{\left(\frac{2L}{R}\right)}_{\sin\theta}$$

$$\boxed{0.5\,\alpha_{AB} = -44.733 + \alpha_{BC}} \qquad ①$$

$$y: \quad 32 = -R\alpha_{BC}\underbrace{\left(\frac{H}{R}\right)}_{\cos\theta} - 32 \qquad ②$$

$$32 = -0.2\,\alpha_{BC} - 32$$

$$\alpha_{BC} = \frac{-64}{0.2} = -320 \text{ rad/sec} \qquad \boxed{\overline{\alpha}_{BC} = -320\,\hat{k}}$$

From ①

$$0.5\,\alpha_{AB} = -44.733 - 320$$

$$\alpha_{AB} = \frac{-44.733 - 320}{0.5} = -729.4 \text{ rad/s}^2$$

$$\boxed{\overline{\alpha}_{AB} = -729.4\,\hat{k}}$$