MECH 467 - Tutorial 9 - Trajectory Generation

A CNC interpolator is to be designed which generates linear and circular trajectories using trapezoidal feed-rate profiles. The CNC has a sample period of T_i = 0.001 [s]. The servo motors have a maximum acceleration and deceleration of A = 1000 [mm/s^2] and D = -1000 [mm/s^2], respectively.

A toolpath containing a linear segment followed by a circular arc is given by the following G-code. Machine is at rest in home position before the G-code is run. (Note that the circular segment starts at the end point of the linear segment.)

N010 G01 X4.0 Y3.0 F12900
N020 G03 X44.0 I20.0 J0.

(F is in mm/min; G03: counterclockwise; I and J are the x and y offsets of the center of the circle relative to the start point (of the circular segment). When a coordinate or parameter is not changed in a G-code line, it keeps its previous value)

1) Find the radius and coordinates of the center of the circle.
2) Calculate the length of the linear and circular segments.
3) For each segment, calculate the number of interpolation periods for acceleration, constant feed, and deceleration.
4) Fill in the information in the table below for the first three interpolation periods of each segment (line and arc).

k	t [s]	l [mm]	f [mm/s]	a [mm/s^2]	x_r [mm]	y_r [mm]	$\dot{x}_r$ [mm/s]	$\dot{y}_r$ [mm/s]	$\ddot{x}_r$ [mm/s^2]	$\ddot{y}_r$ [mm/s^2]
0										
1										
2										
3										