% L4Q7: A script to plot the trajectory of a 2-link planar robot
% positioned at [2, 0] with link lengths of 4 and 2 moving
% counter-clockwise with the second link rotating at the
% same rate as the first.
%
% Usage:    L4Q7
% Arguments: None.
% Returns:  Nil.
% Author:   Lecturers
% Date:     Semester 2
%
% Define the link arm constants.
l1 = 4;
l2 = 2;
rate = 2;

% Create an array of theta values to simulate the robot arm
% rotating around the origin.
theta = 0 : pi/180 : 2*pi;

% Create an array of x coordinates for the end-point of the
% robot arm. The x coordinate for a given theta value is:
%     x = 2 + l1*cos(theta) + l2*cos(2*theta)
% The 2 + is a result of the robot arm not positioned at
% the origin.
x = 2 + l1*cos(theta) + l2*cos(rate*theta);

% Create an array of y coordinates for the end-point of the
% robot arm. The y coordinate for a given theta value is:
%     x = l1*sin(theta) + l2*sin(2*theta)
y = l1*sin(theta) + l2*sin(rate*theta);

% Plot y versus x.
plot(x, y);

% Draw lines representing the axes.
m = 2 + l1 + l2;
line([-m, m], [0, 0]);
line([0, 0], [-m, m]);
% Constrain the axes.
axis([-m, m, -m, m]);

% Create axis labels and titles.
xlabel('x');
ylabel('y');
title('The Robot Arm Cardioid');