1 The Earth, an oblate spheroid (a what?)

→ a sphere flattened at the poles

The surface area of an oblate spheroid such as the Earth is given by $A = 4\pi r_1r_2$ where $r_1$ is the equatorial radius and $r_2$ is the polar radius. Write a program that calculates and displays the difference between $4\pi r_1r_2$ and $4\pi ((r_1 + r_2)/2)^2$ for Earth data $r_1 = 3963$, $r_2 = 3957$. Call the program oblateArea.

2 Function evaluation

Write three different programs (scripts) to determine in which quadrant a user-input value of $A$ degrees belong. Assume that the user may enter any non-negative number. For example, $725^\circ$ is the same, and should be treated, as $5^\circ$. (Hint: the function $\text{rem}$ might be useful.) To avoid ambiguity, we use the following convention:

Quadrant is

\[
\begin{align*}
1 & \text{ if } 0 \leq A < 90 \\
2 & \text{ if } 90 \leq A < 180 \\
3 & \text{ if } 180 \leq A < 270 \\
4 & \text{ if } 270 \leq A < 360
\end{align*}
\]

Print the result. In the first script use four separate if statements (4 separate if-end constructs) and call the program angle1.m. In the second script, use a single if-elseif-else-end construction for the evaluation and call it angle2.m. In the third script, use nesting without using the elseif clause and call it angle3.m. Pay close attention to the differences among the three programs.

3 Golden rectangles

The golden ratio $\phi = (1 + \sqrt{5})/2$ is one of the most interesting numbers in all of mathematics. For example, the ancient Greeks regarded an $L$-by-$W$ rectangle with $L/W = \phi$ or $W/L = \phi$ as the most aesthetically appealing rectangle.

Write a script goldenRect that randomly generates the length and width of a rectangle. The length and width should be in the range of 1 to 9. If the ratio of the sides ($L/W$ or $W/L$) is within $\phi \pm 0.2$, draw the rectangle in red. If the ratio is really “unappealing,” i.e., greater than 3, do not draw the rectangle. Otherwise draw the rectangle in yellow. Use the given function $\text{DrawRect}$ (see Lab 1). Use the following statements to set up your figure window before drawing the rectangle (similar to drawDemo in Lab 1):

```
close all  
figure 
axis equal off 
```

How to generate a random value? The statement $v = \text{rand}(1)$ assigns to variable $v$ a random number in the range of 0 to 1. Note that the 1 in the parentheses indicates that one number is to be generated—it has nothing to do with the range, which is always 0 to 1. So how do you get a random number within a different range? First, the statement $v = \text{rand}(1)$ gets you a real number in the range of 0 to 1. Next, scale (think multiply) and shift (think add) the value $v$ to get the range you want.

4 Stars, disks and rectangles

Write a script myPoster that uses the given functions $\text{DrawRect}$, $\text{DrawDisk}$, and $\text{DrawStar}$, to create a figure of your choice! The only requirement is that the script must involve the (meaningful) use of a for-loop. It is not necessary to use all three draw functions but you should use at least one. Have fun!