Mandala and 5, 6 and 7 fold Division of the Circle

Paul F. Stang
Townshend International School
188 Dolni Trebonin
Czech Republik 382 01
Paul.Stang@Townshend.cz

Abstract

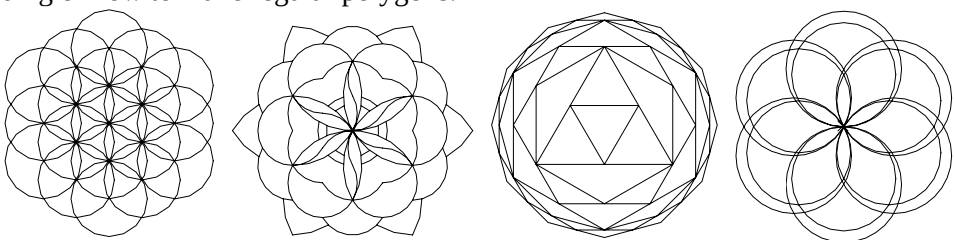
The Compass is perhaps oldest of all the math and drawing tools. When did someone think to put two sticks together, hold one in place and twirl the other, or link two pegs with a rope, pound one in the ground and use the other to draw circles in the dirt? It is commonly known that with only compass, ruler and pencil, a six-fold division of the circle can be made. An amazing array of 2 and 3 dimensional possibilities then follow, to form bridges between Math, Art, History, Culture and Science and even Mythology and Magic! Mathematics is learned through the hands, creativity and social interaction. Further, the compass, when coupled with the phi proportion, can be used to obtain 5 and 7 fold division of the circle. The Initiate, interested in mastering the compass, must begin this journey of exploration by ensuring precision. Often, the compass user grips the device too firmly, pressing harder in an effort to ensure quality. The result of this 'muscling' is often that the point makes an overly large hole in the paper, the compass opens from the pressure, making a spiral, and the paper slips. The proper way to grasp the compass is to twirl the upper post between thumb and index finger, so that it pirouettes. In this way it makes a crisp circle. The image may be faint but we can twirl the compass more times for better definition, rather than pressing harder. With brief explanations, we will now proceed rapidly through a multitude of forms.

The Path to Mandala

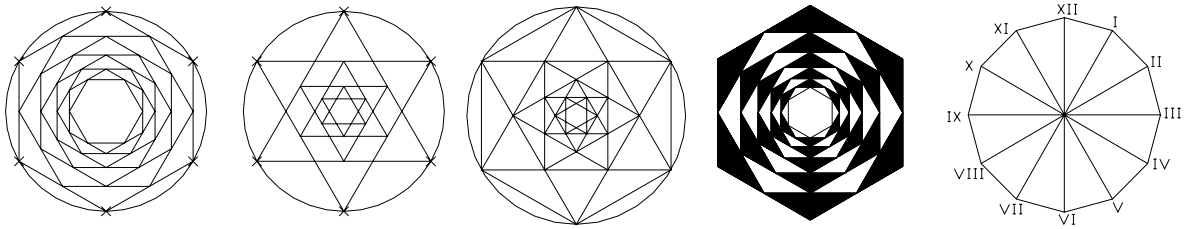
Workshop participants will learn easy geometric drawings, to ensure familiarity and accuracy with the compass (so that they can similarly enable this with their students). They will create basic art forms, known as Mandalas. They will continue, learning how to create flat, three dimensional figures and build platonic solids from flat patterns. They will finish with more challenging techniques, by developing the phi proportion and using it to generate 5 and 7 pointed stars. This final work will expose for them the minds of Da Vinci and the builders of Stonehenge and the Great Pyramid of Giza, and more!

Participants should come away with fascinating material that can really interest and hence motivate mathematics students, while making strong connections between art and history.

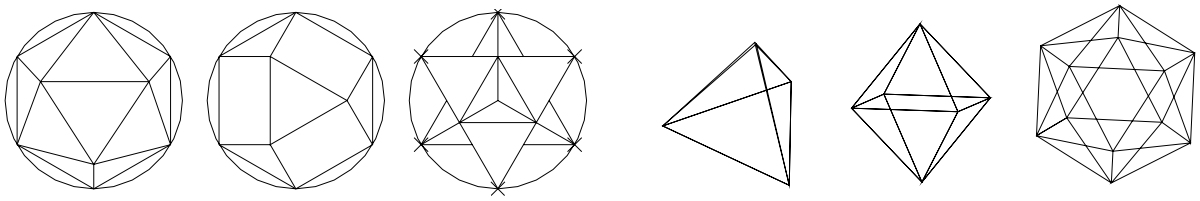
We begin with a compass and ruler to draw mathematical, artistic imagery very useful at developing new interest in students who normally don't like mathematics, and new challenges for those who do. Next will be seen how to make equilateral hexagons with compass and ruler. This will give participants a basic understanding of how to make regular polygons.



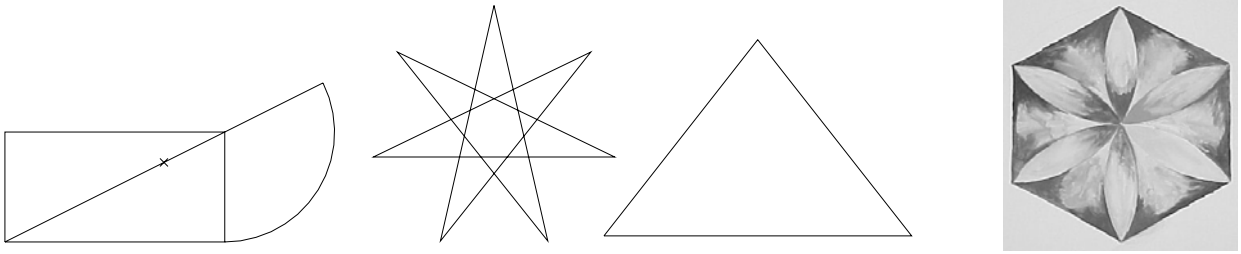
We will draw basic Mandalas, and relate them to historical usage in Eastern - Western cultures, providing fascinating bridges between mathematics and art and architecture, history and science. It will be shown how these techniques can be used to demonstrate fractions, angles, trigonometric relations and fractals. Seeing how to ensure precision, we will continue then with more complex drawings.



Next, a variety of images will be created to show how 3-D can be made on a flat paper. Participants will continue with related techniques on flat patterns that they will then be able to cut out and create three of the platonic solids from. We will see that many common, practical, commercial, religious and mystical imagery can also be generated by these same methods.



The 5-pointed star; a common symbol in society, can also be made with just compass and ruler. Not surprisingly, given all of the phi relationships in the five pointed star, we will use phi for it's construction. More interesting is that the elusive 7-pointed star can also be constructed using phi!



The ease with which all of this work can be done, and the accurate, beautiful pictures are a great surprise for Math students and a good return from long vacations, when the winter doesn't seem to want to end, or a lot of people are absent and it is difficult to maintain continuity.

Conclusion

We have worked through key steps companion to trigonometry in the second or third year of High School. We can pull in students with historical, artistic, social and athletic intelligence who don't normally do well in mathematics. Improvements in tests and overall effort normally exceed one letter grade. Students usually gifted in mathematics, have their characters broadened by such work. Still to be done; develop the 9-division of the circle!

References

[1]Plato, The *dialogues of Timaeus and Critias*.
[2]Michael Schneider, *A beginner's guide to constructing the Universe*, HarperCollins, New York, 1994
[3]Alexander Thom, *Megalithic Sites in Britain*, Oxford University Press, London, 1967
[4]Gerald S. Hawkins, *Stonehenge Decoded*, Doubleday and Company, New York, 1965
[5]W. M. Flinders Petrie, *The Pyramids and Temples of Gizeh*, 1883
[6]Robert Lawlor, *Sacred Geometry*, Philosophy and Practise, 1982