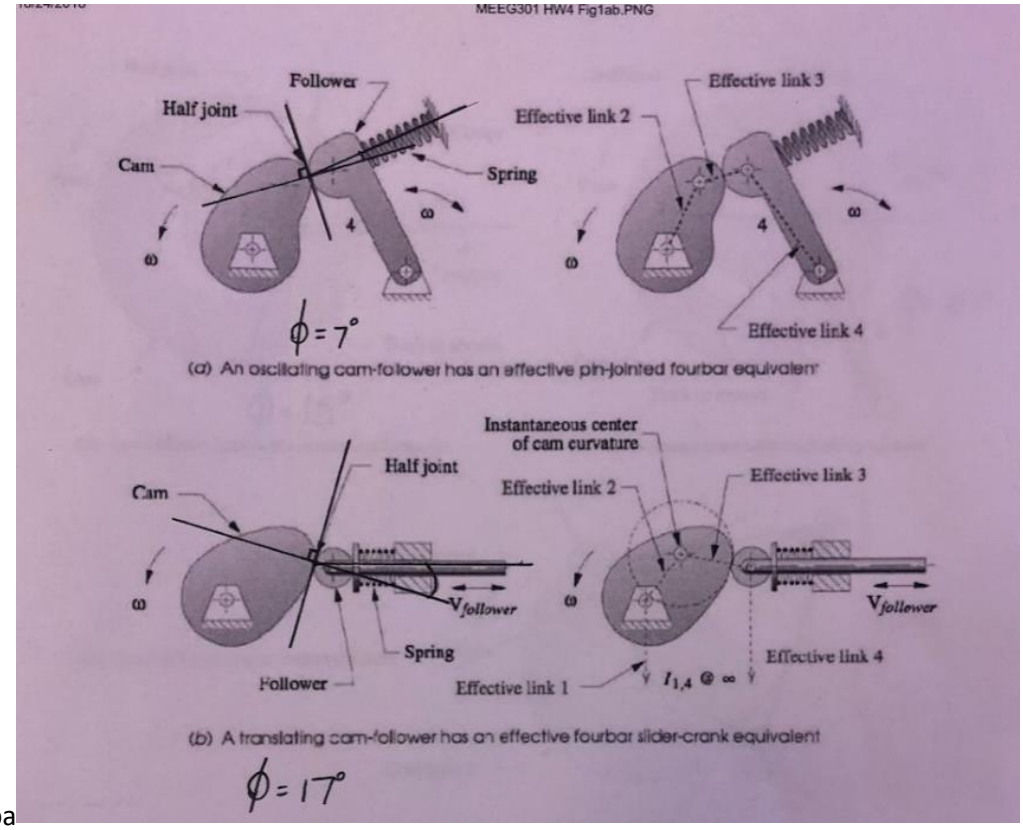
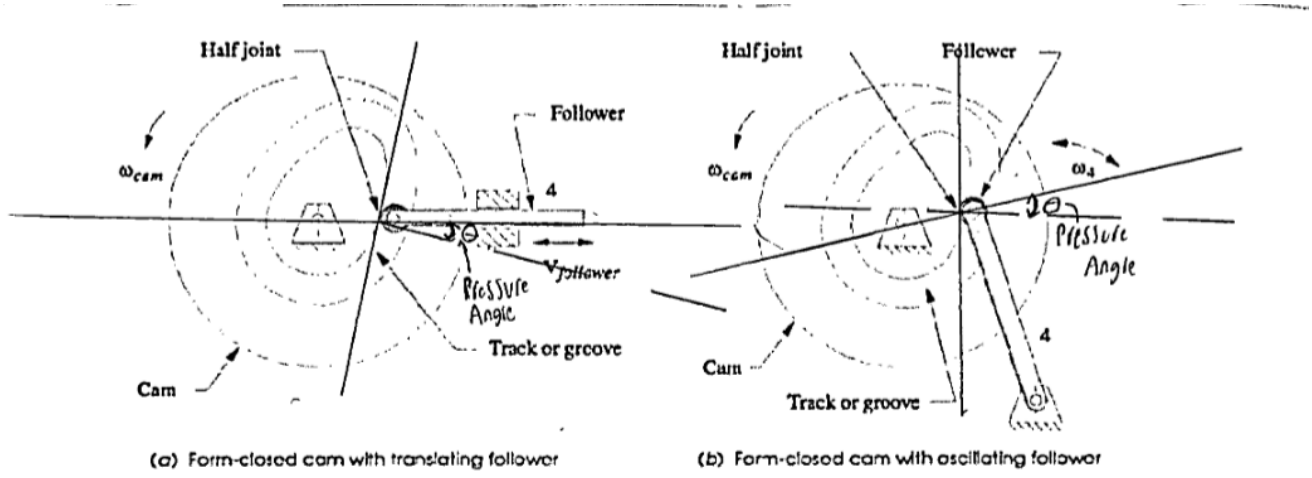
HW 4 Solution

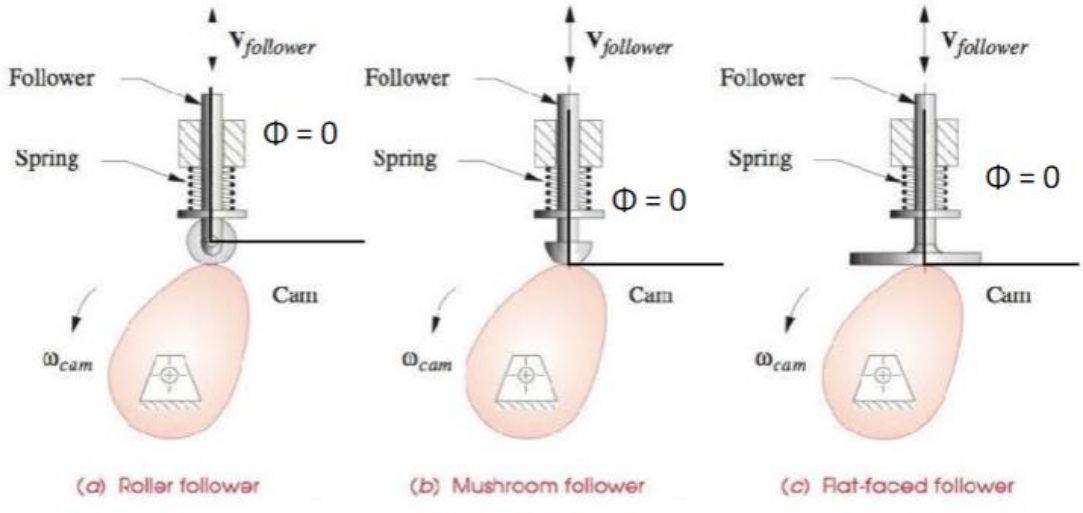
Problem 1



Rst [pa

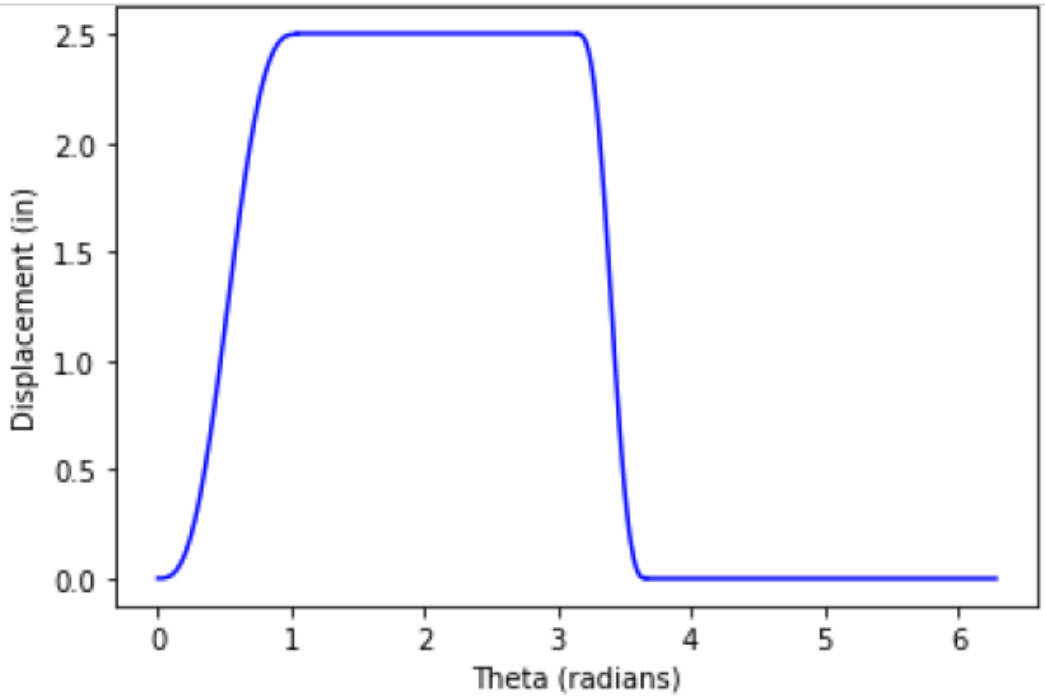
Note: The pressure angle on the first part is the angle between the line joining the two instantaneous center of rotation and the line which is perpendicular to the tangent line.

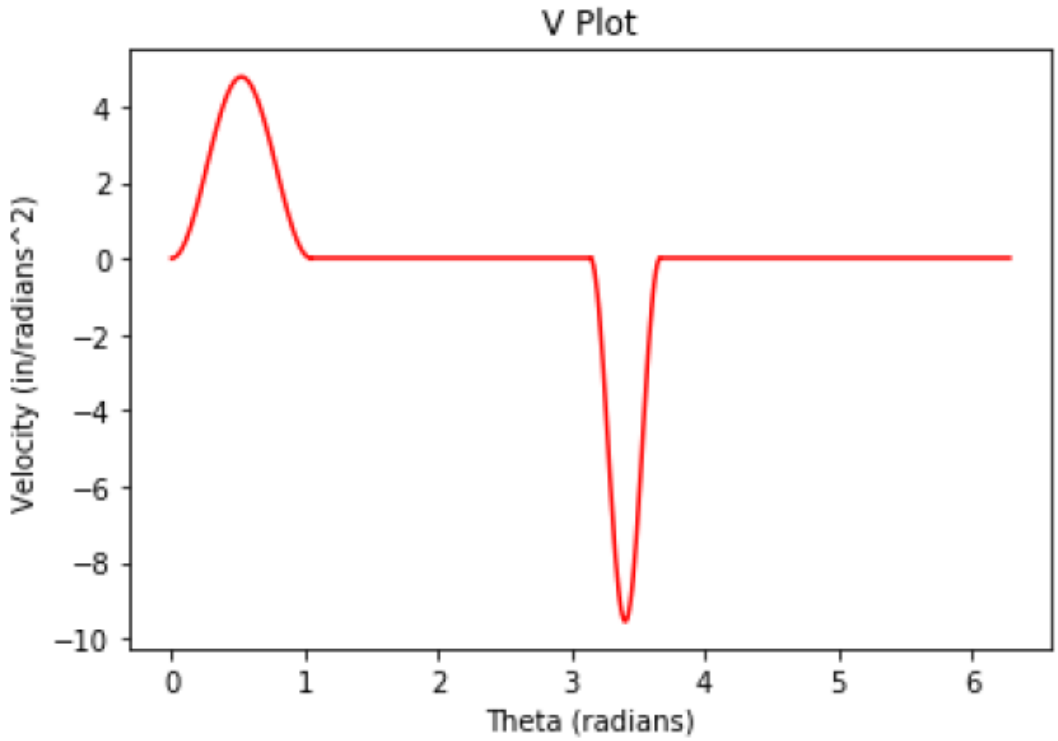




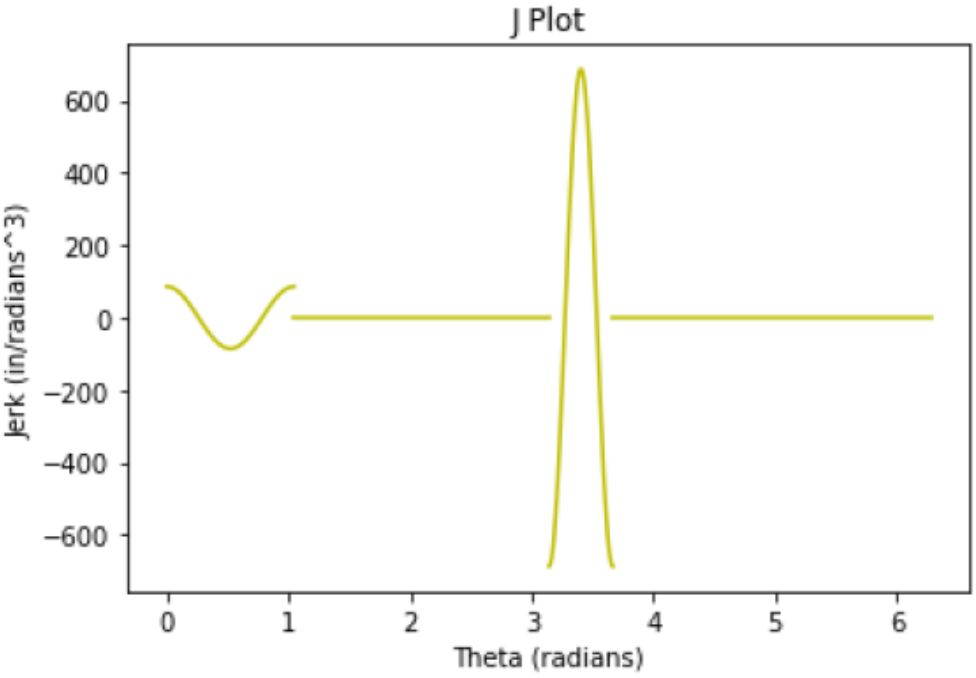
Note: The flat faced follower (c) has a pressure angle of 0, but for the other two it depends on the accuracy of the tangent line but should be close to zero.

Problem 2


Displacement (in)
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
Theta (radians)


V Plot
Velocity (in/radians^2)
4
2
0
−2
−4
−6
−8
−10
0
1
2
3
4
5
6
Theta (radians)


A Plot
Acceleration (in/radians^2)
60
40
20
0
−20
−40
−60
0
1
2
3
4
5
6
Theta (radians)


J Plot
Jerk (in/radians^3)
600
400
200
0
−200
−400
−600
0
1
2
3
4
5
6
Theta (radians)

Problem #2

Find theoretical max acceleration; $\frac{\beta}{4} \cdot \frac{1}{\beta}$

Use C-6 Cycloidal Functions

$$J = -\frac{4\pi^2 L}{\beta^3} \cos\left(2\pi \frac{\theta}{\beta}\right) = 0$$

$$\cos\left(2\pi \frac{\theta}{\beta}\right) = 0 \qquad \frac{2\pi \frac{\theta}{\beta}}{2\pi} = \frac{\frac{\pi}{2}}{2\pi}$$

$$\frac{\theta}{\beta} = \frac{\pi}{4\pi} \rightarrow \theta = \frac{\beta\pi}{4\pi} = \frac{\beta}{4}$$

Acceleration is A_{max} @ $\theta = \frac{\beta}{4}$

In this case $\beta = \frac{\pi}{6}$ radians

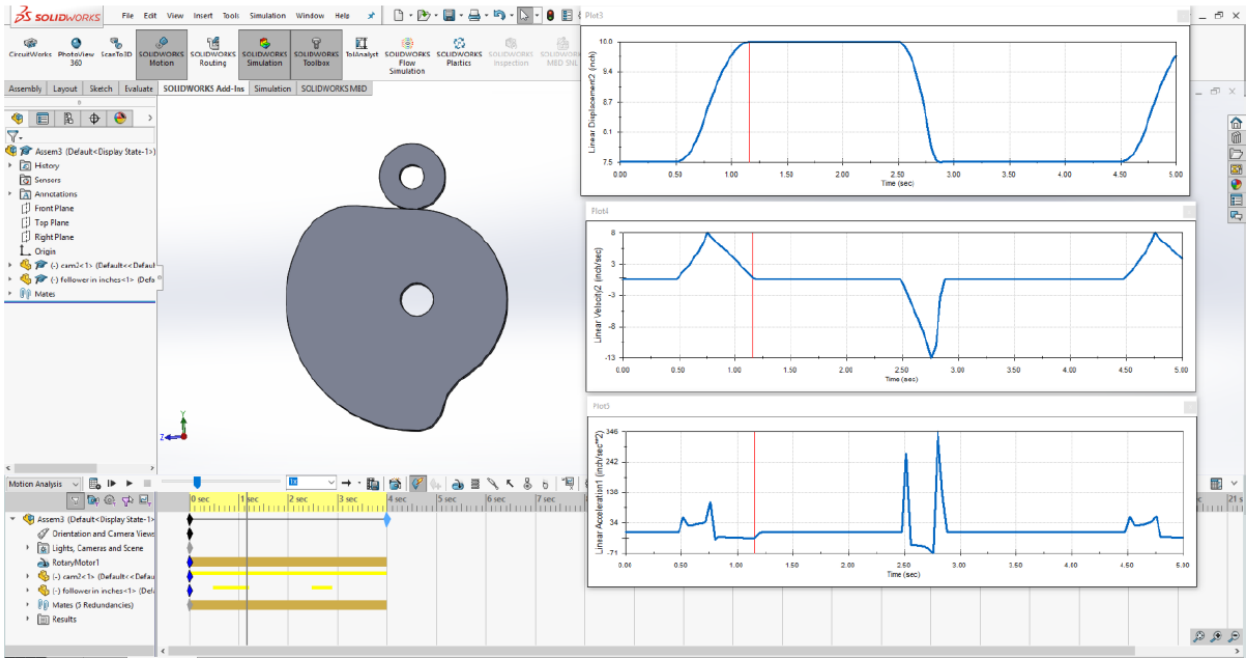
$$A = -\frac{2\pi L}{\beta^2}\left(\sin 2\pi \frac{\theta}{\beta}\right)$$

$$A\left(\frac{\beta}{4}\right) = \frac{-2\pi L}{\beta^2} \sin\left(2\pi \frac{\beta}{4} \cdot \frac{1}{\beta}\right)$$

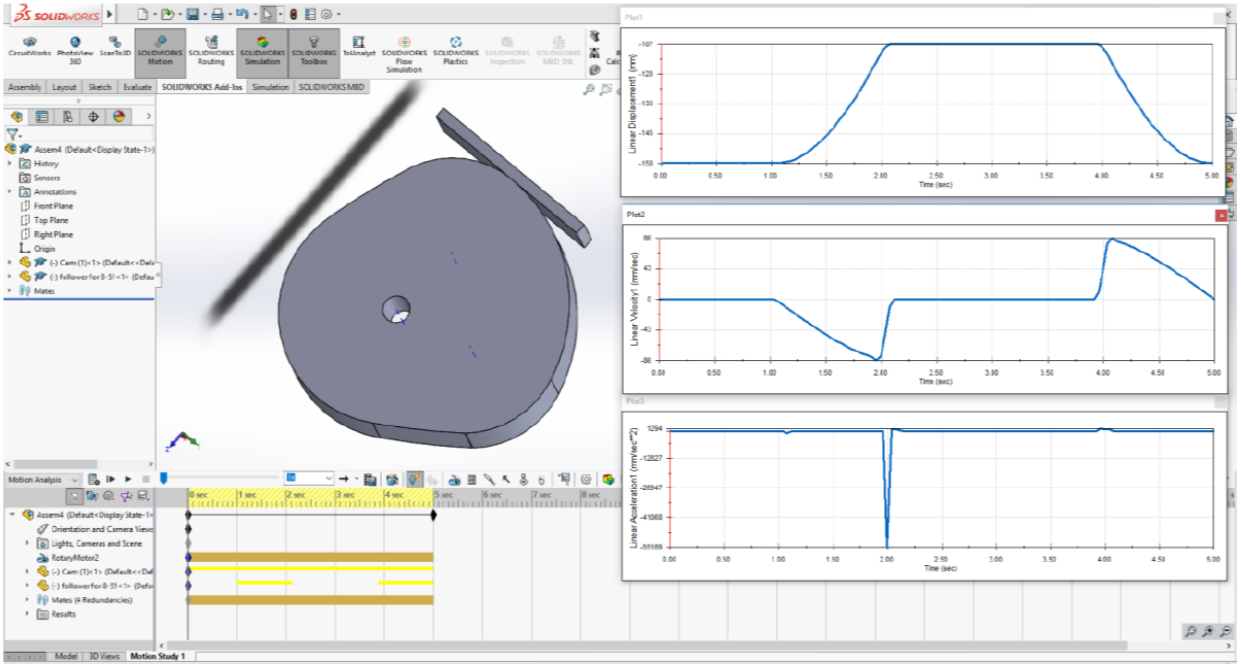
$$A = -\frac{2\pi(2.5")}{\left(\frac{\pi}{6}\right)^2} \sin\left(2\pi \cdot \frac{1}{4}\right) = \boxed{57.29 \text{ in/s}^2}$$

Problem 3

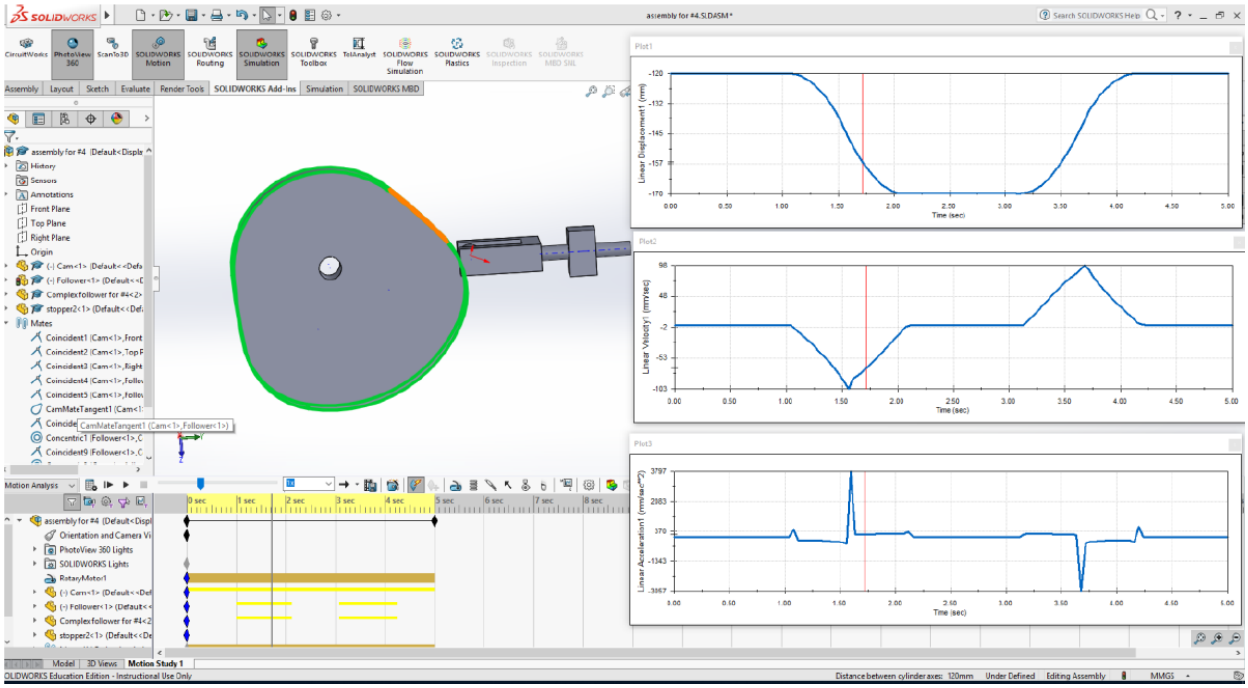
8-45



8-51



Problem 4



Note: There was a wide range of cam designs that you could have, leading to different plots, but the main idea was to get you at least remotely comfortable with what SolidWorks can do regarding Cam and Follower design.