

# A G.A.T.E.WAYS JOURNEYS PROGRAM

*for gifted Year 5 and 6 children*

*with a love of maths*



## ‘MINDCRAFT, MATHSCRAFT’

**G.A.T.E.WAYS** is an independent organization offering challenging, enriching activities and experiences to develop and extend highly able children. This program will run over four sessions.

Minecraft has taken the world of children by storm. Minecraft is a virtual reality game that allows children to create their own worlds. It sounds simple, and in many ways, it is. But the complexities that this virtual sandpit has to offer are endless. If you asked a child to design and build a village, creating the infrastructure and amenities, you might think this would be a large project indeed. But with Minecraft, students thrive on such challenges. Little may they know that they are in fact exploring the basics of engineering, design, creativity and, of course, mathematics. In this Journey we will concentrate on the mathematics and engineering behind Minecraft, or as we will call it in this Journey, MIND-CRAFT.

The sessions will be a mix of design and creation, sketching, building, redesigning and problem solving. **The program won't involve playing Minecraft**, but students with Minecraft access are expected to test out the skills that they have learned and apply them each week for homework.

### Session 1 From 2-D to 3-D and Back:

Just as architects and designers begin with a two-dimensional plan of a structure, so we will begin our first Mind craft experience with a plan. Using this we explore ratio, area, volume and other concepts before reaching into higher dimensions. Shadows are another example of a two-dimensional shape that gives us information about the three-dimensional world. Can you guess the three-dimensional shape from its shadow? What if our three-dimensional objects were just ‘shadows’ of some four-dimensional shape? Is this possible? As well as designing a plan, students are introduced to the Mobius strip, the Platonic solids and many more interesting mathematical shapes and objects.

### Session 2 Mythbusters Meets Minecraft

How tall can you build a tower without structural support? In class we use Lego blocks, but how does this relate to the ‘real world’? What materials and shapes are best for such buildings? What is the longest bridge you can build out of simple rectangular boxes? How can you add strength to this bridge? Do the same restrictions apply in Minecraft? What if we were in charge of feeding a village, and needed to maximise the area of land required while minimising the cost of fencing materials? What is the best shape for our paddocks? Trial and error would take us a long time, but using maths, we can find the answer to this very quickly. We extend this to find the three-dimensional shape with the best surface area to volume ratio. Students then design a swimming pool with these requirements, including calculations of volume and surface area.

### Session 3 Penrose, Perspective and Pixel Art

Tessellations are fun, and we spice things up by looking at Penrose Tilings, and the restrictions that apply in our three-dimensional world. Pixel art is also fun, and we use this as a two-dimensional version of our Minecraft block creations, while exploring ideas of three-dimensional pixel art in Minecraft. Students also work on some one, two and three-point perspective drawing, and compare this with similar techniques used on curved surface using Escher as an example. Students are also introduced to fractals, and the idea of using the binary number system as art.

## **Session 4      Mission to Mars**

In the final session we put all the concepts we have covered so far into one major activity. We are off on a mission to Mars – after brainstorming ideas for structures necessary to allow man to inhabit the red planet, we'll then plan and design our ideas. Again, we look at the difference between buildings that can be created in the Minecraft world, but this time we can also compare similarities and differences with another planet. Each group presents their plan to the group, including comments on issues such as building materials, energy sources and practicality.

This Journey will appeal to highly able children as it covers a range of interests such as design and engineering, as well as being strongly creative. The depth of thinking involved in these projects is quite extensive, and can be explored further in class or at home - there is no limit to the level of knowledge to be gained from these projects.

### **Requirements**

- All specialised materials will be supplied but you will need to bring coloured pencils, writing paper, a ruler, a calculator, and for Week 2, a cardboard box (such as a cereal box).
- Some students might find it helpful to bring a plastic folder to keep their work organised. **Note that i-pads and tablets are NOT required for this Journey as no Minecraft will be played in class time.**
- Also bring a snack (no nuts please).

### **Homework Requirements**

There will be some homework between sessions, including both practising the maths learnt in each class, and applying this in Minecraft, and reporting your findings back to the group.

### **About the presenter**

Anne Eastaugh is passionate about teaching students the magic and wonders of mathematics. She is currently teaching first and second year maths at Monash University. She holds a Bachelor of Science and completed her Honours in Mathematics. She has taught G.A.T.E.WAYS programs for many years, focussing on maths and physics. She believes that creativity and imagination are essential tools for learning. Anne is the author of a book of mathematical adventures for middle year students (Years 5-8), *The Peculiar Puzzles of Professor Fibbernacho*, published by G.A.T.E.WAYS Publications.