Some MATLAB Practice Exercises for Vector Calculus Students

Exercise 1

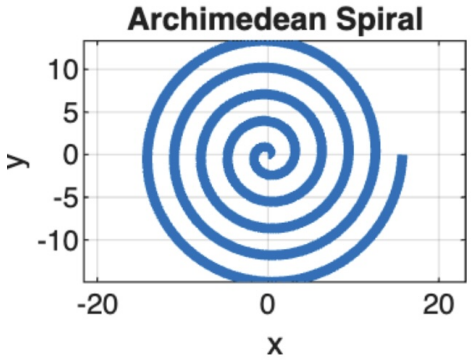
An equation for the circle with center at (3,-2) and radius 4 is $(x-3)^2+(y+2)^2=4^2$
We can also also represent this circle parametrically using $x = 3+4\cos(t), y=-2+4\sin(t)$
Here is some MATLAB code that will produce a nice picture

```
t = linspace(0, 2*pi, 100);
x = 3 + 4 * cos(t);
y = -2 + 4 * sin(t);
plot( x, y, 'LineWidth',4)
xlim([-10 10])
ylim([-10,10])
grid on
```

Modify this code to plot the circle with center (-2,1) and radius 3

Exercise 2

Here is a graph of a figure called an Archimedean Spiral along with some documented MATLAB code that generates it.




```
% Parameters
a = 0;              % Starting radius
b = 0.5;            % Distance between turns
t = linspace(0, 10*pi, 1000); % Angle range (0 to 5 revolutions)

% Parametric equations
r = a + b * t;
x = r .* cos(t);
y = r .* sin(t);

% Plot
figure;
plot(x, y, 'LineWidth', 3);
axis equal; % Essential to keep the spiral looking proportional
grid on;
title('Archimedean Spiral');
xlabel('X'); ylabel('Y');
```

Experiment with changing the number of revolutions and values of a and b to see how the graph changes

Exercise 3

The function $f : \mathbb{R} \to \mathbb{R}^4$ given by $f(t) = \left(e^{-t/10}\cos(5t), e^{-t/10}\sin(5t), t\right)$ generates a curve in 3-space that you can plot in MATLAB with these commands:

```
t = linspace(-10 , 10 , 1000);
x = exp(-t/10) .* cos(5*t);
y = exp(-t/10) .* sin(5*t);
z = t;
plot3(x, y, z)
```

Have MATLAB generate a picture of this curve.
How does the graph change if you replace the last line by plot(x, y)