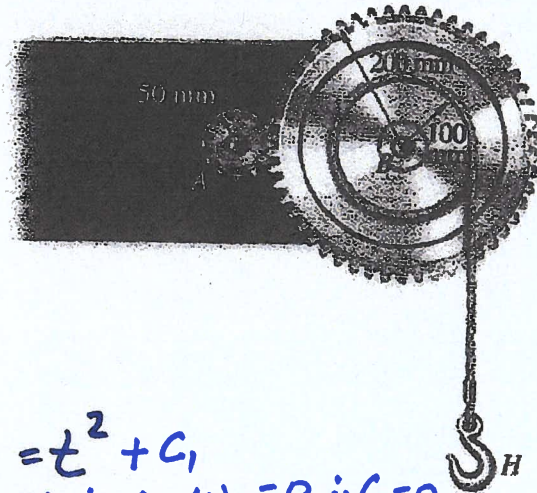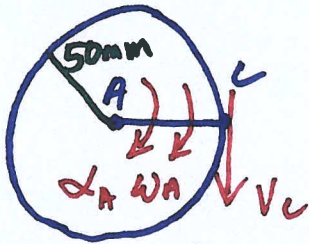## Rigid Body Kinematics I – Problem 2

Gear *A* of the winch turns gear *B*, raising the hook *H*. Gear *A* has a clockwise angular acceleration of $\alpha_A = 2t$ rad/s². What is the upward velocity of the hook at $t = 2$s?

and is initially at rest

$$\alpha_A = 2t \text{ rps}^2$$

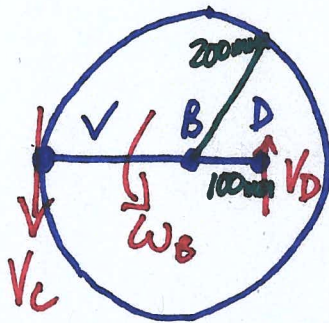$$\omega_A = \int \alpha_A \, dt = \int 2t \, dt = t^2 + C_1$$

at $t = 0$, $\omega_A = 0$ ∴ $C_1 = 0$
∴ $\omega_A = t^2$

$$\omega_A \text{ @ } t = 2s = 2^2 = 4 \text{ rps}$$

$$V_c = \omega_A r_A = 4(50) = 200 \text{ mm/s}$$

$$V_c = \omega_B r_B$$

$$200 = \omega_B (200)$$

$$\omega_B = 1 \text{ rps}$$

$$V_D = \omega_B r_D = (1)(100) = \underline{100 \text{ mm/s}} \uparrow$$