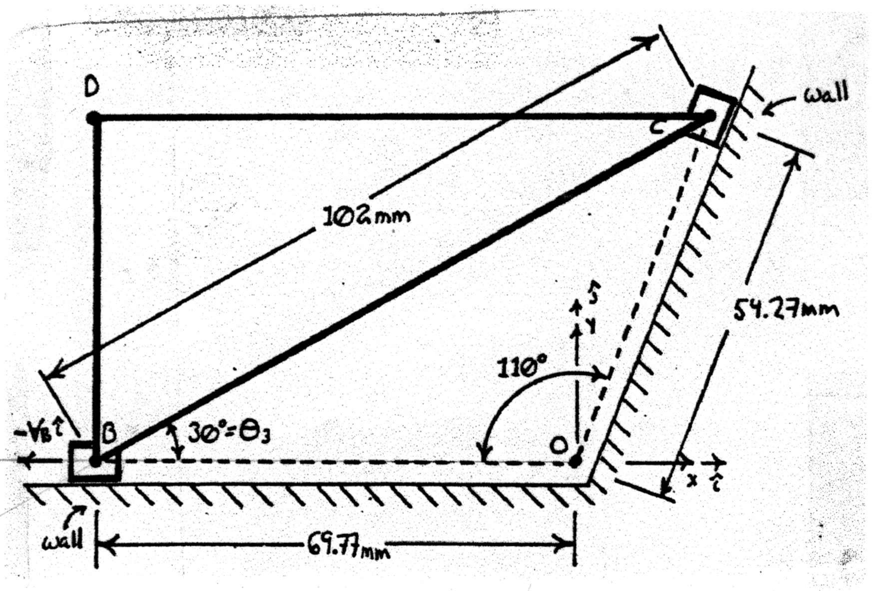
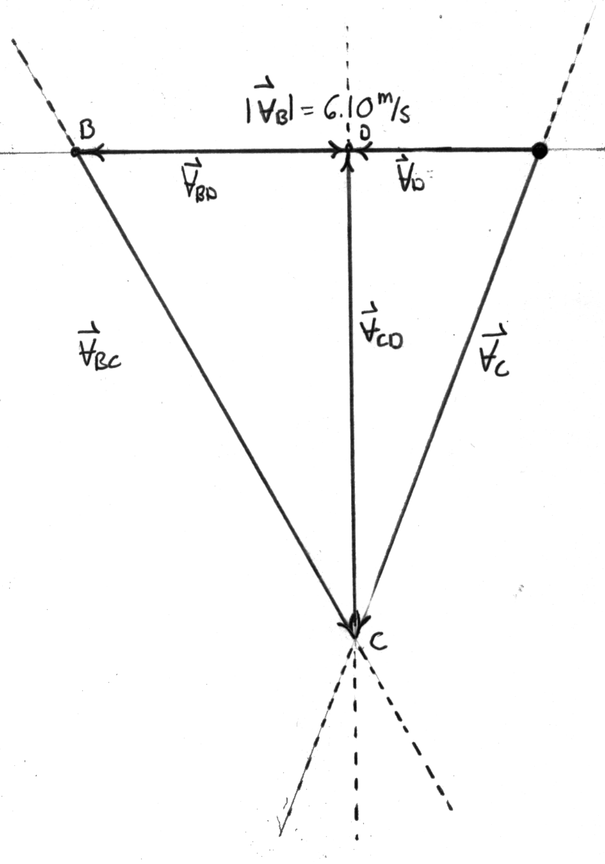
NAME: SOLUTION

PROBLEM 1: For the mechanism shown in the figure below, the slider at point B travels to the left with a velocity of 6.10m/s. Point D is part of a link that attaches slider B to slider C. Both sliders B and C are constrained to travel on the paths shown.

1a. Find the angular velocity of link BCD and the velocity of point D using the velocity polygon method.





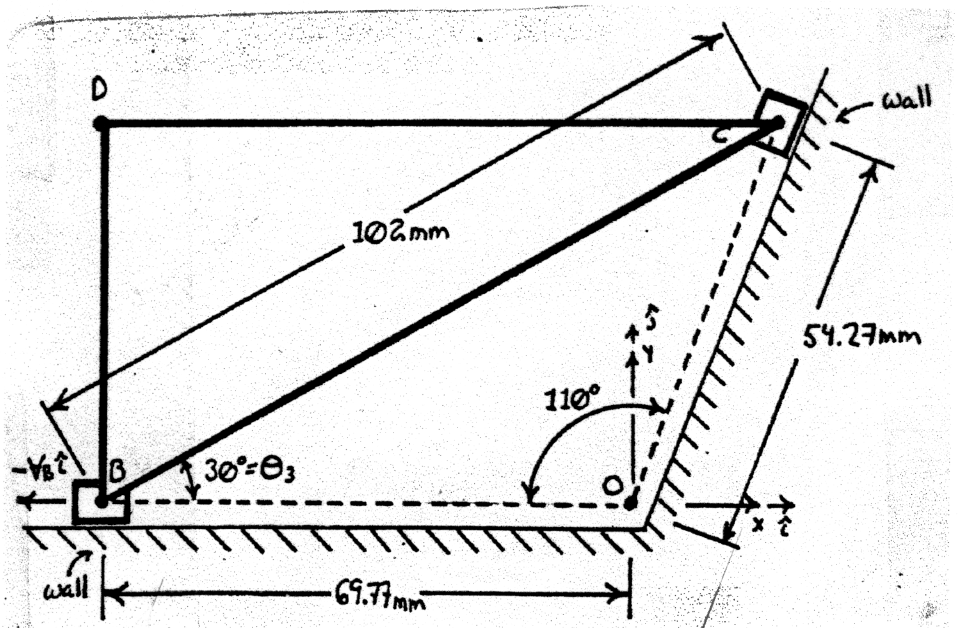
$V_C = 6.9 \frac{m}{s}$

$V_{BC} = 7.4 \frac{m}{s}$

$\omega_{BCD} = \frac{V_{BC}}{r_{BC}} = \frac{7.4 \, m/s}{.102 \, m} = \boxed{72.5 \, 1/s}$

$V_D = \boxed{2.5 \, m/s}$

1b. Given that slide B is decelerating at the rate of 100m/s^2, determine that angular acceleration of link BCD and the acceleration of slide C using acceleration polygons.

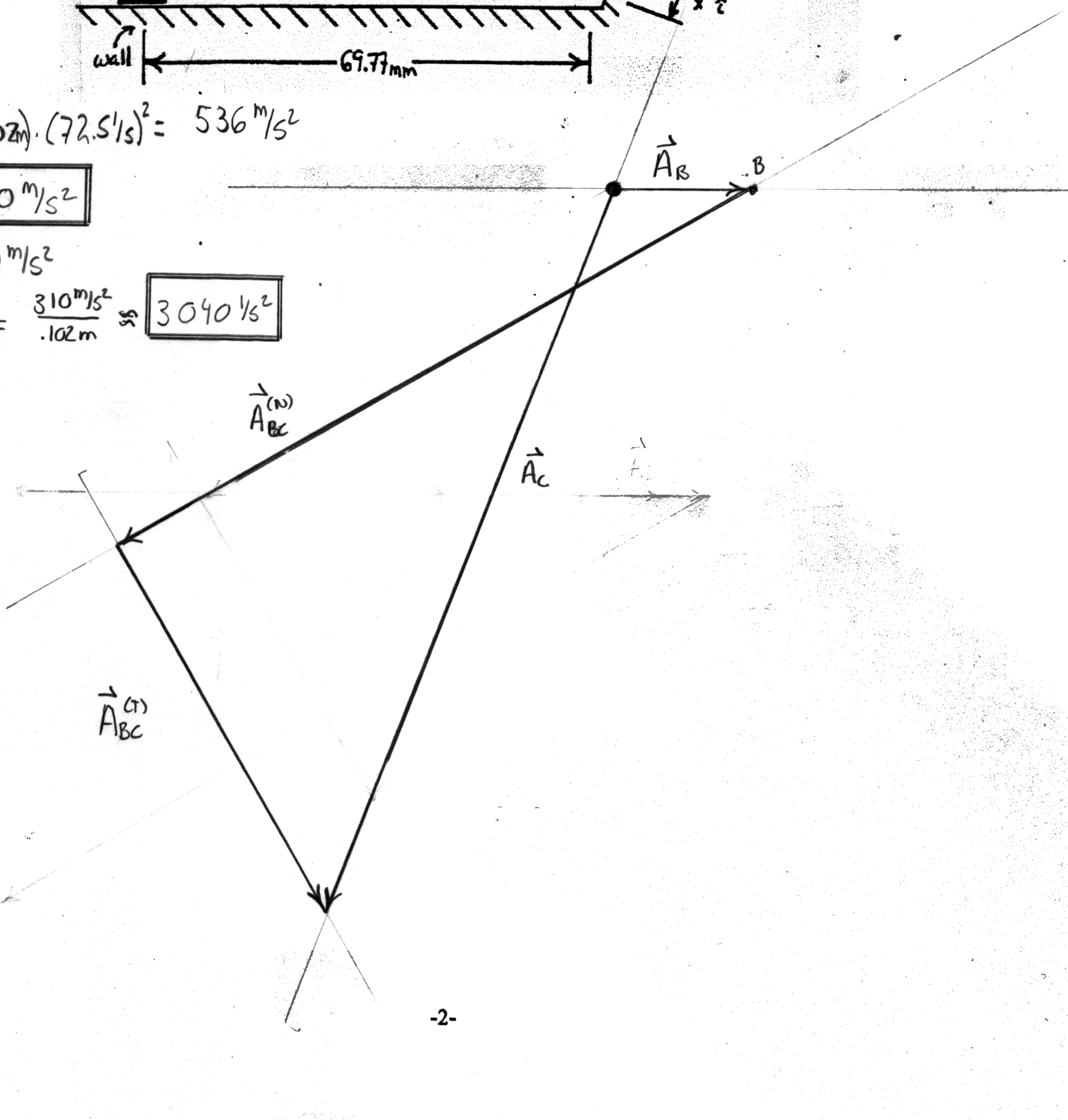


$A_{BC}^{(N)} = (.102m)\cdot(72.5\,1/s)^2 = 536\ m/s^2$

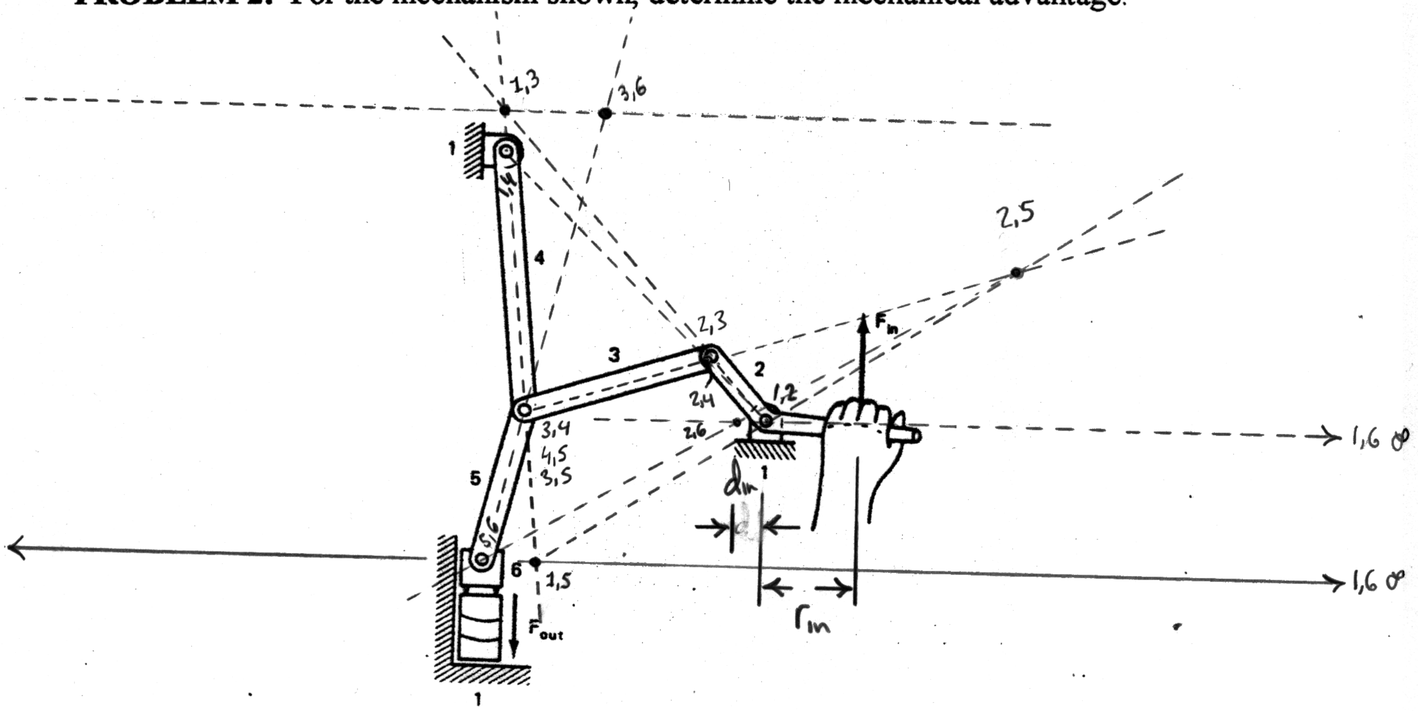
$A_C = \boxed{580\ m/s^2}$

$A_{BC}^{(T)} = 310\ m/s^2$

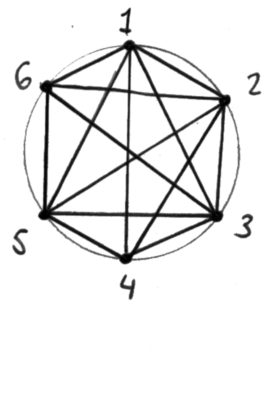
$\alpha_3 = \dfrac{A_{BC}^{(T)}}{r_{BC}} = \dfrac{310\ m/s^2}{.102\,m} \cong \boxed{3040\ 1/s^2}$



PROBLEM 2: For the mechanism shown, determine the mechanical advantage.



$$MA = \frac{r_{in}}{d_{in}} = \frac{12}{4} = \boxed{3}$$



PROBLEM 3: For a cam with the following characteristics:

a. rise ¾ in with constant acceleration in 90°
b. rise ¾ in with constant deceleration in 90°
c. dwell 30°
d. fall ¾ in with constant acceleration in 60°
e. fall ¾ in with constant deceleration in 60°
f. dwell 30°

3a. Determine the polynomials for each of the sections of the cam.

REGION #1 $0° < \theta < 90°$, $\beta = \frac{\pi}{2}$

$S_1 = C_0 + C_1\left(\frac{\theta_1}{\beta_1}\right) + C_2\left(\frac{\theta_1}{\beta_1}\right)^2$

B.C.: $\theta_1 = 0$: $S_1(0) = 0\text{ in}$, $V_1(0) = 0\ \text{in/rad}$

$\theta_1 = \frac{\pi}{2}$: $S_1\left(\frac{\pi}{2}\right) = 3/4\text{ in}$

REGION #2 $90° < \theta < 180°$, $0 < \theta_2 < \frac{\pi}{2}$, $\beta = \pi/2$

$S_2 = C_0 + C_1\left(\frac{\theta_2}{\beta_2}\right) + C_2\left(\frac{\theta_2}{\beta_2}\right)^2$

B.C.: $\theta_2 = 0$, $S_2(0) = 0.75\text{ in}$

$\theta_2 = \pi/2$, $S_2(\pi/2) = 1.5\text{ in}$, $V = 0\ \text{in/rad}$

REGION #3 $180° < \theta < 210°$, $0 < \theta_3 < \pi/6$, $\beta_3 = \pi/6$

$S_3 = 1.5\text{ in}$

REGION #4 $210° < \theta < 270°$, $0 < \theta_4 < \pi/3$, $\beta_4 = \pi/3$

$S_4 = C_0 + C_1\left(\frac{\theta_4}{\beta_4}\right) + C_2\left(\frac{\theta_4}{\beta_4}\right)^2$

B.C.: $\theta_4 = 0$, $S_4(0) = 1.5\text{ in}$, $V_4(0) = 0\ \text{in/rad}$

$\theta_4 = \frac{\pi}{3}$, $S_4\left(\frac{\pi}{3}\right) = 0.75\text{ in}$

REGION #5 $270° < \theta < 330°$, $0 < \theta_5 < \pi/3$, $\beta_5 = \pi/3$

$S_5 = C_0 + C_1\left(\frac{\theta_5}{\beta_5}\right) + C_2\left(\frac{\theta_5}{\beta_5}\right)^2$

BC: $\theta_5 = 0$, $S_5(0) = .75\text{ in}$

$\theta_5 = \pi/3$, $S_5(\pi/3) = 0\text{ in}$, $V_5(\pi/3) = 0\ \text{in/rad}$

REGION #6 $330 < \theta < 360$, $0 < \theta_6 < \pi/6$, $\beta_6 = \pi/6$

$S_6 = 0$

3b. Draw the SVAJ diagram for this cam.