THE MATHEMATICAL ASSOCIATION OF VICTORIA

THE COMMON DENOMINATOR 2/19

CONNECTING CONCEPTS

INSIDE

Jack Fray - Year 6 teacher, Bell Primary School

Teaching maths using a tool like Minecraft isn't a particularly new idea. There are entire books written on the subject, and you can get lost in YouTube loops for hours just watching how it's been used to connect concepts such as area and volume in a context that many students will instantly understand, particularly since the education version became freely available to state schools some time ago.

Previously I've used Minecraft for all kinds of investigations, posing not only mathematical questions, but also using it as a prompt for civics and citizenships units, and as a way of embedding literature into pretty much anything. But this time I was keen to try something different. Inspired by the Escher x nendo exhibition at the NGV, I wanted to see if M.C Escher's famously precise and mathematical sensibilities could provide an extra level of inspiration for students. To begin, I thought it best to cross reference these ideas with the curriculum, and found there was no shortage of links:

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THE COMMON DENOMINATOR
The MAV's magazine published for its members.

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FROM THE PRESIDENT

Michaela Epstein

What do we want students to get out of their education? The intended outcomes are many and varied. One thing that is commonly identified, however, is an orientation towards lifelong learning. We want students who, beyond their experience at school, are curious about the world and see themselves as capable of further learning in whichever area they choose. Although just the starting point, school is a critical step in this journey.

Two articles relevant to this topic recently caught my eye. They are beautiful reminders that adults are learners too and that the same beliefs we have for young people as learners should apply into the adult years.

In response to online commentary about adults' mathematical misconceptions and faux-pas, primary teacher Carla Dawson put a call out for us to be more compassionate. When we see someone say that a third of a kilo is more than half a kilo or have trouble calculating change at a cash register, instead of facepalm-type reactions, Dawson suggests that we (as maths educators) can be more constructive. One way to do this is by asking ourselves, 'What makes sense about their thinking? What would you say or do next if this was a student or a child?' Dawson's piece brings to light the reality we so often see in schools: that not every child finishes their formal education at the 'expected level'.

Former editor of *The Economist* and former deputy governor of the Bank of England, Rupert Pennant-Rea, is an unlikely example of this. Contrary to what you might expect of someone who's held such esteemed positions, Pennant-Rea's knowledge and understanding of basic scientific concepts was – until recently – seriously lacking. At age 70, he chose to go back to studying high school science and wrote about his experiences for *The Financial Times*. Amongst his discoveries is 'just how beautiful science is. My particular favourite is the periodic table, which I had never even heard of a year ago.'

Just like Pennant-Rea, we and our students don't know what we don't know. When in a formal or informal teaching position, one thing we can do is commit ourselves to supporting learners, no matter their age, with their mathematics education and with their drive for further learning.

I'm proud to say that MAV is behind this cause. True to its mission of 'Valuing maths in society', the association supports students at all stages of their development and teachers throughout their career. To find out more, head to www.mav.vic.edu.au or get in touch, office@mav.vic.edu.au.

REFERENCES

Dawson, C. (2019). 'Why talking math with adults matters', *Math Thinking Seen*. www.maththinkingseen.com/blog/2019/1/26/talking-math-with-adults-matters.

Pennant-Rea, R. (2019). 'Discovering the beauty of science through a GCSE course', *The Financial Times*. www.ft.com/content/d765bf0e-0212-11e9-bf0f-53b8511afd73

GET SOCIAL

Did you know that the average person spend upwards of 90 minutes a day on social media? Instead of being drawn into the latest celebrity scandal or viral cat video - spend your time more productively by following MAV's social channels.

Contribute to discussions, start threads and reach out to your professional network.

Facebook www.facebook.com/mathematicalassociationofvictoria

Twitter twitter.com/mav_info

LinkedIn www.linkedin.com/company/mathematical-association-of-victoria

MAV PROFESSIONAL DEVELOPMENT

During Term 2 and 3 2019, a variety of presenters and MAV's own mathematics educational consultants will present workshops focussing on innovative teaching practice.
Make sure you reserve a place by booking online early, www.mav.vic.edu.au/pd.

TOPIC	DATE	YEARS	PRESENTER
Structuring lessons and sequences to challenge and engage all students	24/4/19	7-10	Peter Sullivan
TI-Nspire CAS: The Secret is out! Fast and Efficient Exam Solutions	8/5/19	9 - VCE	Chris Ireson and James Mott
TI-Nspire CAS: The Secret is out! Fast and Efficient Exam Solutions	9/5/19	9 - VCE	Chris Ireson
Primary mathematics: engaging teachers and engaging students	20/5/19	F - 6	Catherine Attard
Exploring properties of shapes using GeoGebra	30/5/19	Secondary	Danijela Draskovic
Formative assessment: the key to improving learning outcomes in mathematics	4/6/19	F - 9	Di Siemon
Critical and creative thinking in mathematics reflections	19/6/19	F - 6	Penny Crossland
Primary and early childhood mathematics education conference (Day 1: Leading whole school improvement in mathematics education)	20/6/19	F - 6	Various
Primary and early childhood mathematics education conference (Day 2: Improving classroom based learning)	21/6/19	F - 6	Various
Horsham F - 10 Mathematics education conference	2/8/19	F - 10	Various

MAV19 CALL FOR OPTIONS

MAV's annual conference is a must for all mathematics educators. The 2019 conference will be held at La Trobe University, Bundoora on Thursday 5 and Friday 6 December.
Save that date in your calendar!

At the heart of MAV's annual conference are teachers. Each year over 1500 mathematics educators including teachers, academics, policy makers, curriculum experts and resource developers come together to share their collective expertise, experiences and ideas.

The 2019 conference will focus on best practice, new ideas and innovative approaches around how:

- sharing action research and evidence is improving practice
- technology can be used as a valuable tool to support teaching and learning
- critical and creative thinking can be embedded into the classroom
- networks and communities of practice can support excellence and improvement.

Submitting an abstract is a chance for you to share your experiences and knowledge with your colleagues.

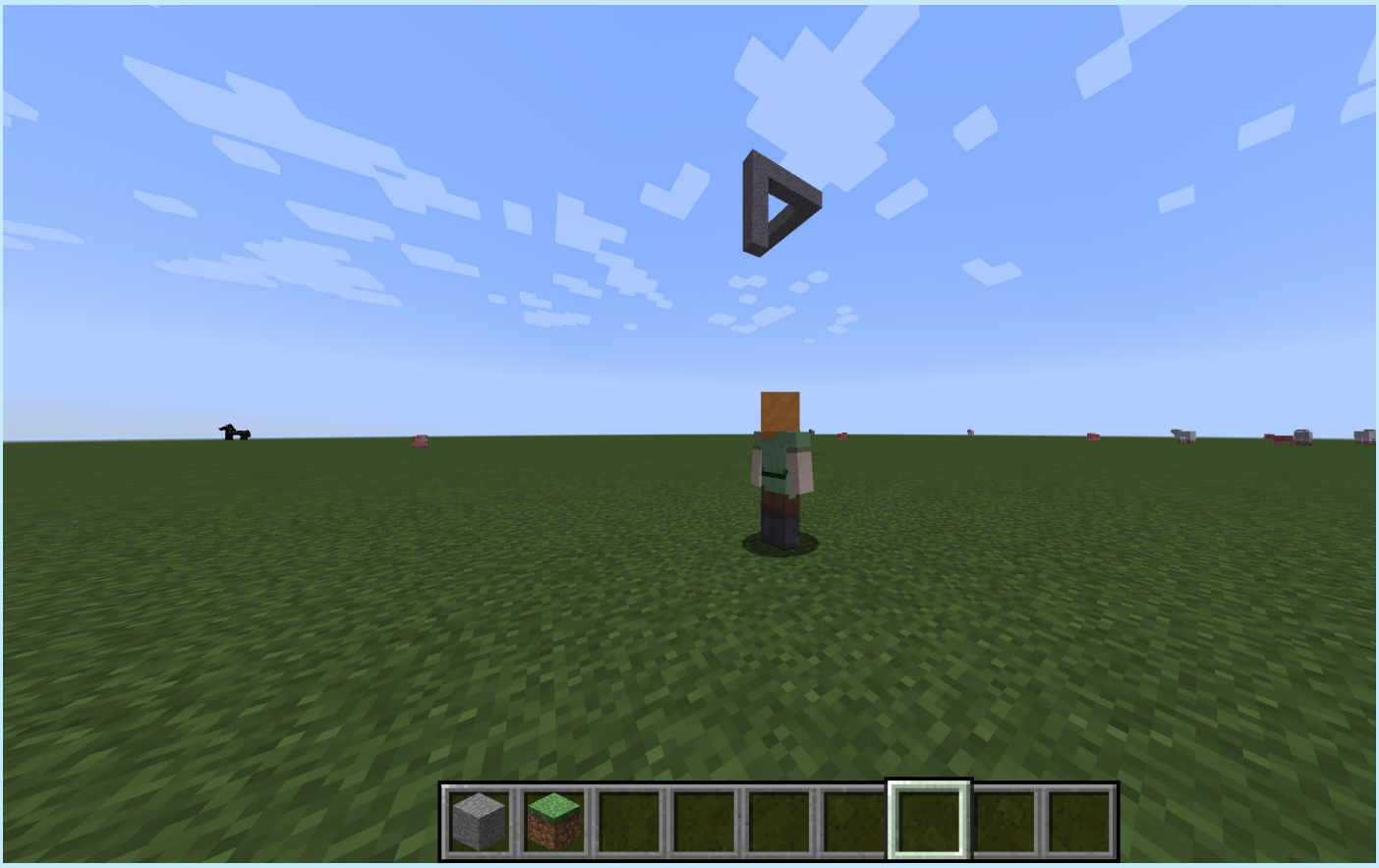
The conference offers teachers the opportunity to learn from experts, hear best practice from classrooms and of course, network with your colleagues.

Submissions will only be accepted online. To access the Call for Options google form, visit www.mav.vic.edu.au/conference-program-2019/call-for-options.html

CONNECTING CONCEPTS

Jack Fray - Year 6 teacher, Bell Primary School

CONT. FROM PAGE 1.



Creating the Penrose triangle in Minecraft.

- Level 3 – symmetry
- Level 4 – three dimensional objects
- Level 5 – translations, reflections, rotations
- Level 6 – prisms
- Level 7 – line and rotational symmetry

And these were just the mathematical links! After a quick look over the Media Arts and Visual Arts curriculum, my mind was firmly set. Whilst a more 'natural' mathematician than I might see such obvious links, for me this was quite an exciting discovery.

For a Year 6 classroom, such a span of possible learning outcomes was perfect, catering to the diverse needs of my students. Indeed, by following this progression, and by giving my students examples from Escher to model their own ideas from, our time spent using Minecraft as a tool with which to build and experiment was clearly signposted. Any fears that students might lose focus, or get sidetracked, were easily dealt with by having clear goals, making every minute spent in the game accountable. Tasks necessarily began with the least complex learning goal; to represent two-dimensional symmetry. I had two main reasons for starting all the students at the same point. For some, working at level three was within their zone of proximal development for maths. For others, it gave them an introduction to using the controls within Minecraft that they were not familiar with. This meant that the two types of 'expert' within the class, both those with experience playing Minecraft and who knew the controls, as well as those with more advanced mathematical understandings, could both come to the fore.

The series of learning tasks progressed neatly from one to then next, as students began by creating any shape they liked in the 2-D plane of the ground, and then created a symmetrical, mirror image next to it. Next, they built the first letter of their name perpendicular to the plane, and then made this letter 'cartwheel' through 90 degree rotations (see image on cover). This worked well for some, but less so for those whose names began with 'O'.

Recognising the symmetrical nature of such letters was still an important concept for students to be able to explain. For some, trying to rotate their letter but seeing no difference was a valuable learning experience. For those who were able to predict that this would be the case in advance, the challenge was how to 'design' their letter so that it would be different when rotated. The crossbar of an 'H', for instance, being closer to the bottom of the vertical lines than the top. Next up, creating a 'box' where each wall consisted of the same letter, thus translating what they had already created. Prisms proved harder, due to the restraints of building using only cubes, but really this had the added result of pushing the bounds of creativity.

Before, all of these tasks could of course be addressed using pencil and paper, or by folding images, or by constructing nets. But each of those methods relies heavily on other skills being accurate and embedded into the students' practise before you can really begin. Of course, it's important that a child should be able to have the fine motor control needed to cut paper precisely, and be able to use a rule to measure and draw a line, but neither of those things are the learning goal for this task.

Where the iPad edition of Minecraft really comes into its own is in the intuitive controls. Placed too many blocks down? No problem, easily remove one as though it was never there. Misaligned your edges? Again, easily fixed. This doesn't erase the error, rather it makes it low-stakes, so students can focus on learning and experience success that much sooner. For students who have a low opinion of their mathematical ability, or suffer anxiety at the thought of getting the 'wrong' answer, this experience is invaluable.

The students seemed to really love this approach to a concept that, for many, was something they had seen before. The difference was the way in which they were able to immediately put their prior knowledge into action, and begin to build upon it. The quality of reflection at the end was also remarkable, as each child was keen to share and describe what they had been able to achieve, and the point of difference between their work and a peer's. Whether it was commenting that 'my tessellation changes from an L shape to a T because that's what happens in the paintings' (referring to Escher's *Liberation*), or the systematic way in which they placed blocks to ensure symmetry, the proficiencies were observable in abundance, something which is not always the case.

Finally, for this sequence of learning, I invited students to follow in the footsteps of Escher, whose art played with all of the themes and concepts that they had been working with. I knew from my own experience of building in Minecraft that it's not only possible to create upside down staircases, but that sometimes this happens whether you want them that way up or not. I was blown away by how the students began to play with perspective to create their desired effect, and they took great delight in showing me how their Penrose Triangle was, actually, not a triangle at all, rather a series of intersecting lines that when viewed from just the right vantage point, all joined up. When I suggested they go home and think about how to build the impossible waterfall, I think I may have set the homework task to end all homework tasks!

The Victorian Department of Education and Training provides the Minecraft: Education Edition free for all Victorian government schools. To find out more visit www.education.vic.gov.au/school/teachers/classrooms/Pages/resourcesminecraft.aspx

If you use Minecraft in your classroom, please get in touch and let us know how you use it in your mathematics journey.

MAV CONSTITUTION REVIEW

Peter Saffin - CEO, Mathematical Association of Victoria

The MAV Council have been working on a proposed new Constitution for the Association. This process has been ongoing for the past 12 months. MAV engaged Mills Oakley Lawyers who are experienced in developing constitutions for the NFP sector, to guide the Council through a very thorough process to ensure that the proposed new constitution is legally sound, and will cater for the needs of MAV and its members into the future.

This process is nearing final stages of preparation, and a proposed new constitution will be put to members to endorse by vote at the 2019 AGM.

To inform members about the Constitution we have put together some FAQs and information to compare the current Memorandum of Articles of Association, with the proposed new Constitution.

Why is a new constitution required?

The current MAV constitution (Memorandum of Articles of Association) is over 30 years old and has had very minor amendments since its creation. Council decided it was preferable to start with a new template that was up-to-date and meets current regulatory requirements, rather than attempt to make further amendments to the existing document. A new constitution will ensure that MAV is positioned and enabled to run as a modern and progressive organisation, and meet its governance requirements more effectively and efficiently.

How is the proposed new constitution approved by members?

The new constitution is adopted by the members by special resolution at the AGM. Members would essentially vote on the new constitution to be approved.

Do I have to vote?

As a MAV member you have the right to vote on the new constitution being adopted. Individual members are able to vote, and the key contact representing a school or institution also is able to vote. Although you do not have to vote, MAV will ensure a quorum of members attends the AGM as usual, to undertake the vote on the special resolution.

When is the AGM where I can vote on the special resolution?

Date: Tuesday 21 May 2019, from 6pm
Venue: ACER, 19 Prospect Hill Road, Camberwell

What will happen at the next AGM if the new constitution is successfully approved?

A special resolution will be voted on at the beginning of the meeting. If the constitution is adopted, the meeting will continue under the terms of the new constitution. This includes the election of Directors that will also take place at the AGM.
If the Constitution is not successfully adopted, the AGM will continue under the terms of the current Memorandum of Articles of Association.

Can I see the proposed new constitution before the AGM?

The current draft of the Constitution is available for your review.
www.mav.vic.edu.au/about-us/mav-council/constitution.html

If you have any questions on the draft they should be sent to Peter Saffin, CEO for review, psaffin@mav.vic.edu.au or call 0403 600 120.

What effect will the proposed new constitution have on my day-to-day membership benefits?

The implementation of the new constitution will not have any effect on your current membership benefits. Member benefits are agreed by the Council from time to time and these will not be changed by adopting the new constitution. The proposed new constitution is about improving the governance to ensure that the organisation is running efficiently and using its funds for appropriate purposes.

What are the key differences between the old constitution and the proposed new one?

Of the differences between the current and the proposed new constitution, many are minor. The summary on page 7 outlines the key differences and changes that will come into effect under the proposed new constitution being adopted.

MAV ANNUAL GENERAL MEETING

Notice is hereby given that the Annual General Meeting of the Mathematical Association of Victoria will be held on Tuesday 21 May 2019.

Following the AGM Professor Geoff Masters, CEO of ACER will present on ACER's work on the Learning Progression Explorer for mathematics, and how he sees the future of learning progression thinking, as endorsed by Gonski 2.0, playing out in schools over the coming years. This will be followed by drinks, nibbles and conversation with special guests of ACER. All MAV members and other interested guests are welcome to attend.

Venue: ACER, 9 Prospect Hill Rd, Camberwell

Time: Arrive at 5.45pm for a 6pm start.

RSVP: psaffin@mav.vic.edu.au by Monday 13 May.

	Current Memorandum of Articles of Association	Proposed New Constitution	Notes
Number of directors	May have six elected positions, up to 12 other elected directors and 2 co-opted directors. This is maximum of 20 directors.	Must be between nine and 14 directors. Made up of a mixture of elected directors, Immediate Past President, and up to a maximum of two co-opted directors.	Under the proposed new constitution the Board can determine the mix of elected directors and co-opted directors. Most boards typically have between three and nine directors. MAV has a larger Board to ensure a diverse representation of education sectors.
Election of board positions	Office bearers are elected by members to the Board by vote at the AGM. Other elected directors are also voted into their positions by members.	Directors are elected by members. At the first meeting after the AGM the Board elects the President, Vice President and Chair of the Finance Committee.	The elected Board will select the most appropriate people to fulfil these key roles for the association from amongst themselves. This is typically in line with how many NFP Boards elect their positions.
Director terms	Directors are elected for one-year terms, up to a maximum of five years, after which a one-year break is enforced before being eligible to be elected once again.	Directors are elected for two-year terms, up to a maximum of six years, after which a one-year break is enforced before being eligible to be elected once again. Terms are now set to alternate, with half of the positions becoming available each year.	Longer terms for Directors enables more stability for the association leadership. Alternating positions ensures that the entire Board is not replaced in a single year, reducing the risk of instability and loss of organisational knowledge.
Immediate Past President (IPP)	Previously the IPP would remain in the role for as long as the new President remained in their position.	IPP can only take up this role if they have been President for at least one year, and have not been removed from the role of President for any reason. They remain IPP for only one year before vacating the position.	The IPP role is to act as a support for the incoming President, and to ensure a level of consistency and handover of knowledge. It is considered that this role is only required for one year after a new President is elected.
Company Secretary	There is a Secretary on the board, but the CEO has been fulfilling the role of official Company Secretary.	The CEO is appointed as official Company Secretary, there is no Secretary elected on the board.	This avoids any confusion around role of Secretary.
Voting process at AGM	Previously included in the Memorandum of Articles of Association.	Now developed as a by-law, based on the voting process in the existing version.	The by-law is agreed by the Board and may be updated from time to time to ensure it remains current. Voting by proxy is still valid.
Rights to vote	The following have the right to vote at General Meetings: -Individual Members -Institution Members -Student Members -Honorary Life Members -Associate Members. The following do not have voting rights: -Patron Members -Honorary members.	All members will continue to have the same rights to vote as per the existing Memorandum of Articles of Association as stated in the previous column.	We assure all members that their voting rights remain the same.

GEOGEBRA IN THE CLASSROOM

Danijela Draskovic -Educational consultant, Mathematical Association of Victoria

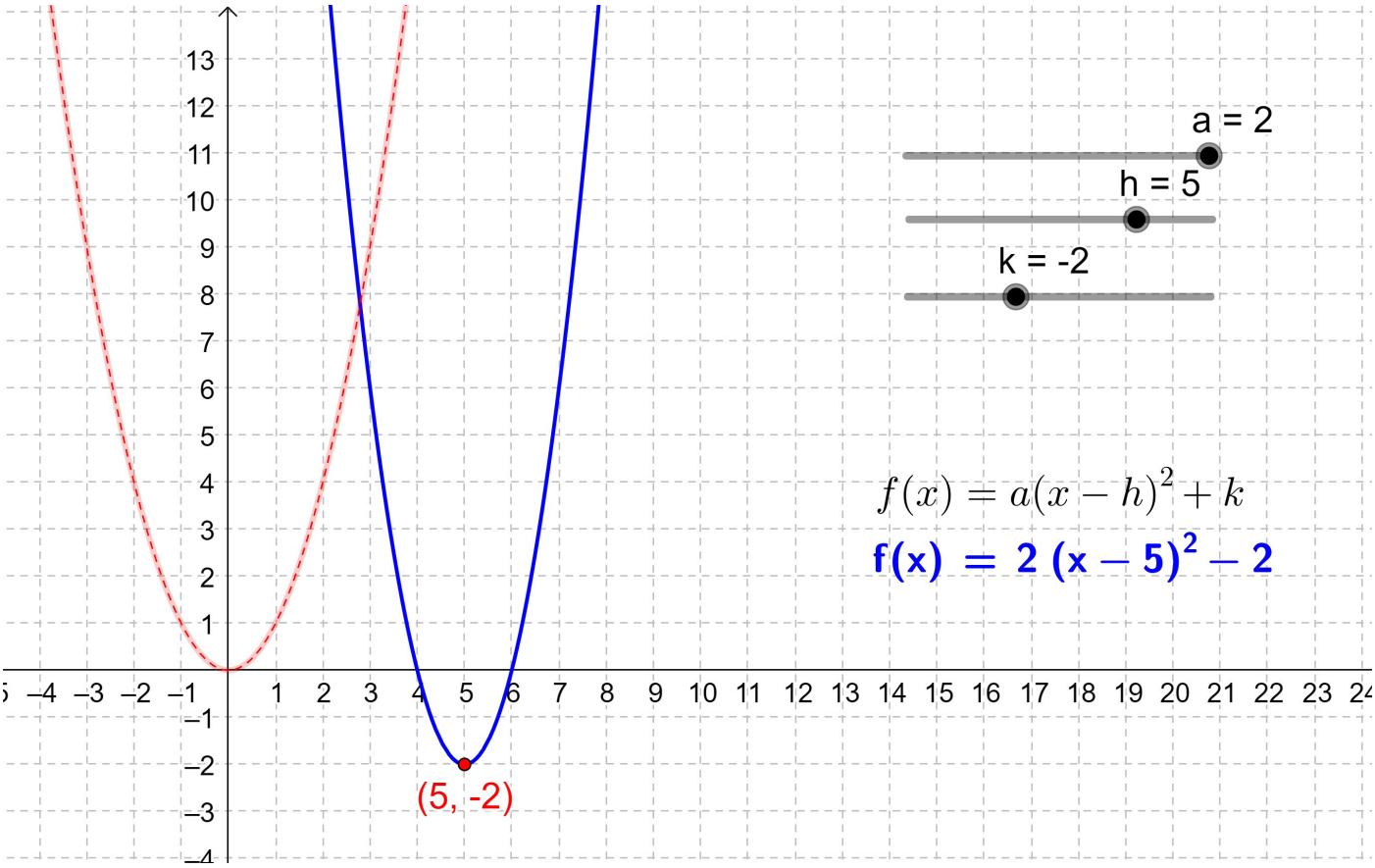


Figure 1.

GeoGebra is an interactive software program that I have used extremely successfully in my classroom, and one that I've raved about to many of my colleagues.

It is a free application that can be utilised for algebra and graphing, geometric modelling, 3D graphics, data and spreadsheets, probability and it has CAS functionality. Importantly, it is simple to use and has a user-friendly interface. In this article I'll share my experiences with this versatile software package and I encourage you to explore its potential.

DISCOVERING GEOGEBRA

I fondly remember my first few teaching years. I was finding my feet in the world of secondary education. I knew my maths inside out, I was able to build rapport with students, and I thought that that was enough. I remember drawing hundreds of graphs on the whiteboard, extremely carefully and precisely to ensure I would make the concept clear. All those wonky linear graphs, and far too pointy trigonometric functions.

All those unit circles that when drawn free handed looked more like unit ovals. And then I discovered GeoGebra. At first I used it to quickly draw functions and display them for my class on the interactive whiteboard, and initially, even that was a huge step up. It meant all my visuals were perfect and clear and no misconceptions could be introduced with inaccurate diagrams.

I used it to draw shapes and graphs which I used for assessments and written resources. The ability to adjust the views and the formatting makes GeoGebra a wonderful tool for this type of application. However, as I continued to explore the program, I discovered very powerful ways to create entire lessons within GeoGebra.

The dynamic and interactive nature of the software makes it perfect for demonstrating transformations of graphs. Parameters can be made in the form of sliders and manipulated, and as they are changed, the graphs adjust accordingly. I have used this feature to help my students independently discover how various parameters control functions.

Figure 1 shows a quadratic function $f(x) = a(x - h)^2 + k$ where a, h and k are adjustable parameters made into sliders. In this example I have also created a fixed parabola (red dashed line) with equation $f(x) = x^2$ so that the difference between the transformed blue parabola and the original function are clearly visible.

The interactive graphic, Figure 1, is very simple to make and can easily be created by students. Once students are given the opportunity to manipulate functions and simultaneously watch how they change, they are more likely to understand the concepts and retain that understanding long-term.

To accompany open-ended, exploratory tasks such as the one above, I employ the High Impact Teaching Strategy (HITS) of Questioning to formatively assess student understanding. I have found that a task such as creating the file as shown above, and answering a few well thought out questions, is more powerful than completing the corresponding textbook chapter on the same topic.

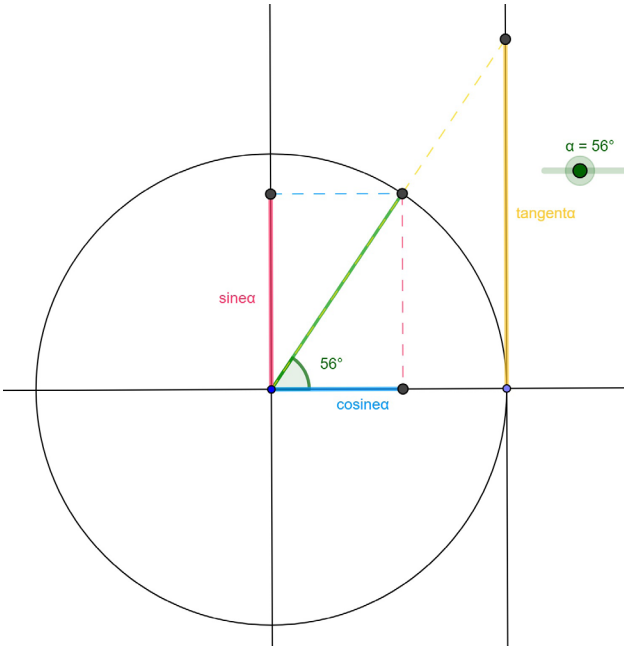


Figure 2.

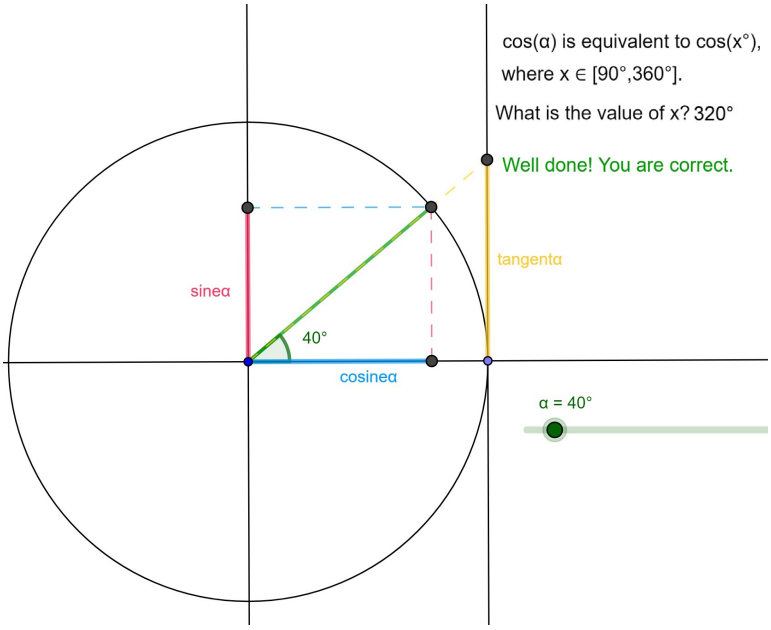


Figure 3.

Students tend to gain a deeper understanding and they get a sense of ownership of the rules once they have discovered them themselves.

Trigonometry is another field in which I extensively use GeoGebra. Sine, Cosine and Tangent functions tend to be accepted by students as abstract notions. However, a simple dynamic applet like the one shown in Figure 2, can quickly correct those misinterpretations. Here, a unit circle is displayed with an angle that can be changed. As the angle changes, the Sine, Cosine and Tangent lengths adjust in response. Rather than wasting valuable class time drawing several static, messy and inaccurate unit circles on the board, this applet quickly demonstrates the concept clearly. This leaves more time for rich classroom discussion and questioning.

A more advanced feature of GeoGebra, which makes it extremely powerful for those that are interested in some basic coding, is the GeoGebra script. Scripting allows the creator of the file to make the page even more interactive by allowing users to answer pre-set questions or tick off instructions. For example, I can code (in Javascript or GGBScript) a question in the unit circle file, and code an answer field to accept user responses. Depending on the input, I can generate a message to say whether it's correct or incorrect, which serves to give instant feedback to the user (see Figure 3). Educators can create entire worksheets within a GeoGebra file. Once they have created the resource, they can use it time and time again.

NOW IT'S TIME FOR A LITTLE BIT OF HOMEWORK

Download GeoGebra and try to create a simulation applet of Pythagoras' Theorem similar to Figure 4.

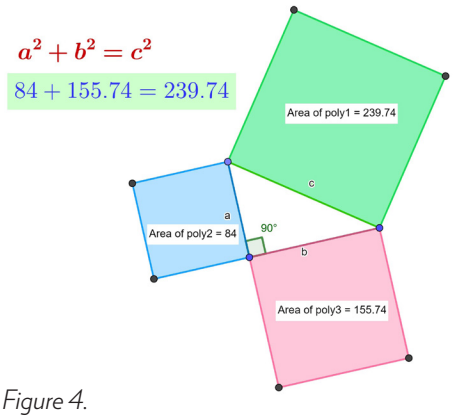


Figure 4.

You should be able to change the size and shape of the right-angled triangle by moving its vertices and the areas of the polygon will adjust accordingly. The values in the equation will adjust as well.

For this exercise you will need to use the toolbar across the top of the GeoGebra page. Specifically, you will need to create segments, perpendicular lines, regular polygons, angles, areas and text.

As an extension, try to create that same interactive applet without using the 'Regular Polygon' tool. This is significantly harder and makes for a very rich task in geometry. Can you create squares that will remain squares without using this pre-set regular polygon tool? This will require some problem solving. (Hint: you may need to use the circle tool.)

Perhaps the most wonderful feature of this software is that all the creators of the GeoGebra files are given the option to save their files to a shared bank of resources. Which means that you can access thousands of pre-prepared files and use them to enhance teaching and learning. Even if you don't know how to create your own, you may use the work of others to get that interactive and visually powerful mathematical resource. It is a fantastic example of collaboration.

If you would like to learn more about GeoGebra and arrange an in-school professional learning workshop, contact Danijela, ddraskovic@mav.vic.edu.au.

RESOURCE REVIEW:
HOW FULL IS YOUR BUCKET?

Alicia Clarke - Foundation classroom teacher, St Mary's Primary School Whittlesea

Students gaining hands on experience. I encourage the use of terms such as full, half full and empty as they explore.

How Full Is Your Bucket tells the story of a young boy called Felix. One day, after he is particularly nasty to his little sister, his Grandpa explains to him about the 'invisible bucket' that everyone carries around.

When your bucket is full, you feel great about yourself, and when it is empty, you feel bad. Other people can fill your bucket by showing kindness towards you, and you can fill other people's bucket by showing them kindness in return. The next morning, Felix's bucket is no longer invisible, and, as he goes about his day the bucket fills and empties along the way.

The book's illustrations, by Maurie J. Manning, show different buckets filled to various points along the way, until eventually Felix's bucket is full to the brim and he experiences positive feelings about himself.

Whilst this story predominantly has a focus on wellbeing for children, it can easily be used as a springboard for an exploration into the measurement of capacity.

The following is an overview of how *How Full Is Your Bucket* could be used with a Foundation class beginning to explore capacity. This lesson was at the beginning of a unit on capacity, and was completed in term four. The Victorian Curriculum states that at the Foundation Level, students will:

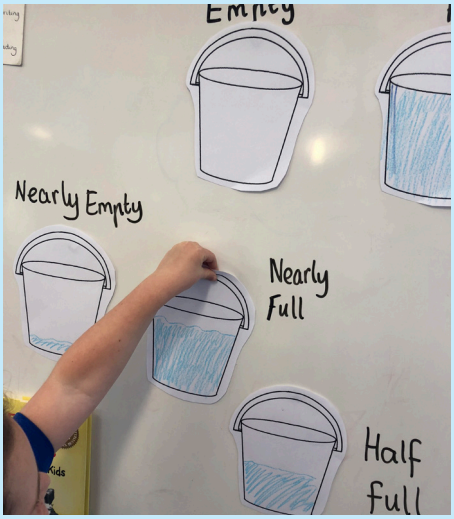
Use direct and indirect comparisons to decide which is longer, heavier or holds more, and explain reasoning in everyday language. (VCMMG078)

In the lesson that follows, the book *How Full Is Your Bucket* is used to do this by introducing everyday language to describe how full the different buckets are.

THE LESSON

After a warm up with some counting and number activities, we began our lesson by reading the story. The picture story book was read as a whole class, with the initial focus being on understanding and enjoying the storyline.

Attention was drawn to the pictures of Felix's bucket, and we simply discussed how much water the bucket had in it. Almost immediately, words such as 'full, almost full, half full, empty and nearly empty' started being used. After reading the story, the students were shown some large pictures of buckets, each with various amounts of water in them. The class came up with some labels to describe how much water was in each bucket. We made a list of all the words we can use to describe how much water is in a bucket.



We then began the hands-on part of our lesson. We ventured outside and students were given small buckets and containers and some large tubs of water. Students were allowed time to experiment with filling their buckets, and were encouraged to describe their bucket to a partner. Some of the things heard during this exploration were:

'My bucket is full'.

'My bucket is empty'.

'My bucket is fuller than yours'.

'Your bucket has less water than mine'.

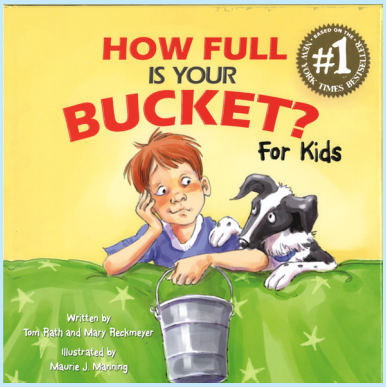
The students then kept some water in their bucket and sat in a circle. Discussion then followed about whose bucket is fullest? Whose is emptiest? Students went back into the classroom, and as a reflection on the lesson completed a worksheet where they had to draw their bucket, with the water in it and complete the sentence:
'My bucket is _____.'

This lesson was a great introduction to capacity.

Although we did not use the actual term capacity (this came in later lessons) the students were developing the vocabulary needed to explore this form of measurement. Using the book as a springboard ensured the students were engaged – they were interested in the story, it was relevant to them and their lives and they had something to link the activity to.

In later lessons, the focus moved more towards informal measurement of capacity. Again, students were given their own buckets, but the question became 'how many scoops does it take to fill your bucket?' Students moved towards having different sized buckets and containers – which takes the most scoops to fill? Which takes the least scoops to fill and so on.

How Full Is Your Bucket was a great way to start our exploration into capacity. Students were engaged in the story and enjoyed the hands on aspect of the lesson, and quickly began using everyday language to describe and compare capacity.



How Full is Your Bucket? is available from MAV's online shop, http://shop.mav.vic.edu.au.

GIRLS IN STEM

Ellen Corovic - Mathematics Education Consultant, Mathematical Association of Victoria

In the Term 1 edition of *Common Denominator*, we published profiles of three inspiring women who have careers in STEM, here we share four more.

SARAH CIRILLO, MECHANICAL ENGINEER, THALES

Sarah's career has allowed her to travel the world and work on all sorts of projects – from comedian Michael McIntyre's famous desk, to a stage in the shape of Russia that featured at the closing ceremony of the 2014 Sochi Winter Paralympics. Sarah took an interest in machinery when she was young, constantly asking her father and brother 'How does this work?'.

During university she was involved in establishing the Adelaide chapter of Robogals, a student run organisation that aims to inspire and empower young women to consider studying engineering, and SAE Society of Automotive Engineers. SAE is open to university students and the aim is to design, build and drive a vehicle.

The vehicle is assessed on three aspects: business, technical and performance – Sarah and her uni mates learned a huge amount from the experience. Some of the skills Sarah learned from this project was how teamwork and communication can shape a team for success, knowledge sharing was critical to achieve the project. The endless testing and re-testing was a great lesson - not everything will work first time! Sarah and her team used the data from the testing to help them continually improve the design and ultimately the performance of the vehicle.

At Thales, Sarah's day is filled with weld calculations, tolerance stacking, mass models and vehicle dynamics. She is tasked with improving vehicle performance and usability by designing clever solutions to problems.

SHARON LAI, ECONOMIST, RESERVE BANK OF AUSTRALIA

During MAV's 2018 Girls in STEM event, Sharon outlined the role of an economist, the role of the Reserve Bank of Australia (RBA) and some of her experiences in this profession. Sharon described how personal choices effect economic growth. For example, as an individual, the choice to use public transport to get to work or school has minimal impact on the population.

However, if one day everyone decided to catch public transport then there would be a large impact. Economists look at all parts of the economy to analyse what's going on, they use this research to help them shape economic policy. Both qualitative and quantitative data is used to observe and make predications about human behaviour.

Sharon described how the RBA economists analyse trends in Australian and overseas through forecasting, modeling and research. An example she shared was the trend the *Skills for the modern workforce* report. The trend data demonstrates that people with analytical and cognitive skills earn more per hour then those with social and managerial skills

KIMBERLEY WHITEHEAD, VEC, CIVIL ENGINEERING

Maths came easily to Kimberley. Her high school maths teacher was a civil engineer and his stories inspired Kimberley to study Civil Engineering at RMIT.

Seeing the sunrise is common in Kimberley's job. She can often be found on site – at the side of a road or on a partly built bridge.

Kimberley's civil engineering career has seen her build car parks and a large number of roads right across Victoria.

A really enjoyable aspect of being a civil engineer is working in close connection to crews. Kimberley's role sees her interface with construction workers, engineers, architects, planners and technicians. Kimberley's role is never dull – running projects sees her on her feet solving problems and navigating unforeseen issues. One of the great perks of the job is driving on a road, or crossing a bridge that she's helped to build.

KIRSTEN PILATTI, CEO, BREAST CANCER NETWORK AUSTRALIA

Kirsten studied marketing and began her career marketing women's netball in Perth. In this role, she needed skills in mathematics and statistics to measure the success of her marketing promotions.

She moved onto a media and communications role at the Cancer Council of Victoria where she had a huge challenge: changing people's behavior. Scientists had proven that prolonged sun exposure could lead to skin cancer and Kirsten needed to use her marketing skills to measure what the community attitudes were and execute a strategy to positively change those behaviours.

She leads a team of 30 staff to provide information and support to people who have been affected by breast cancer and to advocate on their behalf for better treatment and care. This work is based on research and analyses of the gaps in breast cancer support and care. All of Kirsten's decisions are data driven – although not a scientist herself, she needs to understand probability and numbers and translate research into everyday language that can be readily understood by the majority of the community.

Although marketing may not be traditionally considered a STEM career, it's clear that Kirsten uses STEM skills in her job every day.

The Pink Lady. Photo credit: AFL media.

BRINGING IT TO LIFE

To raise awareness of breast cancer, Kirsten and her team partnered with the AFL and created the Pink Lady Round. In 2018, around 18,235 people were diagnosed with breast cancer – during the Pink Lady round 18,235 people came together wearing pink ponchos to represent that number. A large team of people with varied skills work on this project. Data modellers need to work out how large the shape of the pink lady needs to be to accommodate 18,235 people. The image of the lady is then marked out on the oval. And it goes without saying that the logistics of getting 18,235 people from the stands in the MCG to the field is quite a feat!

2019 event: register your interest now

FORD presents Girls in STEAM: Empowering Curiosity
Friday 9 August 2019, 9am - 3pm

Teachers should register their interest in bringing their students to this event at www.mav.vic.edu.au/student-activities/girls-in-stem.html.
The day is aimed at girls in Years 9 and 10.

Ford
Go Further

MAV SPECIAL PD EVENTS 2019

MAV has partnered with some high-profile presenters to provide you with exclusive opportunities to develop your confidence and expertise in mathematics teaching and learning.

STRUCTURING LESSONS AND SEQUENCES TO CHALLENGE AND ENGAGE ALL STUDENTS

Presenter: Peter Sullivan

Using specific examples, Peter will outline the principles of lesson design and also the nature of learning sequences that build on those lessons.

The notion is that students can be productively engaged in working on challenging tasks, appropriately differentiated, and incorporated into cumulative sequences.

The approach includes attention to the main mathematical ideas, the classroom pedagogies, the student disposition, and effective assessment of student learning.

WHEN	Wednesday 24 April, 9am – 3.30pm
WHERE	Fintona Girls' School, Balwyn
WHO	Year 7 - 10 teachers
FEE	$125 (member) $150 (non-member)
REGISTER	www.mav.vic.edu.au/pd

PRIMARY MATHEMATICS: ENGAGING TEACHERS AND ENGAGING STUDENTS

Presenter: Catherine Attard

In this one-day workshop participants will participate in an in-depth exploration of student and teacher engagement with mathematics. The Proficiencies: problem solving, reasoning, understanding, and fluency will feature as a critical pathway for student engagement. Links to mathematics education theory and research will be provided to support the argument that the Proficiencies and the General Capabilities should form the foundation of all mathematics teaching and learning activities.

During the workshop participants will engage with a range of mathematical tasks that promote each of the Proficiencies in ways that promote sustained engagement and deeper learning of mathematical concepts. A range of tasks from short lesson starters through to rich tasks and problem-solving activities will be investigated along with technology enhanced activities. Participants will also be provided with an opportunity to design a set of open-ended tasks that they will be able to take away and use immediately.

WHEN	Monday 20 May, 9am – 3.30pm
WHERE	Community Hub at the Docks (Docklands)
WHO	Foundation - Year 6 teachers
FEE	$125 (member) $150 (non-member)
REGISTER	www.mav.vic.edu.au/pd

THE MATHEMATICAL ASSOCIATION OF VICTORIA

FORMATIVE ASSESSMENT: THE KEY TO IMPROVING LEARNING OUTCOMES IN MATHEMATICS F-9

Presenter: Di Siemon

This full day professional learning program will provide an overview of formative assessment. What it is and isn't and what is needed to implement a targeted teaching approach to mathematics in Years F to 9.

It will introduce participants to the tools and advice available on the DET website to support a formative assessment approach. That is, the Assessment for Common Misunderstandings (AfCM) and the Scaffolding Numeracy in the Middle Years (SNMY) materials.

A brief overview will also be provided of the evidenced-based resources produced as a result of the recent Reframing Mathematical Futures II project on mathematical reasoning.

WHEN	Tuesday 4 June, 9am – 3.30pm
WHERE	Sunshine College
WHO	Foundation - Year 9 teachers
FEE	$125 (member) $150 (non-member)
REGISTER	www.mav.vic.edu.au/pd

VCE STAGE 1 MATHS REVIEW

Forum

The VCAA is undertaking a major review of the current study design for VCE Mathematics to take place after 2020, with a two stage consultation. MAV is providing a forum for members and interested teachers to provide feedback on Stage 1. Dr David Leigh Lancaster, (Mathematics Curriculum Manager, VCCA) will provide the introduction.

Stage 1: The aim of this first stage of consultation is to seek feedback on the structures being proposed for VCE Mathematics and includes:

- three key background papers: New Directions, Working Towards Change and Deeper review – directions and options
- three curriculum structures for consultation.

The three structures A, B, C being put forward for consultation, with Structure A having two models as follows:
Structure A: Model 1 - current VCE Mathematics study design
Structure A: Model 2 - all units completely prescribed
Structure B: Core and alternative model
Structure C: problem-centred computer-based mathematics incorporating data science

Details are on the VCAA website, www.vcaa.vic.edu.au/Pages/vce/studies, select Further, Methods or Specialist. At the bottom of the page you'll see the overview document and background papers.

WHEN	Wednesday 1 May, 4.30pm – 6.30pm
WHERE	MAV Education Centre, 61 Blyth Street Brunswick
WHO	Teachers of VCE and interested secondary teachers
FEE	Free
REGISTER	www.mav.vic.edu.au/pd

REGISTER ONLINE AT
www.mav.vic.edu.au/pd
or call +61 3 9380 2399

5 CENT CHALLENGE

Merryn Auld - Numeracy Leader at Monmia Primary School

They say a waterfall starts with a single drop and you could say that Monmia Primary School took on a similar approach when we commenced our 5 cent challenge.

The 5 cent challenge was the brainchild of Lucy Vorpasso, the school's Student Engagement and Wellbeing assistant principal. Its purpose? To raise funds to support the school's library renovation.

Each class was given a sealed plastic cylinder with a small opening to accept donations. They could hold about 3-4 litres each so fairly generous in size.

The response from the school community was overwhelming. Students were searching through the change tray in cars, upending couch cushions and opening piggy banks. With permission from their families, a number of students even visited the bank to convert their own pocket money into $10 rolls to present to the class. Students would excitedly open them with their peers, dropping the coins in and watching on as their tub grew in volume.

The second part to the challenge was when each class self-selected a wide variety of numeracy activities to create open-ended learning opportunities. All strands of the Victorian Curriculum were covered. Some examples included place value and addition being used to calculate the totals. Measurement and geometry were used to create informal perimeters around one of the student's bodies. Statistics and probability were explored when investigating the likelihood of when the coins were minted.

The most successful class was a Prep grade who filled their cylinder twice over and then had to store more 5 cent coins in additional containers. They received a class party as the winners however, a whole school disco was also organised to celebrate the efforts of the school community.

Not only was this beneficial to the school for its fundraising efforts but it was highly engaging for all students across the school. So much so that one of the first questions I was greeted with upon starting the school year in 2019 was 'Are we doing the 5 cent challenge again this year?'

THE HISTORY OF MATHEMATICS

Terence Mills

The following statement can be found on the website for the Australian Curriculum. 'The Australian Curriculum: Mathematics ensures that the links between the various components of mathematics, as well as the relationship between mathematics and other disciplines, are made clear.' (ACARA, 2010 to present).

Studying the history of mathematics enriches a student's experience of both mathematics and history. We come to realise that there is more to mathematics than numbers, calculations, and equations. Mathematics was created by human beings, from many cultures, over many centuries. Mathematics has a history, and a fascinating history at that.

Having just mentioned equations, it is interesting to consider the origin of the equals sign =. Robert Recorde (1510-1558) is generally credited with introducing the symbol in 1557, just over 500 years ago.

Recorde was a physician and a mathematician, an unusual combination both then and now. From his writing we can infer that he was a dedicated and gifted teacher of mathematics.

Introducing a new symbol has its problems in being accepted. In much earlier times, would you write 'equals' or 'is equal to' rather than use a symbol.

Evidently it was only many years after Recorde had died that it became accepted by prominent mathematical writers. Then there were competing symbols such as || introduced by other writers. There were some other, quite strange, symbols also floating around in the literature, which fortunately did not survive.

Cajori (1928/9) and O'Connor & Robertson (2002) provide more details on Recorde and the symbol for equality which we take for granted these days.

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Cajori, F. (1928/9). *A History of Mathematical Notations*, vols. 1-2. Open Court Publishing Company, La Salle.

O'Connor, J.J. & Robertson, E.F. (2002). Robert Recorde, www-history.mcs.st-andrews.ac.uk/Biographies/Recorde.html, University of St Andrews, Scotland.

MTQ AND MATHS GAMES DAYS 2019

A Maths Games Day is an opportunity for students to develop their mathematical talents and thinking skills in a setting where maths is regarded as fun and worthwhile with like-minded students from a diverse range of schools. It is an ideal way for students to participate in mathematical activities without the usual class room pressures and is a very effective vehicle for getting young people – particularly in the middle years of schooling – excited about maths. Problem solving and mathematical games address the Victorian Curriculum proficiency strands.

The Maths Talent Quest aims to promote interest in mathematics and foster positive attitudes amongst students, teachers and parents. The focus is on the process of mathematical investigations.

Registrations for both Maths Talent Quest and Maths Games Days open on Tuesday 23 April 2019. Register at www.mav.vic.edu.au/student-activities/

Year 7 students working together to solve problems at a Maths Games Day.

NATIONAL MATHS SUMMER SCHOOL

2020 APPLICATIONS ARE OPEN

Canberra, 5-18 January 2020

Being awarded a place at the NMSS gives students who love mathematics an opportunity to have fun together as they discuss and explore mathematical concepts from some very different perspectives. Give your students a chance to apply!

As always, only one or two applicants from each school are selected. This increases the number of schools participating which adds to the richness of the summer school experience. Students from all over Australia who are in Year 11 in 2019 can apply. This summer school is a two-week program held at the Australian National University in Canberra in January 2020. Many enduring friendships are made on this very special summer school, now in its 52nd year.

Each year a few past students return to help run the program which is a testament to the value they place on their own summer school experience.

There is a strong emphasis on solving problems and many students often find themselves working on problems well into the night (because they want to)! There is also a strong emphasis on recreation, exploration and fun, as many activities, tours and talks are organised. During the afternoon, students are free to socialise and explore Canberra (popular activities include ice skating, ten pin bowling, tandem bike riding around the lake). There is an entertaining dinner and concert on the last night.

Selection is based on the strength of a student's written application, a teacher reference, and the creativity and perseverance shown on a problem-solving 'test'. This test includes some unfamiliar problem-solving questions that do not require higher level mathematics to solve them (just creative use of simpler mathematical ideas), some questions that require algebraic proof, and some use of higher-level mathematics in unfamiliar ways.

There is no requirement to be able to do all types of questions to demonstrate the ability to think creatively with mathematical ideas. Being able to use mathematics creatively is what is highly valued.

The NMSS contribution is $1200 and a travel surcharge will apply if students/parents want NMSS to organise return travel from Melbourne airport. The closing date for applications is 26 July 2019 and the 90-minute selection MAV test for NMSS will be held on 2 August 2019 at the applicant's school.

More information can be found at www.nmss.edu.au. Application forms can be downloaded at: www.mav.vic.edu.au/student-activities/national-mathematics-summer-school.html

Please encourage your students to apply!

TECHNOLOGY IN PRIMARY MATHS:
FIVE PRINCIPLES FOR GAINING VALUE FROM INVESTMENT

Dr Duncan Symons - Melbourne Graduate School of Education, The University of Melbourne

The use of digital technologies within primary school teaching and learning is fundamental within everyday school-based interactions and learning and prepares them for a later life where employment and everyday activities will require well developed digital literacy.

Despite this requirement being obvious, many primary school teachers and leaders struggle to know how best to integrate digital technologies in the primary mathematics classroom and also how to approach investment in technologies to support mathematics teaching and learning. Day's (2013) findings support the earlier claims of Herrington and Kervin (2007) who found that, 'Technology use in classrooms is often employed for all the wrong reasons - such as convenience, pressure from school administrators, the belief that students need to be entertained, and so on' (p. 12).

As a class teacher, the author of this paper saw technology used as the 'computer rotation'. Students were asked to work independently on a computer, accessing a variety of mathematics games-based websites commonly focused on 'skill and drill'. These programs claimed to improve students' fluency in the areas of multiplication facts, simple addition, subtraction, basic fractions or decimals. Often such games involve limited multiple-choice questions and allow students to succeed through repeatedly hitting buttons in a process of trial and error. Research suggests that such approaches to the integration of technology in mathematics education may lead to superficial learning that will, at best, provide some degree of procedural knowledge without promoting students' development of more in-depth conceptual knowledge or application of their understanding to broader contexts.

With this in mind, in this article a set of principles for technology integration within the primary mathematics classroom is presented. These will first be clearly defined and secondly an example will be provided with the aim of allowing readers to gain a more concrete understanding of the principal in practice. The following are our principles for technology integration within primary mathematics:

1. **A**ccess the affordances of Web 2.0
2. **E**nsure an equitable approach to technology integration
3. **I**nvest in professional learning, not just apps, and techno-gadgets
4. **O**ffset procedural fluency with deeper conceptually driven learning
5. **U**se interactive devices interactively

ACCESS THE AFFORDANCES OF WEB 2.0

Rather than be passive consumers of information students should be active participants in the process of sharing and constructing knowledge and understanding. Primary mathematics teaching and learning should take advantage of the affordances of Web 2.0 to promote not only fluency but reasoning and communication. Figure 1 shows an example of how this can be achieved through teachers setting up small collaborative groups in an online platform within Edmodo (www.edmodo.com) and having students solve problems through the construction of mathematical meaning making artefacts (see Symons and Pierce (2019a) for more information).

	Animal ages		
Human years	Cat years	Camel years	Lorikeet years
1	5	2	4
2	10	4	8
3	15	6	12
4	20	8	16
5	25	10	20
6	30	12	24
7	35	14	28
8	40	16	32
9	45	18	36
10	50	20	40
11	55	22	44
12	60	24	48
13	65	26	52
14	70	28	56
15	75	30	60
16	80	32	64
17	85	34	68
18	90	36	72
19	95	38	76
20	100	40	80
21	105	42	84

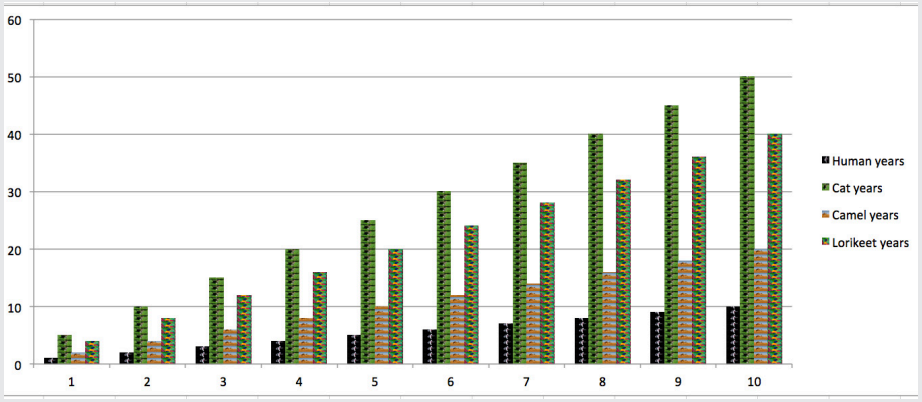

Figure 1: Students representing their understanding of comparative animal ages using Excel

ENSURE AN EQUITABLE APPROACH TO TECHNOLOGY INTEGRATION

It is important when considering investment in digital technologies that an equitable approach is utilised. Recent data shows that within Victoria on average access to digital devices (smart phones, tablets, netbooks etc) is represented by slightly more than one per child. Based on this, it is reasonable to expect that in all Victorian schools, children will have one-to-one access to digital devices. This, however, is not currently the case and therefore there is a level of inequity to technology access.

INVEST IN PROFESSIONAL LEARNING, NOT JUST APPS, AND TECHNO-GADGETS

Research has shown that if technology is to be a transforming tool for learning, a higher initial priority must be to up-skill teachers with the facility to make good use of (possibly already existing) digital technologies, rather than large-scale purchasing of new technology. Thus, whilst students and teachers alike, require equitable access to technology, there must also be equity in the provision of professional learning for teachers and leaders about how to lead technology integration and how to teach with digital technologies in the mathematics classroom.

OFFSET PROCEDURAL FLUENCY WITH DEEPER CONCEPTUALLY DRIVEN LEARNING

Where technology integration in the mathematics classroom does occur, it is usually focussed on developing student fluency. Whilst this is clearly an important

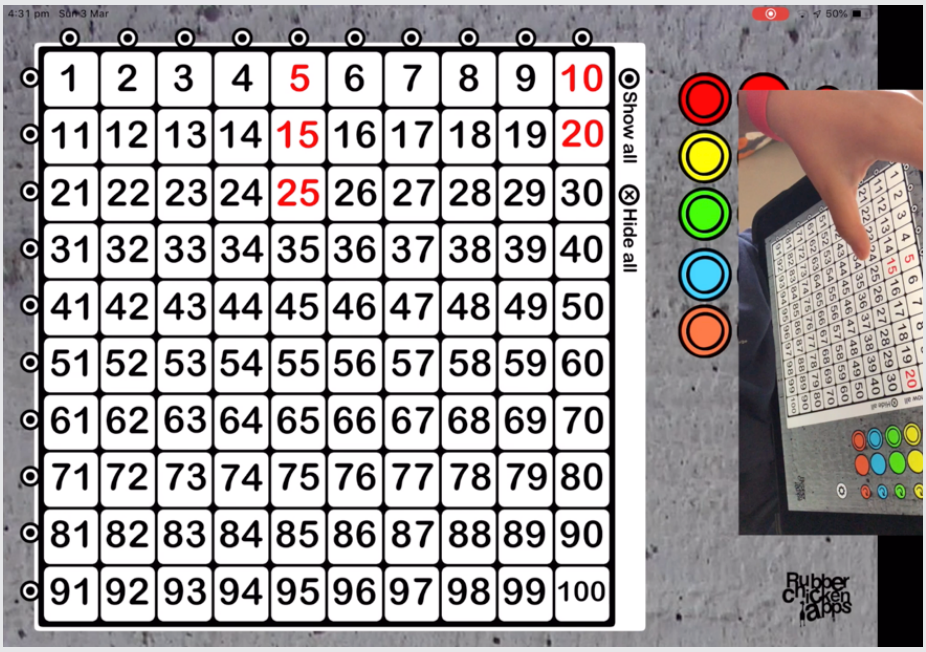

Figure 2: Foundation student interactively using iPad to count by 5s (100s board).

aspect of student mathematical learning, a fluency focussed approach often takes the form of 'drill and practice' games that are often situated online in web browsers. When quizzed about his computer use in the mathematics classroom a Year 5 student recently stated:

> The multiplication games are more of... like games... but they don't really teach you anything... because all you just do is just click, click, click.

This reinforces the notion that technology use can often occur for all the wrong reasons. My recommendation is that through utilising Web 2.0 features that require students to create and represent their mathematical thinking understanding, reasoning and problem-solving procedural learning can be offset with deeper conceptually driven learning.

USE INTERACTIVE DEVICES INTERACTIVELY

Zevenbergen and Lerman (2007) raise questions about how Interactive Whiteboards are utilised within the classroom. It appears that in Australian schools these devices have quickly been embraced, often without significant pedagogical change. Zevenbergen and Lerman (2007) point to teachers' reliance on pre-prepared packages and lessons for the IWB, and the adherence to these lessons limiting teachers' adaption to their students' particular learning needs. They suggest that the seductive quality of the device can capture students' attention in the short term but may not lead to improved learning. In the over ten years since their research findings were published, one might wonder if a possible novelty effect may have worn off, allowing for the true pedagogical potential of the tool to be realised.

Unfortunately, Sheffield (2015) still reports a reluctance of primary/ elementary school teachers to move beyond the unidirectional use of an IWB as purely a data projector. Little use is made of their interactivity, arguably the IWB's most potentially transformative capability.

CONCLUSION

It is hoped that this article has established the need for all decisions taken when integrating technology in the primary mathematics classroom to be carefully examined. A leader of a primary school should easily answer, citing evidence, why they have chosen to invest in technology in the manner selected and a teacher of primary mathematics should be able to provide an evidence base providing rationale, for their utilisation of technology for teaching and learning within mathematics.

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This article is a summary of a keynote presentation that will be given at the 2019 MAV MEG Primary Mathematics Conference.

The conference will be held at The University of Melbourne on Thursday 20 and Friday 21 June.

The theme for the first day of the conference is leading whole school improvement in mathematics. The second day focuses on improving classroom-based learning.

Register now at www.mav.vic.edu.au/conference/primary-and-ec-2019

2019 VCAL NUMERACY STYLE

Shane O'Connor - VCAL Program Officer, VCAA, Justine Sakurai - Sandringham College and Felicity Fox - Melbourne Polytechnic

2019 sees an exciting chapter in VCAL Numeracy with the implementation of the new VCAL Numeracy Units. All of the units have been re-written, hopefully keeping the activities that are currently working, and adding new ideas that will challenge and engage our learners.

All Sample Assessment Task Templates (SATT) will need to be recorded on the new 2019 templates. For Quality Assurance (QA) Stage 1 purposes, if you are a new provider, check with your regional VCAL Liaison Teacher (VLT), as to which SATTs are to be presented. For existing providers in the Grampians and Northern Metropolitan Regions, you must have already submitted your Numeracy SATTs, at the lowest VCAL Level.

There are now six VCAL Literacy Skills Units as well as six Literacy Skills Units in the VCAL Literacy and Numeracy Skills Strand. The two new Numeracy Skills Units are:

- Numeracy Skills Intermediate Unit 2
- Numeracy Skills Senior Unit 2

The purpose of both of these new units is to enable students to develop, refine, extend and apply numeracy knowledge and skills through an investigation in a familiar and unfamiliar industry area linked to the VET units in their VCAL program or employment. The numeracy involved focuses on Number, Measurement, Financial Numeracy, and Probability and Statistics.

The numeracy focus areas of the units also are linked to the three key stages of an industry, namely the Inputs, Processing and Outputs stages.

Intermediate Level Unit 2 requires students to develop an investigative numeracy-based project plan (Learning Outcome 1) using routine calculations that is linked to a familiar workplace environment such as the student's VET placement. Six numeracy tasks are to be planned at the classroom level then investigated (Learning Outcome 2) at the workplace level.

Senior Level Unit 2 requires students to develop an investigative numeracy-based project plan (Learning Outcome 1) using complex calculations that is linked to an unfamiliar workplace environment. Eight numeracy tasks are to be planned at the classroom level then investigated (Learning Outcome 2) at the workplace level.

Learning Outcome 3 at both the Intermediate Level Unit 2 and Senior Level Unit 2 focuses on the representation of the numerical data gathered in the tasks investigation, and Learning Outcome 4 at both levels focuses on the communication of the represented data. The representation of the data in Outcome 3 is designed to utilise contemporary software tools and devices, whereas the communication of the numerical data in Learning Outcome 4 is meant to include the workplace and other industry sites as possible venues.

For QA purposes, Intermediate Level Unit 2 and Senior Level Unit 2 are not to be used, unless requested by your regional QA panel. The units that should be submitted at QA are either Foundation Level, Intermediate Level Unit 1, Senior Level Unit 1 or Advanced Numeracy Skills Senior.

It should be noted, that the two new Numeracy units are at a general credit level. This means that learners will still need to complete at least Foundation Level Numeracy, as the numeracy component of their Foundation or Intermediate Certificates. The Intermediate Numeracy Level Unit 1, Senior Numeracy Level Unit 1 and Advanced Numeracy Skills Senior will still continue to contribute the numeracy component for any of the VCAL Certificates.

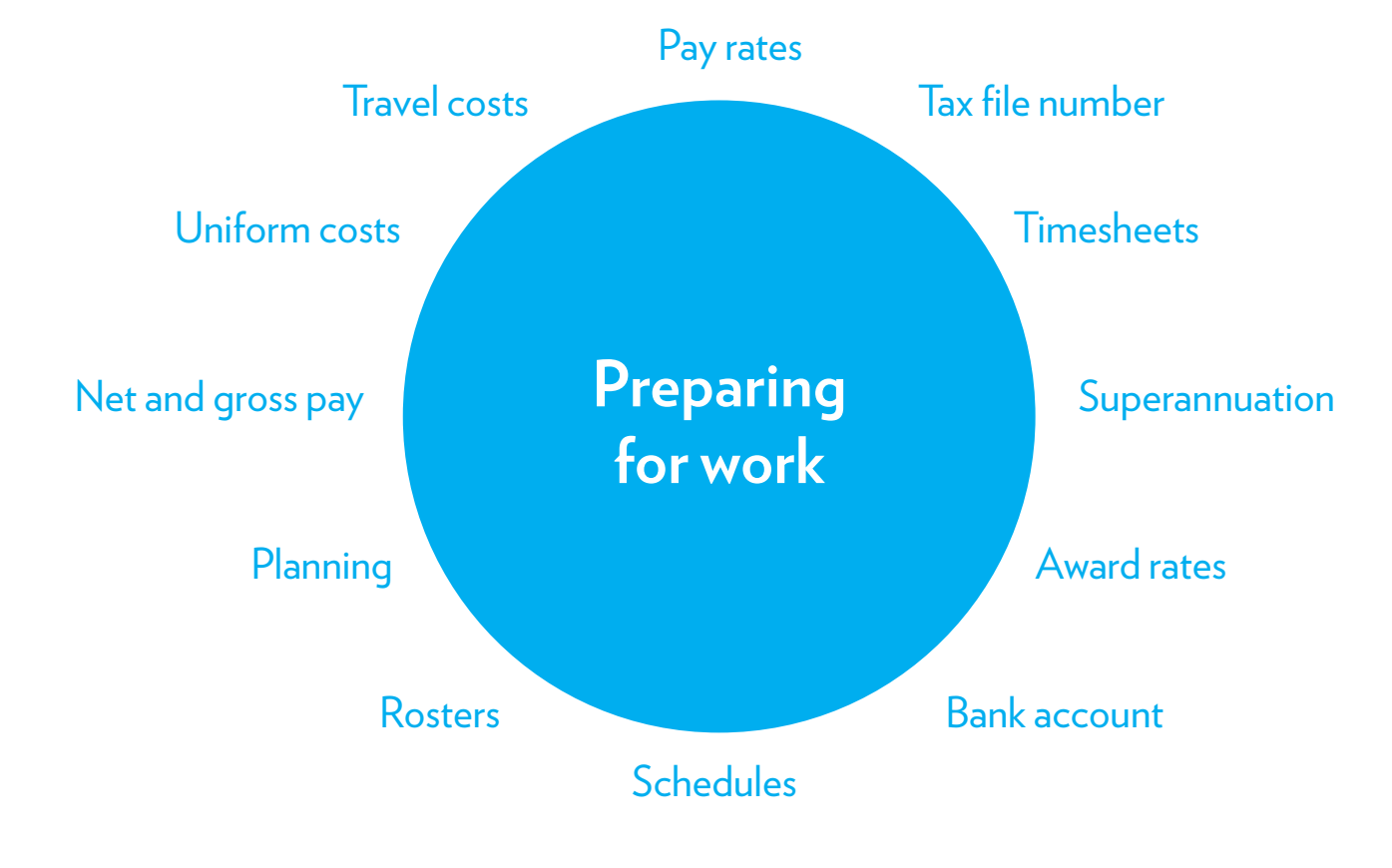
Unit One of VCAL Numeracy has a repeated structure across the 4 outcomes (note Foundation level has 5 outcomes, with the last being 'Preparing for Work'). Each outcome has the same broad elements of: mathematical knowledge and techniques, comparative mathematics, estimation and approximation, writing and interpreting numerical expressions, and applying mathematics. Across the levels of VCAL from Foundation (Year 10 equivalent) to Senior (Year 12 Equivalent) the outcomes mirror in content but increase in difficulty and level of skills required.

Learning Outcome 1: The Numerical Skills focusses on understanding numbers, developing skill at performing operations, and being able to compute fluently. Students should be at ease with both mental methods, using estimations and approximations. Equally, students should freely incorporate the use of technology, including the tool most prevalent in current society, the mobile phone. Outcome 1 has the capacity to be taught in an applied manner, with teachers encouraged to use scenarios from real life when designing lessons. Fractions can be considered by: sharing a biscuit or cake, spanners and bolts, which are named as fractions, can make an ideal teaching activity, and halving, doubling a recipe such as playdough, which can then be used to demonstrate fractions in a tactile manner.

Learning Outcome 2: Financial Literacy is designed to teach students to be able to make decisions about money in a range of situations and to gain an understanding of key financial concepts central to participating in Australian society. Students must also develop the skills to manage personal finances and understand risk in a range of financial situations. Teaching strategies can include; using play money to perform calculations around cost and change, inflation can be explored by looking at changing costs over time, and mortgage calculators can help students understand the complexities of compound interest. The intention is for students to develop the skills and knowledge to manage financial resources in a range of situations.

Learning outcome 3: Planning and Organising takes in many of the concepts that were found in the previous Location, Money and Time Learning Outcomes. In this regard, it is important to keep the engaging tasks that you have successfully used before (they will however, have to be mapped against the new Learning Outcomes). Similarly in Learning Outcome 4; Measurement, Representation and Design draws some of the ideas that were explored in the former Measuring and Design Learning Outcomes.

For all units now, all Learning Outcomes must be demonstrated to a level of competency, for the Unit to be awarded. There are provisions this year that students who are completing their Numeracy Units, which they started last year, to finish in 2019.



Foundation Numeracy 5: Preparing for work - use and communicate numerical skills in a practical context within the work environment.

In this regard, Numeracy teachers should speak to their VASS coordinator about their enrolment in their continuing units.

The revised VCAL Numeracy curriculum has seen the welcome addition of Learning Outcome 5 at the Foundation level only. This outcome 'Preparing for work: use and communicate numerical skills in a practical context within the work environment', is a critical component of preparing our students for life beyond the school setting. The focus of VCAL Numeracy is for our students to make mathematical connections to the real world and this outcome reinforces that sentiment.

Activities could include researching the steps involved in applying for a tax file number, evaluating and calculating costs involved in working, visiting a bank to open a bank account and researching award rates, including breaks and entitlements. (All thirteen criteria points must be met to satisfactorily complete this outcome.)These tasks could also be integrated with the Work-Related Skills unit.

The learning outcome 'Preparing for work' allows our students to continuously make the connections between numeracy and the work environment.

The VCAL Literacy and Numeracy Skills Strand now has a Curriculum Planning Guide (CPG) for all units as well as an extensive Advice for Teachers (AFT) resource for all units.

The Numeracy Skills Units AFT contains considerable content information, delivery advice, teaching suggestions, project plan templates, and hard copy and online teaching activities for the two new numeracy units.

The VCAA and the Victorian Applied Learning Association are delivering a range of teacher professional development activities to support teachers wishing to deliver the two new units. For further information, contact VCAA's VCAL Unit.

If you teach VCAL Numeracy and would like to share your stories of success in the classroom, we'd love to hear from you.

Your story doesn't need to be word perfect, the editors can guide you through that process. If you are interested to learn more, email office@mav.vic.edu.au.

PUZZLES

Michael Nelson - Learning specialist, Drysdale Primary School

LOWER PRIMARY

5

Think of a number. Double it. Add ten. Half it. Take away the number you started with and you're left with 5. How is this possible?

Solve simple addition and subtraction problems using a range of efficient mental and written strategies(VCMNA107)

Explore the connection between addition and subtraction (VCMNA106)

I was counting by a number. It took 10 numbers for the ones to repeat. What number was I counting by?

Investigate number sequences, initially those increasing and decreasing by twos, threes, fives and ten from any starting point, then moving to other sequences (VCMNA103)

MIDDLE PRIMARY

If I had a rectangle with an area of 24cm^2, how many sets of dimensions would have a perimeter of greater than 24cm?

Compare objects using familiar metric units of area and volume (VCMMG166)

Use scaled instruments to measure and compare lengths, masses, capacities and temperatures(VCMMG165)

Nike can place 8 large boxes of shoes or 10 small boxes of shoes into a carton for shipping. In one shipment, they sent a total of 96 boxes. If there are more large boxes than small boxes, how many cartons did they ship?

Develop efficient mental and written strategies and use appropriate digital technologies for multiplication and for division where there is no remainder (VCMNA156)

UPPER PRIMARY

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

I choose a prime number. I made it by adding four consecutive prime numbers. How many prime numbers could I have chosen?

Identify and describe properties of prime, composite, square and triangular numbers (VCMNA208)

Three brothers live on a farm. They bought seeds. Ben bought 75 sacks of wheat whilst Adam bought 45 sacks. At home, they split the sacks equally. Charlie had paid $1400 for the wheat. How much did Ben and Adam get of the sum, considering equal split of the sacks?

Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers and make estimates for these computations (VCMNA209)

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MAV SACS SUGGESTED STARTING POINTS

2019 | ALL STUDIES

MAV SACS SUGGESTED STARTING POINTS

VCE

The MAV 2019 VCE Mathematics SACS materials are designed to provide suggested starting points for VCE Mathematics teachers for their School Assessed Coursework (SAC).

MAV SACS 2019 materials have been written by experienced VCE mathematics teachers. They are for use by teachers to aid in assessment of student School Assessed Coursework for Further Mathematics, Mathematical Methods and Specialist Mathematics.

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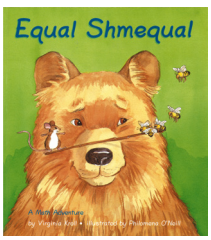


EQUAL SHMEQUAL

F-3

Mouse and her friends want to play tug-of-war, but the teams aren't equal. Nothing works until Mouse starts to think about it mathematically and divides the teams based on weight. Mouse and her animal friends work to measure and equalise their teams based on size, weight, and effort. A perfect addition to any STEM/STEAM collection.

$11 (MEMBER) $13.75 (NON MEMBER)

25 GAMES FOR GAMES DAYS

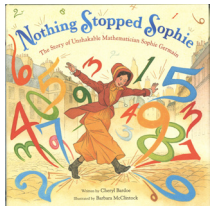
5 – 10

The Mathematical Association of Victoria (MAV) Games Days are very popular and a great way of engaging students through competing with like-minded individuals. MAV often gets enquiries from schools either wishing to run smaller scale games days at a local or school level or requesting games days resources.

MAV has compiled a selection of favourite maths games some used in games days. Whether for games days or for general classroom use, the games are a useful tool in engaging all students.

The resource has been designed with one game per page, so teachers can print the desired page as is. Each game has the same format, listing materials required, the rules and the aim of the game.

$20 (MEMBER) $25 (NON MEMBER)



NOTHING STOPPED SOPHIE

5 – 9

The true story of 18th century mathematician Sophie Germain, who solved the unsolvable to achieve her dream. When her parents took away her candles to keep their young daughter from studying maths...nothing stopped Sophie. When a professor discovered that the homework sent to him under a male pen name came from a woman...nothing stopped Sophie. And when she tackled a maths problem that male scholars said would be impossible to solve...still, nothing stopped Sophie.

For six years Sophie Germain used her love of maths and her undeniable determination to test equations that would predict patterns of vibrations. She eventually became the first woman to win a grand prize from France's prestigious Academy of Sciences for her formula, which laid the groundwork for much of modern architecture (and can be seen in the book's illustrations).

$22.75 (MEMBER) $28.44 (NON MEMBER)

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