MATH 241
MATLAB Problem Set 1

Print out the plots of each part of the following problems to hand. If you wish to economize on the amount of paper, you may use the command `subplot` (page 93 of the MATLAB Companion).

The first four problems can be done on the command line, although it is useful to put all the commands in an Mfile.

1. a) Use the command `plot` to draw the polygonal line in $\mathbb{R}^2$ through the points $(1, 2)$, $(1.5, 3)$, $(2, 2)$, $(\pi, 4)$.

b) Draw the rectangle with vertices $(1, 1)$, $(4, 1)$, $(4, 3)$, $(1, 3)$. Be sure to close the rectangle by drawing the fourth side. To make the drawn rectangle sit inside a larger rectangle, we set the limits of the x and y axes with the command
`>> axis([0, 5, 0,4]).`

2. Graph the function
$$f(x) = \frac{\cos x}{1 + x^2}$$
on the interval $[0, 2\pi]$.

a) Use the commands

```
>> x = linspace(0, 2*pi, 11);
>> y = cos(x)./(1+x.^2);
>> plot(x,y)
```

The result should be a polygonal line through the 11 points $(x_j, f(x_j))$, where $x_j = (2\pi j)/10, \; j = 0, 1, \ldots, 10$.

b) Do this in a different way with the commands

```
>> f = inline('cos(x)./(1+x.^2)')
>> plot(x,f(x))
```

c) To make a smoother curve, increase the number of points.

```
>> x = linspace(0, 2*pi, 21);
>> plot(x,f(x))
>> x = linspace(0, 2*pi, 51);
>> plot(x,f(x))
```

3. a) Draw the circle with center at $(1, 2)$ and radius $r = 3/2$ with commands

```
>> t = linspace(0, 2*pi, 101);
>> x = 1+1.5*cos(t);
>> y = 2+1.5*sin(t);
>> plot(x,y)
```

To make the circle look like a circle instead of an egg, use the command
>> `axis equal`.

b) Use the command `hold on`. Then by changing the number of t points, draw the hexagon in this circle.

4. a) Let S be the triangle in the xy plane, $S = \{(x, y) : 0 \le x \le 2, \ 0 \le y \le x\}$. Let T be the triangular piece of surface in $\mathbb{R}^3$ that is the part of the plane $z = 2x + 3y$ that lies over S. Draw the polygonal lines that form the boundary of S (a triangle in the xy plane). In the same figure, draw the polygonal lines that form the boundary of T (a triangle in xyz space) using the command `hold on`.

b) Plot the great circles C_1 and C_2 of radius one in the same figure using `hold on`. C_1 is intersection of the xz plane with the sphere of radius one, and C_2 is the intersection of the vertical plane $x = y$ with the same sphere.

5. Write a script Mfile with a for loop that plots the graphs on the interval $[0, 5]$ of the functions
$$f_n(x) = \frac{1}{1 + x^n}$$
for $n = 1, \ldots, 10$. Use the command `hold on` to put all the graphs in the same figure.