

Possible mathematics topics for investigation

The following are starter ideas to show what mathematics could be investigated. If students are interested in one of them, it would certainly make a worthwhile project. Alternatively, students can construct their own project, or modify one of the following examples.

Orders of infinity

How is it that there are just as many rational numbers (fractions) as there are integers but that there are more irrational numbers than rational numbers?

How many different 'infinities are there anyway?

Steiner points

What is the minimum road length needed to connect three towns? What if there are four towns?

Investigate the mathematics behind these ideas, explain the construction and proof of the Steiner Point and show some of its application.

Finding π by random processes

How can a constant like π be found by methods such as throwing pins on lined paper?

Investigate this and other methods for calculating π .

Constructing nomograms

Before the introduction of electronic calculators, nomograms (special scale drawings) were widely used for all manner of different calculations.

Give some examples and explain the way in which they can be constructed. Demonstrate their application.

Mandelbrot's bug

What exactly is Mandelbrot's Bug and how is it constructed? Is it a fractal?

Explain how you can use a computer to show the principles underlying the Mandelbrot's Bug

The mathematics of juggling

How many ways are there of juggling three balls? ... four balls? ... more?

Can the different juggling methods be described mathematically? A simple demonstration would be appropriate.

Transforming graphics

Click, grab and stretch and a graphic can be enlarged or rotated. How does it work?

Explain the mathematics behind the common transformations of computer graphics. Demonstrate on simple shapes.

Magic squares and magic figures

How are magic squares constructed – for any size square? Are there such things as magic cubes or magic pyramids? If so explain how they ‘work’ and how they are constructed for different sizes of solids.

Spirals

What are mathematically different spirals and how are they constructed? What kinds of equations are most useful for defining spirals? This project lends itself to some attractive graphical output – maybe on a poster.

Escher = mathematics + art

Who was Escher and what is the mathematics that underlies Escher’s distinctive drawings? Show the basis for their construction and create one of your own.

Prime numbers

In the age of public key encryption large prime numbers have changed from being mere curiosities to very valuable commodities. How do you find them? Illustrate your research report by finding all of the primes between 12 340 000 and 12 350 000 (with the help of a computer).