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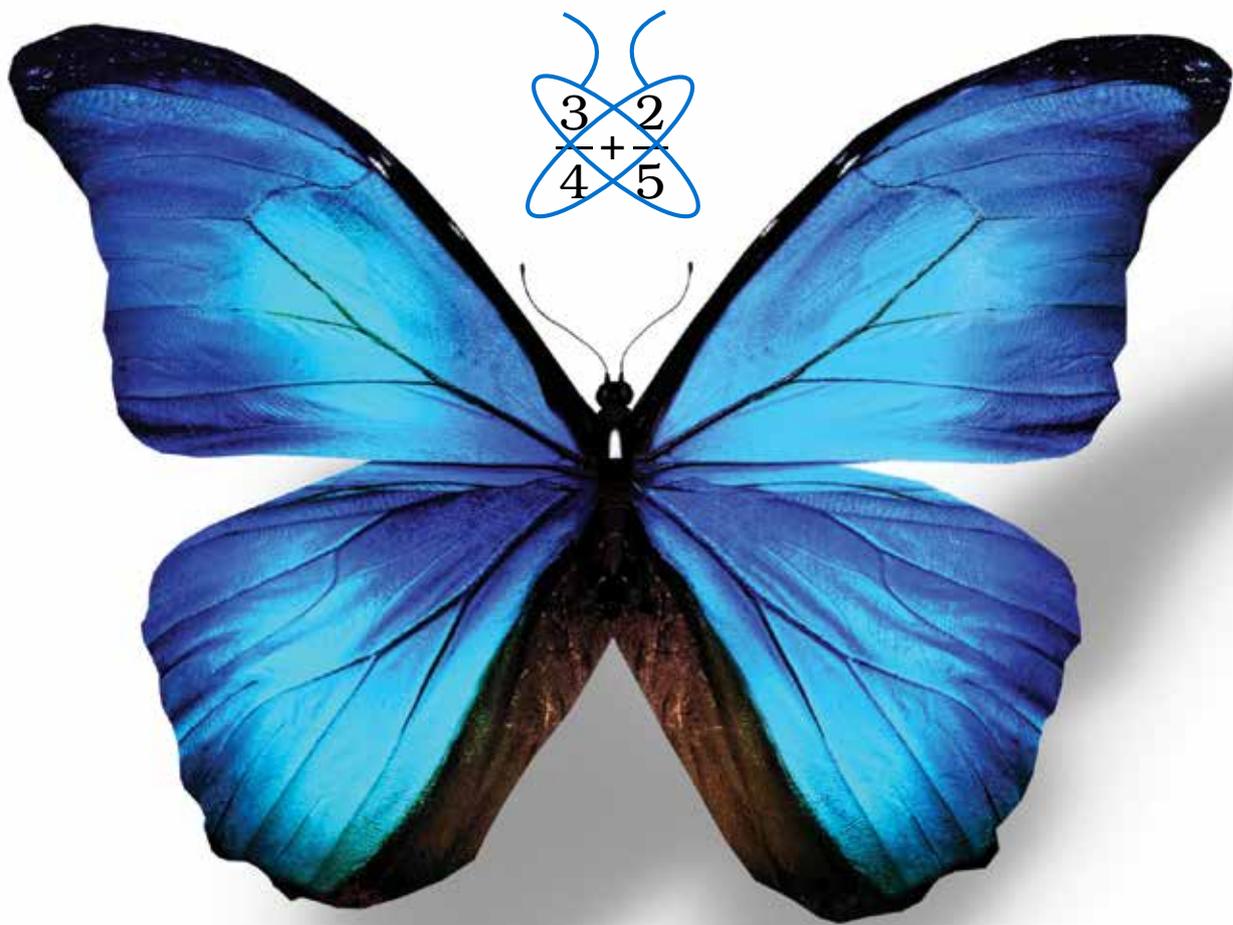
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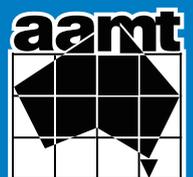


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live editing

Telling mathematical stories with live editing

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Using 'live editing' it is possible to write code that can be run a section at a time. This makes it easier to spot and correct errors. It can also be used to create an interactive mathematical story.

The example illustrated in Figure 1 was created using MATLAB software. This particular example is able to take the user on a mathematical journey with historical connections. Using the language of the digital age it tells a tale about the mysterious *Great Geometric Mosaic* (Ayuntamiento de Cordoba, 2016).

The *MATLAB* script comes in two forms: text and code. Text sections can contain titles, headings, pictures, equations and text; whilst the code sections (Figure 2) contain the actual commands. Each section of code can be run one at a time by clicking on "Run Section" from the Live Editor menu bar at the top of the screen.



Figure 1. Example of 'live editing' using MATLAB.

```
angle=0:0.01:pi;
x1=cos(angle);
y1=sin(angle);
fill(x1,y1,'b')
axis equal off
hold on

x2=0.5*cos(angle)-0.5;
y2=0.5*sin(angle);
fill(x2,y2,'r')

x3=0.5*cos(angle)+0.5;
y3=0.5*sin(angle);
fill(x3,y3,'r')

fill(x1,-y1+2,'b')
fill(x2,-y2+2,'r')
fill(x3,-y3+2,'r')
```

Figure 2. Section of code to be run.

And so, with students seated comfortably, the story begins...

Origins of the Great Geometric Mosaic

The Great Geometric Mosaic is to be found in the Hall of Mosaics in the Alcazar in Cordoba, Spain. It is a Roman mosaic dating back to the 2nd century BCE. This elaborate pattern is part of the mosaic.



The secret behind this pattern is found lower down on the mosaic. Here we can see two semi-circles enclosed within a larger semi-circle. Let's begin by drawing this figure.



Figure 3.

The mathematical journey ensues in the code sections. An array of angles is created from zero to pi in steps of 0.01 radians. The cosines and sines of these angles are assigned to the x and y coordinates of the unit circle. This creates a semi-circle which is then filled in blue colour.

Similarly, two red circles are created which are smaller in size and are translated horizontally, one to the left and the other to the right. This whole process is repeated with some adjustments which create a reflection. The output from each section appears on the right-hand side of the screen (refer Figure 4).

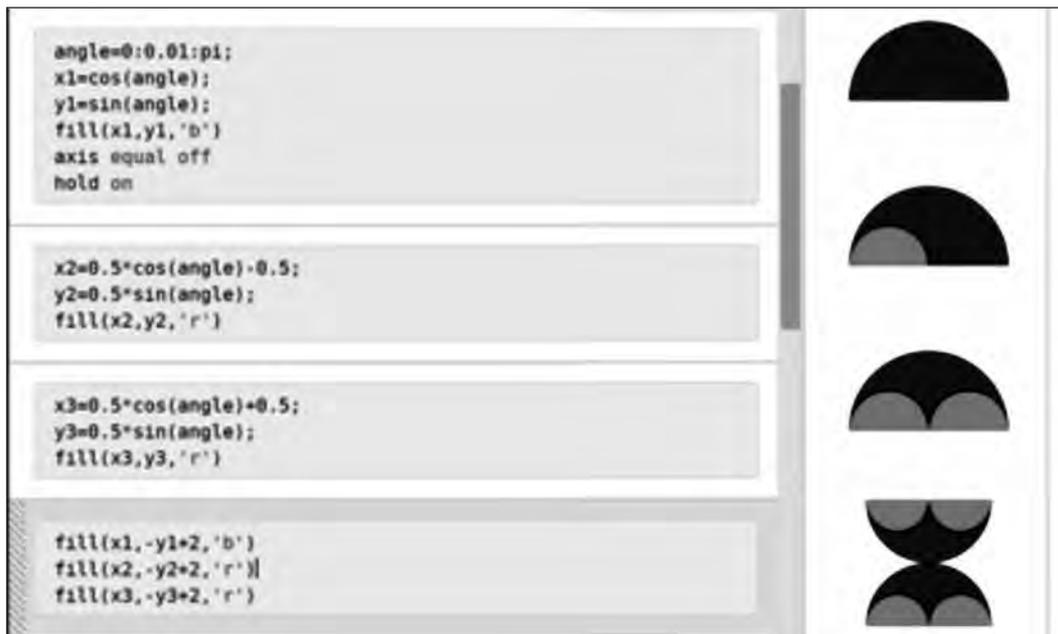


Figure 4.

A three by three grid is then established and a figure is created which is made up of nine copies of the previous figure. The odd numbered figures are rotated through ninety degrees. The background colour is set to red.

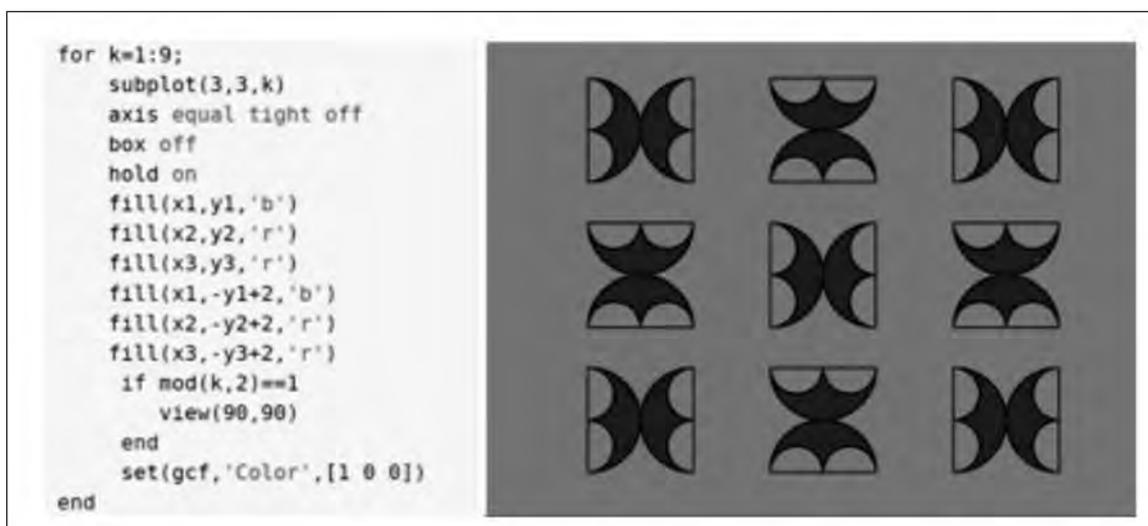


Figure 5.

Double-clicking on this figure takes the student into the Figure window where some final touches can be made. After a little clicking and dragging the secret of the Alcazar is finally revealed!

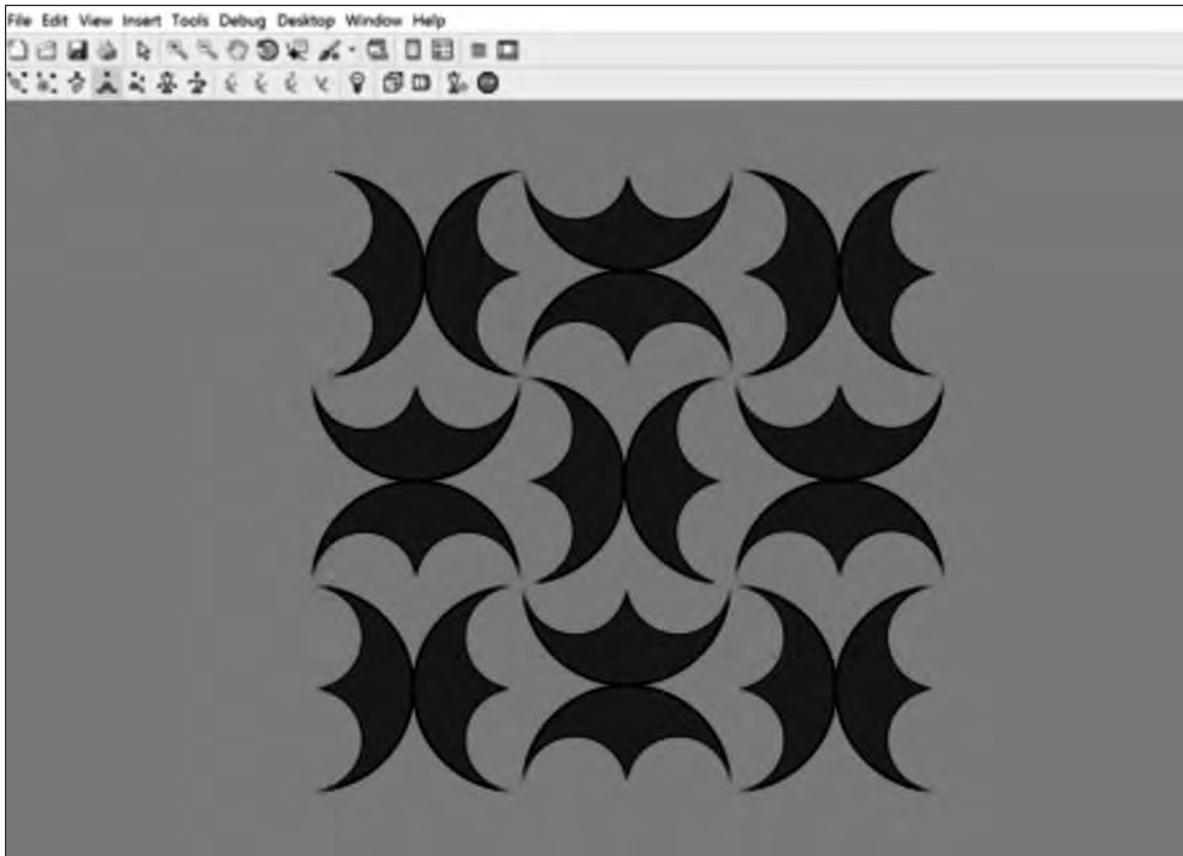


Figure 6.

So, how did this story unfold? It was, to begin with, a mysterious tale of the ancients. It took us on a mathematical adventure. It often resembled an interactive pop-up book with colourful pictures. But importantly, through the use of live editing, code was visible throughout the story. Like a “glass computer”, live editing allowed the working of the code to be seen plainly. It could be unpacked, pondered over, edited and improved if so desired. Live editing is undoubtedly a powerful medium for introducing coding into the mathematical stories that we tell in the classroom.

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- Ayuntamiento de Cordoba (2016). *Hall of Mosaics*. Retrieved 21 November 2016 from <http://www.alcazardelosreyescristianos.cordoba.es/?id=623&lang=3>
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