THE MATHEMATICAL ASSOCIATION OF VICTORIA

THE COMMON DENOMINATOR 1/19

INCIDENTAL MATHS

INSIDE

Amy Somers, Leading teacher of mathematics, Lyndale Greens Primary School

After attending David Butler's keynote presentation, Playful and Joyful Maths, at the 2017 MAV conference, I was inspired by the idea of 'incidental maths' and I began to think about how I could incorporate incidental mathematics into our students' time outside of the classroom.

While all classrooms have maths displays and we have a number of numeracy and literacy activities throughout the playground I wanted students to engage with mathematics outside their classrooms and to be able to 'play' with maths like in Sara Van Der Werf's 'maths play tables'. I wondered how we could make this work at our school and how could we ensure all materials remained neat and tidy?

Inspiration hit me when I saw the Tangram Puzzler in the Term 3, 2017 edition of *Prime Number*. As we didn't have a space to set up a 'maths play table' I decided to set up a 'maths play wall'.

Continued on page 4

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

Magazine 270, January 2019

The Mathematical Association of Victoria, 61 Blyth Street
Brunswick VIC 3056

ABN: 34 004 892 755
Tel: 03 9380 2399
Fax: 03 9389 0399

office@mav.vic.edu.au
www.mav.vic.edu.au

Office hours:
8.30am – 5pm
Monday to Friday

President: Michaela Epstein
CEO: Peter Saffin

The Common Denominator is edited and produced by Louise Gray, Stitch Marketing.

Print Post Approved
Publication No: PP100002988

FROM THE PRESIDENT

Michaela Epstein

Welcome to 2019! We're excited to have you join us for a full calendar of events run by MAV this year.

Behind the scenes, there is also much going on. In particular, MAV's constitution is undergoing a review. In this article, I want to share with you the process for how this review has been taking place, what this might mean for you, and what you can expect to see next.

But first, why bother going through a full constitutional review? What's the need? Well, time. A constitution should be reviewed on a regular basis – at least every three years – to ensure that it reflects current objects, activities and operations of an organisation. The review is also a way of checking that we are compliant with any relevant legislation and that the processes embedded in the constitution continue to be meeting our practical needs with sufficient flexibility. For MAV, the constitution has not had a review or change in fifteen years. The opportunity that the review provides will bring this significant document in line with the current needs of the association and our community.

HOW DOES A CONSTITUTIONAL REVIEW HAPPEN?

The review is being led by the MAV Council. It is a task that is not being taken lightly! For much of the past year, we have been working closely with a number of stakeholders who have been able to provide expertise and valuable perspectives. This has included lawyers who work specifically with organisations like MAV and who have outlined the areas of the constitution where a decision on any potential change is needed. For example, how individuals or institutions gain membership, and how Councillors are elected. Each area for consideration has been deliberated on and rigorously debated by Council, with further input from some members. Recently updated constitutions of other education associations have also been consulted. I would like to thank those members involved in this process for their considered input.

WHAT DOES A CONSTITUTIONAL REVIEW MEAN FOR YOU?

First, if you are a member, MAV is your association. We want the association to best serve you, and the constitution outlines the mechanisms by which this happens. Second, while Council will be making recommendations on the document, it is up to you to allow this to go through. Any change is to be voted on by members at a general meeting, such as an AGM. We will inform you of exactly when this is taking place, what is up for consideration and how you can have your say.

In the meantime, if you have any questions about what's going on feel free to get in contact, via office@mav.vic.edu.au.

SAVE THE DATE

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!

The conference offers primary and secondary teachers the opportunity to learn from experts, hear best practice from classrooms both nationally and internationally and of course, network with your colleagues. Keep an eye on MAV's website for information on registering and the call for options.

MAV PROFESSIONAL DEVELOPMENT

During Term 1 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
VCE mini conference	15/2/19	VCE	Various
VCE mini conference	18/2/19	VCE	Various
Coding using the TI-Nspire CX	21/2/19	7–12	Danijela Draskovic
Inquisitive, inspiring warm ups	27/2/19	7–12	Helen Haralambous
VCE mini conference	1/3/19	VCE	Various
Further Maths and Specialist Maths SAC evening	4/3/19	VCE	Various
Maths Methods SAC workshop	6/3/19	VCE	Various
Re-framing mathematical futures II	6/3/19	F–10	Di Siemon
Meet the Assessors	12/3/19	VCE	Various
Integrated STEM	13/3/19	Primary - middle years	Duncan Symons
SAC workshop	14/3/19	VCE	Various
Meet the Assessors	18/3/19	VCE	Various
Meet the Assessors	19/3/19	VCE	Various
Meet the Assessors	20/3/19	VCE	Various
SAC workshops	25/3/19	VCE	Various
Meet the Assessors - Maths Methods	26/3/19	VCE	Various
Meet the Assessors - Further Maths and Specialist Maths	27/3/19	VCE	Various
Meet the Assessors	3/4/19	VCE	Various

2018 MTQ AWARDS

Following the judging of the 2018 Mathematics Talent Quest, five schools received an Outstanding School Award. This award is judged on the influence the MTQ has on the schools' overall mathematics program and takes into account the quality of entries received from that school. Congratulations to:

- Carey Baptist Grammar School
- Jells Park Primary School
- Mentone Grammar School
- Port Melbourne Primary School, and
- Windsor Primary School

THE JIM TROTTER AWARD

Jim was an active member of The Mathematical Association of Victoria's Student Activities Committee. The award is presented annually to an outstanding upper primary investigation. Congratulations to:

Maya O'Halloran-Scott from Port Melbourne Primary School for her investigation *What would be the effect on Melbourne if the train capacity doubled?*

LA TROBE UNIVERSITY – YOUNG WOMAN IN MATHEMATICS RECIPIENTS

Primary - Isabella McDonaugh from Penleigh and Essendon Grammar School - *Junk Mail – it is just a big waste?*

Secondary – Sophie Bridges from Emmanuel College - *Compound interest*.

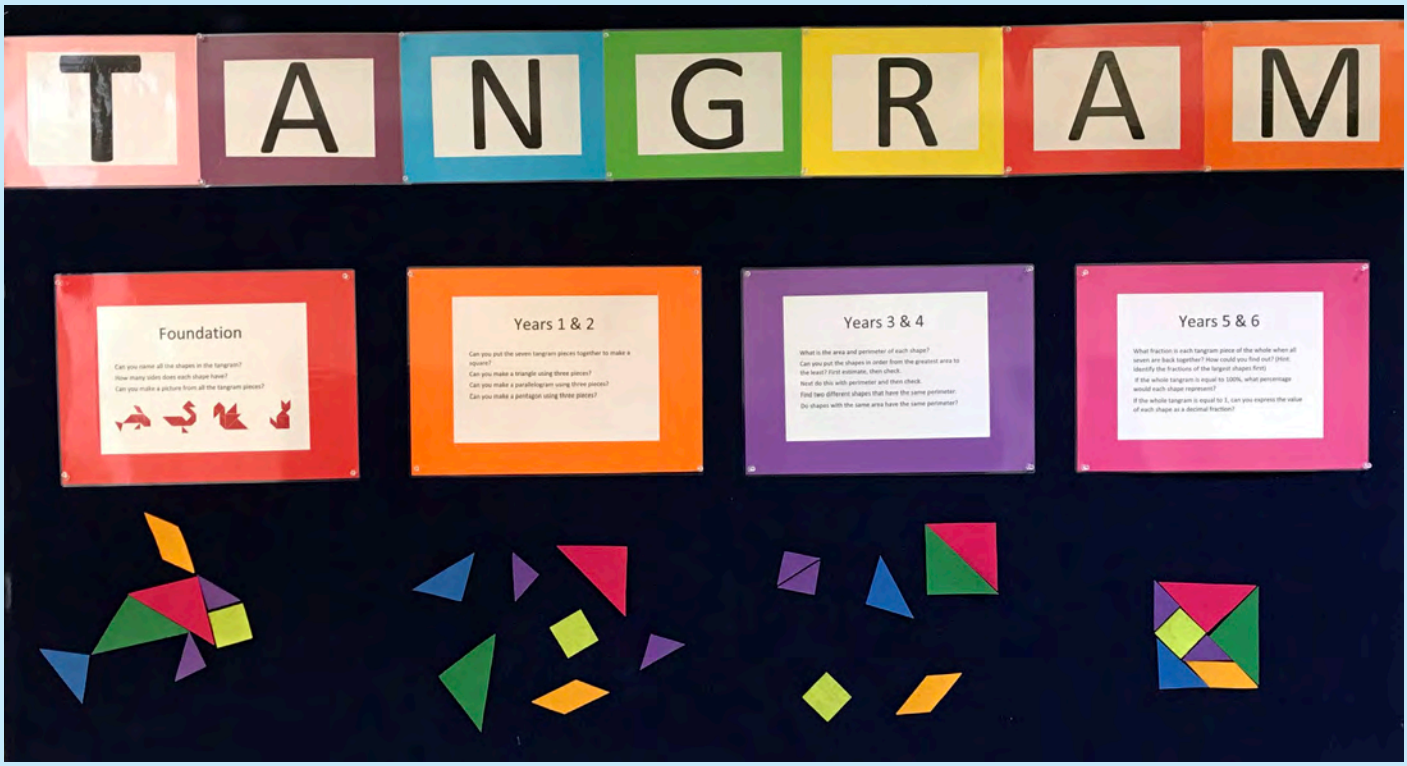
GET YOUR SCHOOL INVOLVED IN THE 2019 MTQ

MTQ is open to individuals, small groups or classes from Prep - Year 12. Enter online at www.mav.vic.edu.au from Tuesday 23 April.

INCIDENTAL MATHS

Amy Somers, Leading teacher of mathematics, Lyndale Greens Primary School

CONT. FROM PAGE 1.



The first display I set up used questions based on the Tangram Puzzler and four Tangrams that I had cut out of felt so that they would stick to our notice board. This notice board is in a very central place in our school. It is close to the office, it's where students get dropped off before school and where they wait to be picked up after school, it's in front of a seated area where parents can wait for meetings or to pick up their kids and is also in the corridor that links our office to our staffroom so there is regular traffic passing the 'maths play wall'.

It was important that it was in a central space where kids could engage with it and also in a place that staff were constantly passing so we could check that it was kept neat and tidy and therefore looked inviting.

What amazed me was just how popular this wall became. Students started interacting with it immediately and even younger and older siblings would play with the shapes when they came to pick up or drop off their brothers and sisters. Some students would even race to the wall at the end of the day to make sure they got a spot!

Another interesting thing was that students weren't reading the questions for their age group but were drawn to the tangram pictures and would see if they could recreate them or make their own symmetrical pictures with the shapes. It wasn't uncommon to see an older student trying to make the same picture as a younger student and to see them helping each other. This not only helped to develop their mathematical reasoning but also helped them to improve their vocabulary in the process!

I kept this Tangram display up for a term and even though students were still using it and only a couple of felt pieces went missing (luckily I had made extras so I could replace them as needed) I decided it was time for our next display.

As I had noticed some gaps in student knowledge about 2D shapes, and it was an area that most students would be studying, I decided that this would be my next area to focus on.

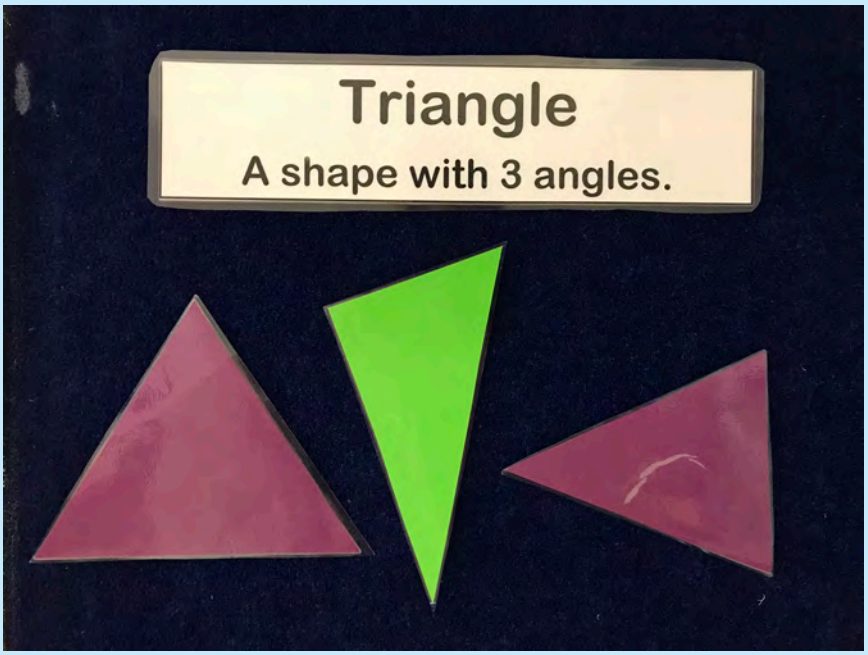
I cut out a range of 2D shapes to make a Shape Sort activity. I had learnt from my first display that the kids would interact with the wall however they liked but I wanted them to be exposed to the names of a range of shapes and to see shapes in different ways. For example, a lot of student's concepts of a triangle was that of an equilateral triangle with its base sitting horizontally. I wanted them to see that triangles and other shapes don't have to be equilateral or regular but could look very different. I also wanted them to see shapes on their side and upside down to extend their concepts of these 2D shapes.

For the first week, I just put up the shapes to see what would happen. Students created some beautiful designs and just had fun playing with them.

Next, I put up the headings and encouraged students to sort the shapes. Again this led to a lot of discussion between students of various ages. As well as headings with the names of the groups of shapes, I also put the names of individual shapes on the back of the shapes themselves to help students to learn their names.

This was particularly important for the rhombus and the kite shapes that students have the common misconception of calling diamonds. Another interesting misconception I noticed through discussions with students was that they thought that the arrowhead/chevron shape was a triangle due to its pointed tip. Noticing this helped to inform our teaching and correct this misconception.

It was also great for students to make connections between what they were



studying in class and their time playing on the maths wall. When they'd make a connection they would want to tell me all about it and take me to their class, or show me their homework so I could see what they were learning about and how it connected to the shapes on the wall.

Another 'fun' activity students created with the shapes was to see how high they could stick the shapes. This encouraged them to use comparative language (highest to lowest) and to discuss the names of the shapes that they were using. They also had a lot of fun in the process!

Next I'm planning to cut up a whole heap of the same basic shapes so that students can explore which shapes do and don't tessellate. I would love to hear other ideas for 'maths play walls' or how other schools are incorporating incidental maths into their schools.

REFERENCES

https://saravanderwerf.com/2017/05/29/you-need-a-play-table-in-your-math-classroom/

https://mav.vic.edu.au/files/fun-maths-puzzles/Prime-No-32-3-2017.pdf

Have you been inspired to create an maths wall at your school? We'd love to see a picture of your creations, email them to office@mav.vic.edu.au.

(IM²C international mathematical modeling challenge)

An opportunity for senior secondary students to work as part of a team to solve a genuine, real-world problem using mathematics.

12 March – 5 April 2019

Completely free to enter, and open to all Australian schools, the International Mathematical Modeling Challenge (IM²C) exists to support the real-world application of learning, build proficiency, encourage collaboration, and challenge students to use mathematics to make a real difference to the world around them.

Operating in teams, comprising up to four students from the same school, the IM²C challenges students around the world to work together to solve a common real-world problem by devising and applying an original mathematical model.

By mobilising students in teams, the IM²C replicates real-world conditions, requiring proficiency in mathematics alongside collaboration and contributions from different skill sets, perspectives and methods to achieve overall success.

Working together under the supervision of a team advisor (usually a teacher) for up to five consecutive days between 12 March and 5 April 2019, teams will unpack the given problem, hypothesise, test, and develop a working solution, before preparing and submitting a report on their solution to the Australian judging panel.

Two teams will be chosen to represent Australia in the International phase of the competition, with their solutions competing against others from countries around the world.

For further information and to register, please visit

www.immchallenge.org.au

ACER

The International Mathematical Modelling Challenge (IM²C) in Australia is organised and implemented by the Australian Council *for* Educational Research (ACER), and under the guidance of a national advisory group.

COMBO CHALLENGE

Sue Gardiner - Merbein P-10 College

During 2018, my Year 2/3 students had been working hard to develop a 'growth mindset' and understanding 'What Mathematicians Do' to solve problems.

At the beginning of the year students were happy to participate in maths if they perceived tasks as achievable. First term was dedicated to hands-on learning opportunities, setting open-ended rich tasks, and using problem-solving language and questioning.

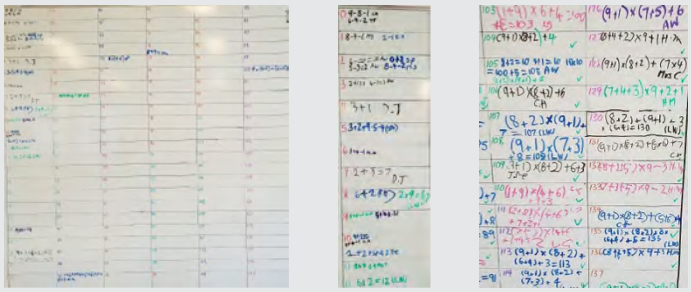
The students were often put in situations where a 'challenge' was posed with little initial modelling or discussion, and they were left to explore and solve. By the end of the term, students became 'mathematics explorers' realising that finding accurate solutions was one component of problem-solving, but applying their knowledge to varied situations and articulating their thinking were just as important.

I had the opportunity to listen to a team of staff from MAV at a local Curriculum Day in May. Along with many inspiring ideas, I took the warm-up game *Domino Combo* to the classroom.

The game became a favourite warm-up. All students became increasingly fluent in completing equations, their confidence increased and were ready to focus on more complex processes with the four operations.

During August, MAV education consultant Cath Epstein, demonstrated a more challenging version of this game involving playing cards. The format of the game is similar; however, each player receives five cards, meaning they could have the numbers from 1-9. This provided more opportunities to extend students' knowledge. Two cards are used for the centre. As an added challenge, the aim of the game is to collect the most cards. To achieve this, players create a pile of all cards used for their turn. In order to receive more cards, another rule was added: aim to use as many of their collection cards as possible each turn. Like *Scrabble*, used cards are replaced each time until the unused pile of playing cards are all used.

I love how this game allows all students to participate no matter their current level of skill/knowledge, it easily provides opportunities to extend students that are more capable.



The whiteboard got filled pretty quickly!

The students *loved* this new format. Fuelled by their enthusiasm, I scrapped my planned lessons the following week and set them the following challenge.

Using one or all of the numbers from 1 - 9, can you create an equation that equals all of the numbers from 0 - 137? (137 was the total number of rectangles I could fit on my whiteboard!)

After the first session, the students mainly focussed on the answers up 20. Before they wrote up their equations on the whiteboard, they had ask two classmates to check their equation.

By the end of this session, I thought that I had set the challenge too high, but I decided to persist. I am so glad I did! The following morning, students were racing up to me with solutions.

The students were encouraged to share their strategies and as a class we focussed on the question 'What do I already know?'

The concept of multiples of 10 was discussed (example 9 x 10 = 90) but there were no 10 cards. Students identified that they could add two cards to create 10, 8 + 2, then multiply it by 9. This lead to discussion around the use of brackets to show that some parts of the equations had to be completed first, even if they were not the first part of the whole equation: 9 x (8 + 2) = 90. Very quickly, students realised that they could simply add to this equation for the sequential answers: 9 x (8 + 2) + 1 = 91, 9 x (8 + 2) + 3 - 1 = 92

Armed with this new knowledge, the student took off with even more enthusiasm. There was even friendly competition to see who would be the first student to write up a correct equation for the highest answer of 137. By the end of this session, the whiteboard was just about complete.

All students in the class were extremely proud of their achievements and were heard racing off to other teachers in the Learning Centre shouting 'We did it!'.

DOMINO COMBO

Using Dominoes with numbers 1-6, each player collects and shows five dominoes, with another domino placed in the centre.

Player 1 has to identify the answer of the centre domino using any operation (as this game was introduced the students only used addition and subtraction. Once multiplication and division units were completed later in the year, the students could use any of the operations.)

Player 1 must find one of the dominoes on their collection that has the same answer.

Player 1 must verbalise their thinking and have it confirmed by the other players.

Player 2 has their turn following the same structure.

If a player cannot use a domino in their collection, they must pass. If all players pass, another domino is added to the centre.
The player to use all five dominoes in their collection is the winner.

EXAMPLE

Centre Cards 6 and 3 = all possible equations are 6 + 3 = 9, 6 - 3 = 3, 6 x 3 = 18 and 6 ÷ 3 = 2

Player Collection Cards = 2, 6, 8, 1, 5. Possible solutions include 8 + 1 = 9, 8 + 6 + 5 - 1 = 18, 8 + 2 = 10 ÷ 5 = 2.

HANDS-ON PLACE VALUE

Simone Saunders - Gifted and talented teacher, Lowther Hall Anglican Grammar School

Lorelle* was a bright and enthusiastic Year 2 student who approached her learning with confidence and enthusiasm.

A quick learner and thriving on difficult challenges, Lorelle was operating at a level significantly higher to that of her peers in mathematics, evident by her ability to apply several mathematical concepts to solve multi-step worded problems with three digit numbers. As the Gifted and Talented teacher at Lowther Hall, I was asked to support Lorelle further by providing mathematical enrichment.

Given Lorelle's ability to apply 3 digit numbers to a variety of mathematical contexts, I decided to introduce her to thousands.

I showed her a 4-digit number and asked her if she knew its value. She read 4,236 as forty-two hundred and thirty-six. I then showed her 54,987 which she read as fifty-four hundred, nine hundred and eighty-seven and finally, she read 583,532 five hundred and eighty-three hundred, five hundred and thirty-two.

With this in mind, we revisited her knowledge of numbers to 100 using concrete materials. We modelled numbers by bundling icy-pole sticks, made and broke up numbers using MAB, created written numbers using number expanders and built bridges over number lines to show bridging numbers.

Building on this consolidated knowledge we then made 999 with MAB and a number expander. I handed her a unit block and asked her what number we had now. 'Ten hundred', she answered. I proceeded to model to her that by adding a unit to 999 we now had 10 units that we could trade for a ten stick and continued trading until I had 10 hundreds. 'How will we trade the hundreds?' she asked. I went on to explain that we trade hundreds for thousands and immediately a penny dropped. 'Ahhh,' she said, 'I get it, I can see it'.

In no time, Lorelle was reading, writing and making 4 digit numbers.

Fast forward 12 months and Lorelle is in Year 3. Again, I was asked by her classroom teacher to help introduce Lorelle to millions. When given a 7-digit number such as 2,354,657 Lorelle read it as two thousand, three hundred and fifty four thousands, six hundred and fifty seven.

We sat down and I made a seven digit number with a number expander and began to explain to her that one thousand groups of one thousand was actually a million. 'No, no, no,' she replied, 'I need you to teach me with the MAB'. Lorelle knows how she learns best, she needs to physically build and see how things connect and if I was going to support her success, I had to model new numbers to her using MAB!

We spent a whole morning collecting every MAB block we could and set off on a road of discovery to find out what the number after 999,999 was, how it was made and what it looked like. We started with a 1000cm^3 and then placed ten cubes in a row to represent a stick (10,000). We then placed ten sticks side by side to represent a flat (100,000) and then we were stuck...we had run out of MAB!

I then began to draw MAB on paper and explain to Lorelle that we would then trade 1,000 flats for a one million block. Although she appeared to know what I was talking about, she was adamant: she needed to see it and we needed to build it.

Not one to shy away from a challenge, Lorelle and I set about planning to make a 1,000,000cm^3 MAB.

Lorelle determined that each flat needed to be 100cm x 100cm making it 10,000cm^2 and that we would need 1,000 of them.

We drew a plan of what it should look like and placed an order at Bunnings for the required materials.

To make sure the 1,000,000cm^3 MAB looked like a real MAB block, Lorelle decided she needed to draw each cube on the structure so that she could clearly see what 1,000,000 1cm cubes looked like. Not only was Lorelle learning about what one million looked like, she was also learning that if it took one second to draw one cube, one million seconds was also a really long time!

Eventually we finished and immediately Lorelle set out to connect her 1,000,000cm^3 to the other MAB blocks. She went back to the very beginning and made a huge model of how we trade units to tens, tens to hundreds, hundreds to thousands and thousands to millions.

She built 7 digit numbers and was able to add and subtract hundreds and thousands, made multiplications models showing hundreds multiplied by thousands, took photos and created posters of what different numbers looked like and presented her learning to her class. For Lorelle, all of a sudden, place value (which was previously a challenging task and something she didn't enjoy) began to make sense and she was able to manipulate large numbers with ease.

Seeing Lorelle's confidence with numbers and enthusiasm for maths grow as a result of this learning has made me realise just how important it is to listen to our students.

Lorelle knew the ways to learn best and what had to happen for her in order to understand place value. By understanding herself as a learner and being able to articulate her needs, Lorelle faced a challenge head on and overcame it. For me, the look on her face when everything 'clicked' reaffirmed to me how much I love my job!

** Name changed for privacy reasons.*

RESOURCE REVIEW:
ENGAGING WITH MATHEMATICS THROUGH PICTURE BOOKS

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

A student completing an activity from Engaging with Mathematics through Picture Books after reading Diary of a Wombat.

Engaging with Mathematics through Picture Books is a teacher resource book, aimed at early years teachers, which focuses on using picture story books within the teaching and learning of mathematics. Providing ideas and activities for almost 20 picture story books, this resource contains both theoretical and practical information, and is presented in an easy-to-read, teacher-friendly format. Each chapter includes an overview of the mathematical concepts as well as detailed lesson plans that use picture story books as a springboard for learning across all areas of the mathematics curriculum.

This review aims to provide readers with an overview of the resource, as well as show examples of how it can be used by teachers in the classroom.

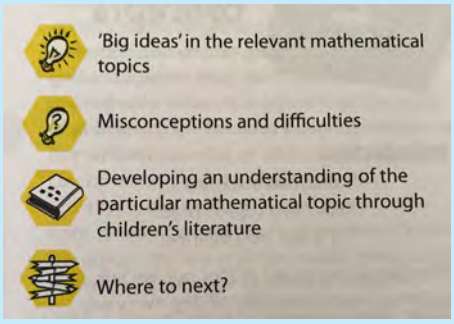
OVERVIEW

Engaging with Mathematics through Picture Books is divided into reader-friendly chapters, and features lovely coloured photographs to supplement each learning activity. The over-arching concept of the resource is engagement. The first chapter discusses engagement, defining 'true engagement' as being 'multidimensional, consisting of cognitive, operative and affective engagement – it is 'in task' behaviour rather than 'on task' behaviour'. This is then discussed in further detail, with examples given as to why picture story books are engaging for young children.

The text is then organised into chapters according to the following mathematical topics and concepts:

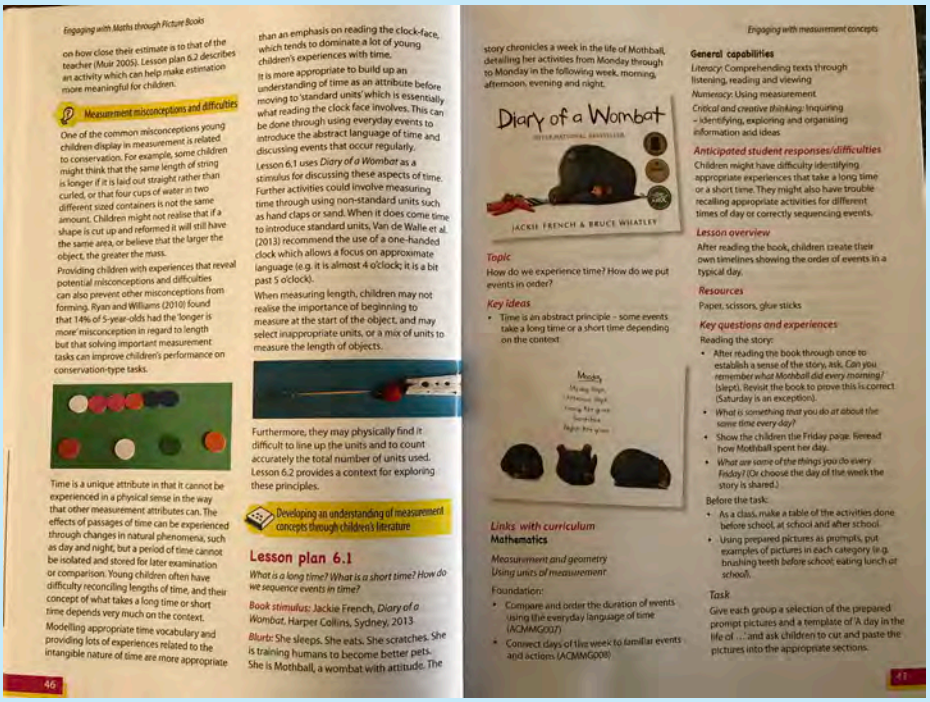
- early number concepts
- place value and number facts
- patterning and algebraic thinking
- smaller and bigger numbers
- measurement concepts
- geometrical concepts
- chance and probability
- the proficiencies.

A handy feature of each chapter is the icons used throughout the book to make navigation of each chapter easier for the reader.



Easy to follow navigation key.

Each chapter contains an overview of the topic or concept, the big ideas involved, learning sequences to follow, and misconceptions or difficulties that children may experience. The authors then focus on developing an understanding of the topic or concept through children's literature, and details two lesson plans using two different picture books as a stimulus for teaching and learning around each topic. Most chapters also contain a useful list of other picture story books, teacher resources and ICT resources that could be used to explore the topic or concept. Furthermore, each lesson plan explicitly shows links to the curriculum,

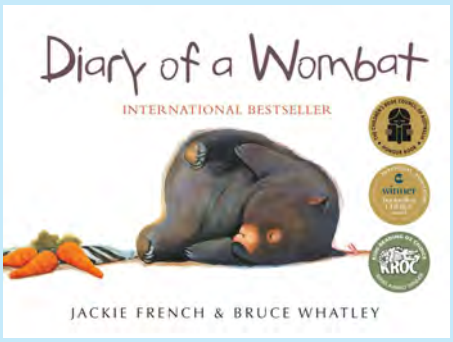


Lesson plan: Diary of a Wombat.

Student work sample.

listing relevant content descriptors. The image above (top) shows what is included in the text in more detail.

USE IN THE CLASSROOM: DIARY OF A WOMBAT



Using this resource as a guide, the following is an example of how the picture story book *Diary of a Wombat* was used in a Foundation classroom mathematics lesson.

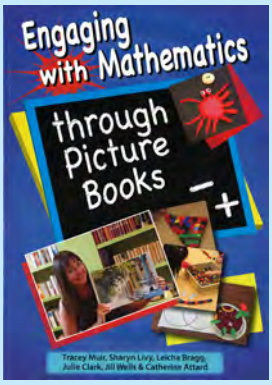
This picture story book is used as a springboard for teaching measurement concepts. The focus of the lesson provided in *Engaging with Mathematics through Picture Books* is 'What is a long time? What is a short time? How do we sequence events in time?' The lesson plan provided in the text includes a brief blurb of the book, some key ideas, links with the curriculum for the Foundation level, general capabilities covered, an explanation of anticipated student responses and difficulties they may encounter, a lesson overview with resources, key questions and then and explanation of the tasks, including extending and enabling prompts. It is extremely detailed and relevant to the classroom.

The following lesson took place approximately halfway through a unit on duration of time and days of the week. We began by reading *Diary of a Wombat* and pointing out the names of the days of the week on each page. Students were able to predict what day would come next before turning the page. After reading, we used the picture book to help us to order the days of the week. We then talked about the order in which the wombat completed his tasks, and linked this to when we do certain tasks, for example, the wombat ate grass at night – what do we do at night? Students then completed an independent activity where they were asked to sequence events in the order in which they would happen.

This lesson was a great example of the activities included in *Engaging with Mathematics through Picture Books* - there are numerous more learning activities like this one in the resource!

Engaging with Mathematics through Picture Books has so many applications and uses for early years teachers it is impossible to review them all.

This book is a rich resource, useful across many areas of the maths curriculum and for several different classroom levels and settings. A must-have for every teachers' bookshelf.



Engaging with Mathematics through Picture Books 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 early August, 297 students from 27 schools gathered at Ivanhoe Girls' Grammar for MAV's Girls in STEM Day presented by Ford. This is the second year that MAV has run this event and it won't be the last! The day was inspiring and it's fair to say that students' attitudes to STEM won't ever be the same. Forget nerdy and dorky, STEM is infinitely interesting and the career possibilities are sky high.

Students heard from women who work in a diverse range of careers, including a

- weather scientist
- aerodynamicist
- architect
- civil engineer
- mechanical engineer
- economist
- health campaigner

It was fascinating to hear the career paths of these women, and even more intriguing to hear more about the depths of their roles and how they use skills in STEM each and every day.

In this edition of *Common Denominator* we profile three of the women who spoke at the event, our next edition will cover four more.

DR SUE BARRELL, CHIEF SCIENTIST AND GROUP EXECUTIVE, SCIENCE AND INNOVATION, BUREAU OF METEOROLOGY

Next time you hear the weather forecast, consider all the data that's been collected and distilled to arrive at '23 degrees and windy'.

Dr Sue Barrell unpacked the many and varied projects that the BOM work on. They use huge data sets – with up to 30 million data points – to make predictions and forecasts. The BOM also provide advice to a wide variety of clients from industries such as aviation, insurance, mining, the defence force and of course the public.

Sue spoke about how complex data is translated and simplified into a weather forecast. The Australian BOM is one agency in a global network. In order to predict the weather in Australia, the BOM need to know what is happening globally. Their scientists must understand and interpret the effect of ocean currents, cloud dynamics, space, the atmosphere and surface observations. Sue estimated that 70% of job roles at the BOM involve STEM.

While the BOM's data set is enormous, they can't measure everything. This is where mathematics plays a huge role. BOM scientists must use uncertainty assumptions in their modelling. This gives a range of possible outcomes and from there, scientists determine which is the most probable outcome.

So next time you check the BOM app to see if it's going to rain tomorrow, or hear a warning for thunderstorm asthma – think about where that data came from and the amazing scientists, mathematicians, meteorologists and forecasters who delivered that data to your smart phone.

TARYN JAMES, AERODYNAMICIST, FORD

Taryn grew up in a small country town in North East Victoria and was the only girl at her school to study VCE mathematics. In her teens, she flew to America and it was love at first flight. She was determined to have a career that involved planes. Then and there, Taryn vowed to become an air hostess. After reflecting on that idea, she decided if she loved planes that much, then she may as well learn how to fly the plane.

In the end, Taryn decided that aerospace engineering at Monash University was the right decision – and she's never looked back.

Now working as an aerodynamicist at Ford, Taryn is tasked with figuring out how to make air move over cars in the optimal way to improve fuel efficiency.

To do this, Taryn takes full scale clay car models – and in same cases, real prototype cars – into wind tunnels all across the world. Tiny probes are placed all over the car and winds of up to 200km/h are tested on the vehicle.

Taryn collects data from the probes and uses a super computer and her mathematics and physics knowledge to determine whether the design of the car is optimal or if it needs adjustments in order to increase fuel efficiency.

Taryn spoke about how it feels to be a female in a very male dominated industry. Initially she was reluctant to ask questions at team meetings but now realises that questions are essential to learning. Taryn's advice to girls interested in engineering is to keep yourself open to opportunities and give yourself a solid foundation by choosing STEM subjects in the VCE years.

CHIVONNE HOLLIS ARCHITECT, CHT ARCHITECTS

As a young girl, Chivonne watched for hours as her draftsman father drew plans using a set square, rulers, protractors at the old fashioned drafting table. Chivonne decided that she was keen to follow in her father's footsteps and combine a love for creativity with her skills of logic and reasoning. This led her to pursue a career in architecture.

Although Chivonne considers herself to be an average mathematician, she is endlessly fascinated by graphics, data and perspective.

Architecture combines all the elements of STEM with a healthy dose of creativity. Scale can determine how a space makes us feel, repetition and patterns are often used in architecture to give a space interest and efficiency. Chivonne was the first female architect to be employed at CHT fifteen years ago. Since then, she has achieved a few more firsts – the first person at the company to have a baby and the first to work part-time. Chivonne describes her career as being the perfect blend of academia and real life. She applies her STEM knowledge each day and the end result is seeing her buildings come to life.

BRINGING IT TO LIFE

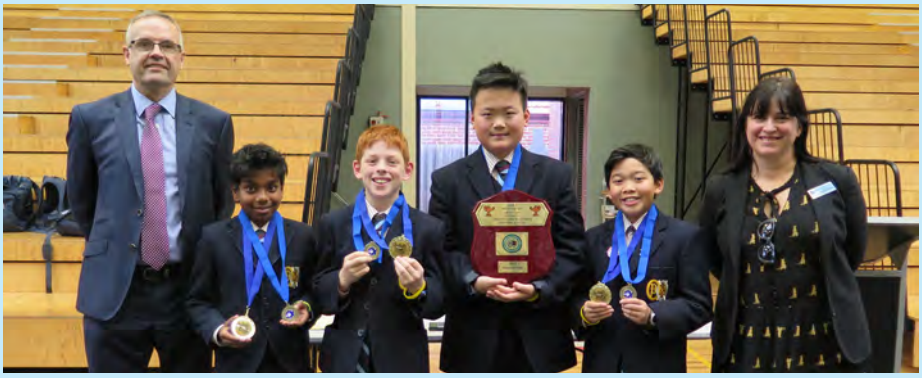
Chivonne was part of the team that designed and constructed an aged care facility in Werribee. Many of the residents suffer from dementia so it was important for the architects to design a building that could offer the residents the feeling and comforts of home. Differently sized windows on the face of the building allowed residents to easily identify which room was theirs, patterns on the carpet brought touches of familiarity, open communal spaces easily allow for wheelchair access.

Mathematics was used in every element of design from the pitch of ramps and roofs, elevations, geometry of openings, radius of door openings, width of hallways and dimensions of bedrooms. The building of a physical structure includes the work of many STEM careers: architects, modellers, builders, engineers and surveyors.

Wyndham Lodge, image courtesy of CHT Architects.

MAV will hold a Girls in STEM event again on Friday 9 August 2019 and encourages any teachers who are interested in bringing students to register online at www.mav.vic.edu.au/student-activities/girls-in-stem.html. Bookings open on International Women's Day, Friday 8 March. The day is aimed at Years 9-11 students who have an interest in STEM.

OUTSTANDING SERVICE



Peter Maher and Jennifer Bowden(MAV) with 2018 PEGS Year 5 Maths Games Day students.

For 35 years The Victorian Maths Talent Quest (MTQ) has successfully provided students with the opportunity to challenge themselves through creative mathematical investigations. Whilst the MTQ is managed by MAV, its success relies heavily on the volunteer committee members and teachers who give their time and expertise to ensure the success of the awards.

In late 2018, the MAV Student Activities Committee nominated Peter Maher for an Outstanding Service Award.

Peter Maher is a teacher and mathematics leader at Penleigh Essendon Grammar School. He has inspired many students and teachers to see the beauty and real-life connections in mathematics. Peter is not only an inspirational teacher, but has also written over 32 mathematics books that pose challenging tasks and problem-solving activities, extending students beyond the daily curriculum. He has co-ordinated the Maths Olympiad since 1988.

Peter has made positive contributions to the MAV Student Activities for the Victorian Maths Talent Quest and Year 5 Statewide Student Games Day. 2018 was the ninth year that Peter hosted the Year 5 Games day at PEGS. The day is always highly engaging for all students and teachers who attend and is a favourite inter-school competition for many schools! The day has the perfect balance of competition and collaboration between students, with all students gaining a greater enjoyment of mathematics!

Peter has also been the school coordinator for the Maths Talent Quest at Penleigh Essendon Grammar School for over 20 years. He has given guidance to new schools and teachers and has given advice and support to MAV consultants and our committee as the MTQ has evolved over time. He has inspired both students and colleagues to extend their mathematical understanding and love of maths!

The MAV Student Activities Committee and Council would like to thank Peter for his ongoing commitment and support and take great pleasure in awarding Peter the 2018 Outstanding Service Award.

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	Tuesday 30 April, 9am – 3pm
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

MATHS ACTIVE ACCREDITATION

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

CHALLENGE: SURVIVE AND THRIVE! A DAY FOR MATHS ACTIVE SCHOOLS

Presenters: Peter Sullivan and Norman Do

It is one thing to survive, but another to thrive! This whole day event will focus on how to embrace challenge to maximise teacher and student engagement and learning.

The day will commence with Peter Sullivan focusing on developing lessons and sequences to challenge and engage students. The middle of the day will consist of a structured feedback session for schools to provide input into how they overcome leadership and teacher level challenges.

The day will conclude with mathematician Noman Do. Norm will engage participants with the beauty and elegance of mathematics. This will be a hands-on and interactive day.

WHEN	Wednesday 24 April, 9am – 3.30pm
WHERE	Community Hub at the Docks (Docklands)
WHO	Teachers of all levels
FEE	$125 (member) $150 (non-member),
REGISTER	www.mav.vic.edu.au/pd Note: this event is open to Maths Active Schools only. To learn more about becoming a Maths Active school, visit www.mav.vic.edu.au.

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

REWRITING THE HISTORY (AND FUTURE) OF TRIGONOMETRY

David Massingham - www.alifewithoutlimits.com.au

What do writing, mathematical symbols and land surveying have in common? They were all invented in ancient Mesopotamia thousands of years ago.

For some students, it's difficult to see the practical applications of their mathematical study, or the historical context. But a recent revolutionary discovery about the way the ancient Mesopotamians approached trigonometry is so fascinating that it's sure to capture the imagination of every student in the classroom.

MATHS AND SURVEYING IN CONTEXT

The history of maths and surveying is a fascinating one. The two are inextricably linked, and thanks to the archaeological endeavours of the last 150 years, we now know a little more about the role surveying played in ancient times, and how it helped build the foundations that our modern society rests on.

But it is the discoveries of the last year or two that have really illuminated how ancient people approached the subject of surveying. In fact, it came down to an Australian effort – Dr Daniel Mansfield and his team at the University of New South Wales – to decode a message from Ancient Mesopotamia that could impact how trigonometry is practiced today.

Could it be that the experts of 4,000 years ago had a better idea of how to approach maths and surveying than us? It seems that at the very least, they certainly could give us a few pointers. First though, a little background...

HISTORY SCRIBED IN BABYLONIAN CLAY

Religion, myths and gods were at the heart of many ancient cultures, and Mesopotamia was no different. As such, surveying was viewed as a divine gift from the gods.

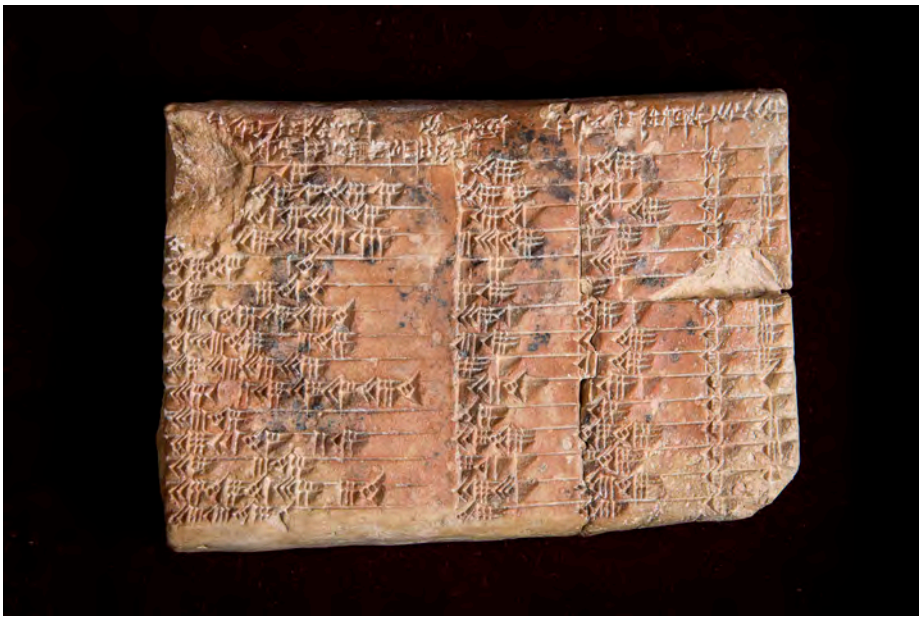
This is backed up across Sumerian sources and literature, where we have found references to land surveying as a practice delivered to human beings by higher powers.

In fact, there are depictions of gods bestowing surveying instruments to mortals, found on art works dating back over 4,000 years.

The purported creative and architectural gifts of the Sumerian god of wisdom, Enki, were praised in hymns in ancient times. Enki was said to have been directed by Enlil, the chief deity amongst Mesopotamian god figures, to make the world an orderly place.

It makes sense then that the earliest evidence of a land measurement system modern scholars have found was inscribed in clay tablets from Ancient Mesopotamia, dated at approximately 3,500 BC. This was a time of great creativity, with the invention of writing, lettering and numerals over the course of a relatively short period. The creation of numerals and writing, it seems, was soon followed by their implementation in land surveying practices.

These clay tablets tell that story – and show us that in some ways, maybe the Ancient Mesopotamians had a better system at the base of their calculation efforts than we do today.



FROM MESOPOTAMIA WITH LOVE

It was one of these clay tablets – nicknamed Plimpton 322 (see image above) – that proved key to Dr Mansfield and his team's research. So key, in fact, that they view it as one of the most sophisticated scientific artefacts of the ancient world.

In essence, Plimpton 322 is an ancient trigonometry table. This rewrites our understanding of ancient mathematics and surveying practices.

For one thing, historians previously thought that trigonometry was invented by the Greeks – but here they find the Mesopotamians were devising trigonometry calculations around 1,500 earlier.

But it is the method of their calculations that may have the real impact on how surveying and maths work in the future.

'The tablet not only contains the world's oldest trigonometric table,' Dr Mansfield explains. 'It is also the only completely accurate trigonometric table, because of the very different Babylonian approach to arithmetic and geometry.'

This approach, it transpires, is simpler and more precise than the approach we use in modern trigonometry which utilises angles and base 10 in calculations. Babylonian mathematics instead used ratios (not angles) and base 60 calculations.

Clearly, this is not just a lesson in surveying but also in complex mathematics.

WHAT DOES THIS MEAN FOR TODAY'S SURVEYOR?

For decades researchers had supposed the Plimpton 322 was a scribal text used in ancient schooling, not the potentially revolutionary calculations that were thousands of years ahead of their time.

In terms of surveying - a practice which relies on numerical accuracy at all times – Plimpton 322 shows us a way to gain greater precision. The question now becomes for today's surveyors, how does transitioning from our current decimal base system to the Babylonian's richer base 60 process work?

WHAT DOES IT MEAN FOR TODAY'S MATHS STUDENT?

This provides a potential opportunity for mathematics teachers to deepen the student's understanding of not only the processes of trigonometry, but also the history of it.

Providing a cultural and/or historical backdrop to any high school lesson is sure to deepen and broaden the learning experience. Experimental lesson plans challenging students to utilise the base 60 approach to calculations? Surveying lessons for the classroom?

A good place to start is the surveying workshop and teaching activity resources, see www.alifewithoutlimits.com.au. These activities draw on mathematic foundations to introduce students to the world of surveying.

There's a fascinating road ahead.

REFERENCES

3,700-Year-Old Babylonian Stone Tablet Gets Translated, Changes History, Collin Gossel, February 20 2018

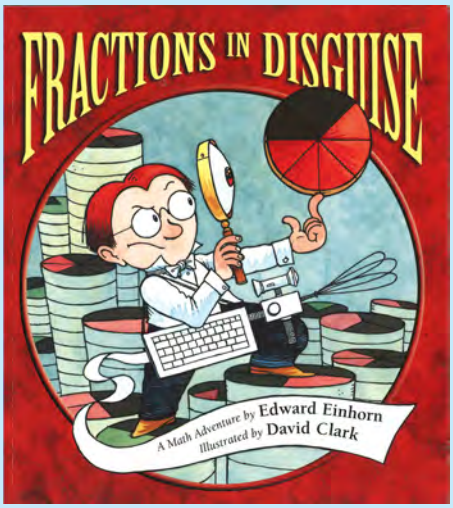
Mathematical secrets of ancient tablet unlocked after nearly a century of study, Maev Kennedy, August 25 2017

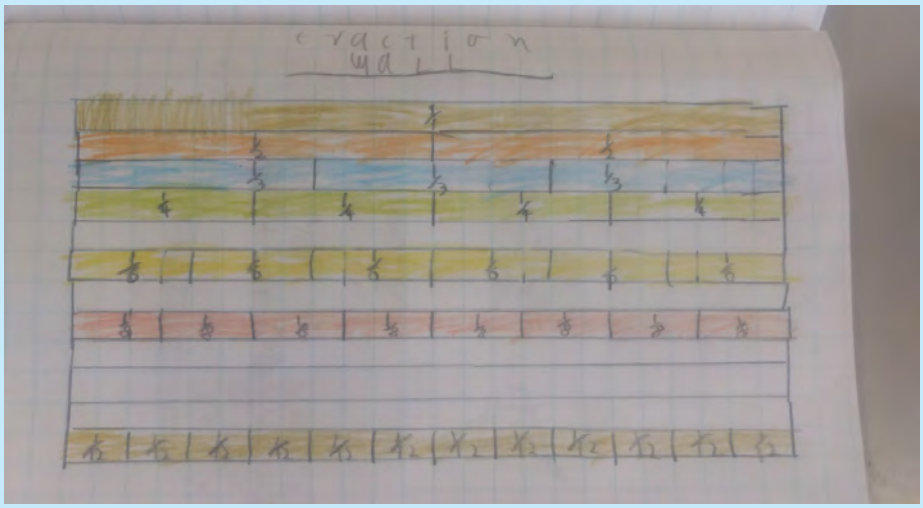
Mansfield, Daniel F. and Wildberger, N. J. Plimpton 322 is Babylonian exact sexagesimal trigonometry. *Historia Mathematica* Volume 44, Issue 4 (Nov 2017): pages 395-419. Elsevier Inc.

Images credit: Andrew Kelly, UNSW.

FRACTIONS IN DISGUISE

Jack Fray - Bell Primary School





At the start of Term 4 last year we were $\frac{3}{4}$ of the way through the year, with $\frac{1}{2}$ an eye on the long summer to come, this meant only one thing: time to teach fractions. But how to engage with Year 3s beyond talking about pizza or cake? Storytelling, good storytelling, captivates everyone. *Fractions in Disguise* provided a great starting point; triggering discussions and curiosity, and opening our eyes to fractions everywhere.

The hero, George Cornelius Factor, is an avid collector of fractions. When a five-ninths gets stolen, he sets out to track it down with the use of his 'Reducer', a gadget specifically designed to simplify fractions according to their common factors.

This wasn't our first lesson about fractions, but the book offered a great opportunity to practise what we already knew; numerators and denominators are explicitly mentioned, and the observation that the five-ninths 'looks like a $\frac{1}{2}$, but the more you look, the more you realise it's a little bit more' fit perfectly with the students' own appreciation for what fractions represent. This also sparked a genuine inquiry – what do fractions look like next to each other? Finally, I had an authentic opportunity for students to build a fraction wall.

We started with a goldfish bowl, a Michael Ymer technique. As I modelled how to draw the fraction wall in a grid book, the class helped me make some important decisions. How many centimetres wide should the fraction wall be? How should we orientate the page?

There were many suggestions on width, with seemingly no perfect answer. 10cm meant easy halves, but more difficult quarters. 20cm solved that problem, but thirds were problematic. Once 24cm was suggested, a few students worked out how far each basic fractions would be, before deciding that we could do enough to get started.

Some students picked this up quickly, and only had to check the fraction magnets on the board to reassure themselves. Others broke the whole down into its parts by representing them with MAB, and sharing the 24 units into equal piles where possible. Once we had completed all of the 'easy' rows, where the fraction could be expressed as a whole number, we came to the next teachable moment – how can we work out where our fifths should be?

The fraction wall gave students a new frame of reference, helping them to visualise what $\frac{2}{3}$ might actually look like. We used this as a springboard to consider what these fractions may look like. By folding a single square of paper into quarters, and comparing the different ways other people approached the same task, students had created their own concrete representation. As an added bonus we were able to check for equivalence by cutting a quarter from each piece of paper and reassembling it on another.

Now, as the students' understandings of the concepts raised by the story developed, so did the complexity of their questions. An important feature of the story is George's 'Reducer', which he uses to simplify fractions. Without using specific mathematical vocabulary, the idea of common factors was introduced in a way that allowed students to offer their own explanation for what exactly was happening. George 'dials' a number 3, points it at a $\frac{3}{21}$ and turns it into a $\frac{1}{7}$. The same happens when he dials a 5 and takes aim at a $\frac{10}{15}$ reducing it to a $\frac{2}{3}$. Thanks to all the effort we put into multiplicative thinking earlier in the year, the students saw clear patterns. Encouraged by the need to solve the mystery of the missing $\frac{5}{9}$, they also had the motivation to try and verbalise what was happening.

The process of simplifying fractions is never easy, and in some ways the book actually made this harder. 'Reducing' a fraction, such as $\frac{2}{4}$ into $\frac{1}{2}$ makes perfect sense. But when discussed in terms of division, some students, particularly those using on concrete materials, struggled. Seeing the size of the fraction increase as the denominator decreased was counter-intuitive. Despite this, *Fractions in Disguise* was a great way to introduce the idea of simplifying fractions, without bombarding students with terminology.

By following George's adventure, and demonstrating what was happening with both concrete materials and by working through problems together on the whiteboard, we were able to approach the subject without anxiety or the mental barriers that can often accompany what can be perceived by students as 'difficult'. Did all the students understand perfectly? No, but I'm certain the next time they encounter fractions, they'll feel much more confident and closer to success.

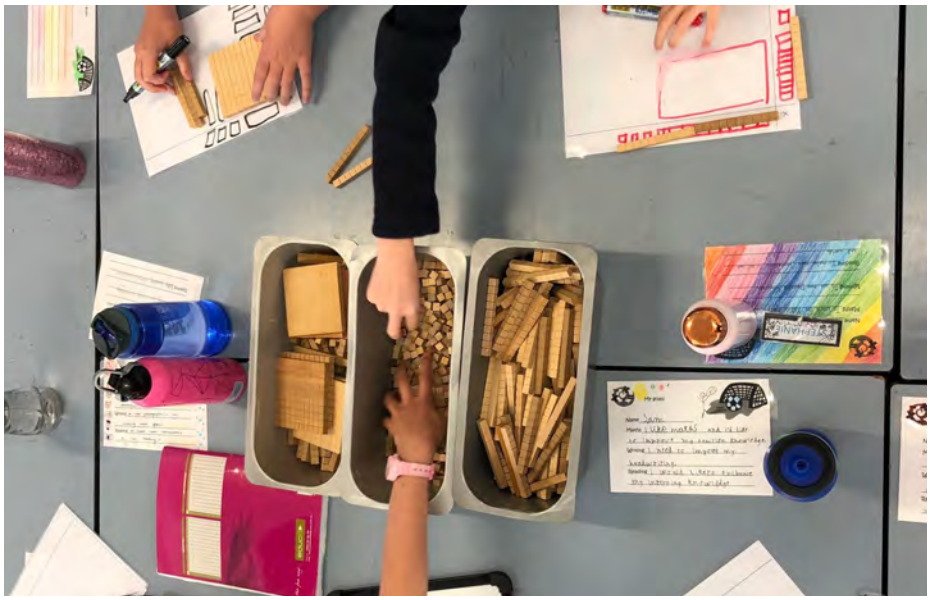
THE TRIALS AND ERRORS OF A GRADUATE TEACHER

Sam Wang - Templestowe Heights Primary School

I often hear teachers and university lecturers telling their students that they are writers or scientists when they are teaching these subjects, and from what I've seen, children do feel like they are writers or scientists. However, when I tell my students that they are mathematicians, I just don't get the vibe that they feel like they are mathematicians.

A part of me thinks that their experiences has taught them to be driven by a desire to give the correct answer to a maths problem, rather than be mathematicians.

Students can distinguish the difference between good spellers and good writers, however I feel my students can't differentiate between a person who is good at calculating numbers and a person that is good at investigating numbers.



A NEW SCHOOL, A NEW TEAM AND A NEW YEAR LEVEL TO TEACH

A new classroom, a new set of peers and a new teacher – My students set their gaze on me.
I wonder what my students' are like?
I wonder what my teacher is like – I hear them thinking.
'I love mathematics!' I announce.
My new students groan in unison.

Being a graduate is about learning the craft of teaching. Different challenges had to be met every term. Ranging from simply remembering my students' names to mediating student friendship problems. At our school we teach Number and Algebra by 'zoning', where students are placed in needs-based groups according to their Zone of Proximal Development. Most days I feel like I'm chasing my own tail learning about how the school operates. Fortunately, my degree at La Trobe University has equipped me with a range of strategies and resources to overcome most of the administrative challenges.

At the start of Term 4, I found the most success with mathematics, even though I'm still in the process of exploring and experimenting a range of strategies. Rather than explaining to students the theory about mathematics or how it is useful in life, I have been incorporating stories of or about mathematics in my lessons. We pretended to be from the ancient civilisation and tried to count large groups of numbers by using MAB. It was arduous! We explored how the ancient Babylonians created the multiplication algorithm because they were probably sick of making arrays out of stones to calculate large groups. Now they see how the algorithm actually makes sense through visual and physical manipulatives and context. Bringing mathematics to life by giving a role to every student and myself, I am engaging the students actively in their learning.

I try to present a range of mathematical investigations and create an environment that is filled with laughter, rather than groans. I now frequently hear my students telling me they want to know more about certain mathematical ideas or they just simply want to investigate and explore just like a mathematician. Do I still hear my students telling me that they hate mathematics? Sometimes. But there's a shift in their mathematical disposition, a curiosity that was once not there.

MY STUDENTS WANT TO BE INVESTIGATORS AND MATHEMATICIANS, RATHER THAN A CALCULATOR.

The biggest thing I took away from La Trobe University was that the best way to engage students is to humanise the subject that we are teaching. It is critical that we invigorate our lessons and the curriculum in a way where it's exciting and relatable to both the students and teachers.

As a graduate, I realise it's really about trial and error and finding ways to constantly improve my practice. If I do not experiment with a range of strategies to engage my students, all of my teaching and learning exercises would have lost their effectiveness. Does it really matter if a lesson goes wrong? I don't think so. In fact, my team encourages me to keep exploring different ways to teach and engage our students. Just as we are forgiving of our students when they do something wrong, they are just as forgiving when our lessons don't go as we intended them to.

The important part is to reflect and take away what worked and what didn't, and to use that experience to inform future actions. It's about looking back to think forward.

Some teachers might say that they don't like mathematics or have a negative mindset towards it, but we are all mathematicians. Teachers use trial and error to find out what works and what doesn't work, analyse data and patterns to inform individual progress and make predictions to what will result in the best outcomes for our students.

I'm trying to find the right balance between exploring innovative ways to present content and presenting that content in ways that are engaging for both the students and the teacher!

NEW 2019 VCAL NUMERACY UNITS

Jamie Gray, Peter Lalor Vocational College

Fantastic news! Finally after a lot of planning, trialling and consultation, both the new and updated VCAL Numeracy units have been written, and are currently available on the Victorian Curriculum and Assessment Authority (VCAA) website. They have been accredited for the period 2019 to 2022 and VCAL providers are encouraged to frequent themselves with the units, previous to the start of 2019.

The six VCAL Numeracy 2019 units are:

- Foundation
- Intermediate unit 1
- Intermediate unit 2
- Senior unit 1
- Senior unit 2
- Advanced Numeracy Skills Senior.

The Intermediate unit 2 and Senior unit 2 are new for 2019 and are project based units. The Foundation, Intermediate unit 1 (previously Intermediate), Senior unit 1 (previously Senior) and Advanced Numeracy Skills Senior have been updated and VCAL providers will need to be aware that significant changes have been made.

There are two main documents available on the website providing support for the new VCAL units and they are the *Curriculum Planning Guide* (choose the Numeracy Skills Strand Unit document only) and the *Advice for Teachers* (Numeracy).

The *Curriculum Planning Guide* provides details of all available VCAL Numeracy units. The guide includes all of the six VCAL units, including the two new units, the learning outcomes for all the VCAL units, the elements for all the learning outcomes and the criteria dot points for all the elements that need to be addressed.

The *Advice for Teachers* document is a new initiative that looks to separate pedagogical suggestions, teaching strategies, conditions of assessment, potential integrated activities and other support material away from the compulsory course content planning guide. As well, the document provides a *Scope and Sequence* section, respective to a learning outcome perspective, included in the appendix.

VCAL NUMERACY COORDINATION

There are a few things that both VCAL Numeracy teachers and VCAL Coordinators need to know, in relation to the new Numeracy units. The old rule that the Foundation Numeracy unit will support Foundation and Intermediate Level Certificates and that Intermediate and Senior Level units will support all VCAL Level Certificates is still true. However, it should be noted that the new Intermediate unit 2 and the Senior unit 2 do not provide numeracy credit at the particular level but do provide a general credit.

This means that it is still imperative that VCAL students complete Foundation, in support of Foundation and Intermediate Certificates and Intermediate unit 1 (and/or Senior unit 1) in support of Foundation, Intermediate and Senior Level Certificates. Therefore, the Intermediate unit 2 and Senior unit 2 are seen to build upon and complement the unit 1 learnings.

It is also noted that the condition that students were exposed to all learning outcomes and only had to be competent in all but one learning outcome, to achieve the unit, is no longer the case. Thus, students will have to achieve competency in all learning outcomes to be awarded the unit, at the particular award level.

THE NEW LEARNING OUTCOMES

These were written deliberately to achieve consistency between the three award levels. Therefore, you will notice that learning outcomes 1, 2, 3 and 4 are similarly titled at Foundation, Intermediate unit 1 and Senior unit 1 Levels. In order, they appear as LO1 Numerical Skills and Processes, LO2 Financial Literacy, LO3 Planning and Organising and LO4 Measurement, Representation and Design. Foundation has another learning outcome, LO5 Preparing for Work, and somewhat covers for the fact that there is no Foundation unit 2, allowing the students to access a project based task.

I strongly believe that this consistency will aid teachers in their planning, particularly their Quality Assurance (QA) documents and also in accommodating scope and sequencing into the creation of student activities.

Similarly, the Intermediate unit 2 and the Senior unit 2 both have been written to the same learning outcomes. In order, they appear as LO1 Numeracy-based Project Plan, LO2 Numeracy Skills, LO3 Data Representation and LO4 Results. In this way a nice symmetry is created whereby the students, either at Intermediate or Senior, plan their project, carry it out, record and analyse their findings using technologies and then present it.

Advanced Numeracy Skills Senior has had the number of learning outcomes reduced from seven to five. In order, they appear as Further Study in Maths LO1 Data, LO2 Measurement, LO3 Formulae and Graphs, LO4 Algebraic Techniques and LO5 Problem Solving.

THE NEW NUMERACY ELEMENTS

Similarly to the learning outcomes, the new numeracy elements were written deliberately to achieve consistency between the three award levels. Therefore, you will notice that elements (a), (b), (c), (d), and (e) are correspondingly titled at Foundation, Intermediate unit 1 and Senior unit 1 Levels. In order, they appear as Element (a) Mathematical Knowledge and Techniques, Element (b) Comparative Mathematics, Element (c) Estimation and Approximation, Element (d) Writing and Interpreting Numerical Expressions and Element (e) Applying Mathematics. Each element has approximately three criteria dot points, generating about 15 criteria dot points that have to be completed to achieve competency in that particular learning outcome.

The elements are written quite differently in VCAL Numeracy Intermediate unit 2 and the Senior unit 2, compared with the Unit 1 elements. The elements in Intermediate unit 2 and unit 2 are not named and basically work as criteria dot points.

Advanced Numeracy Skills Senior has had the number of elements reduced to three for each of the five learning outcomes. In order they appear as Element (a) Mathematical Knowledge and Techniques, Element (b) Mathematical Language and Element (c) Interpretation.

Differentiation, localisation and real-world application around the topic are all critical VCAL curriculum components.

THE NEW VCAL INTERMEDIATE 2 AND SENIOR 2 NUMERACY UNITS

These units are designed to engage student interest through an investigative project. At the Intermediate level, the project looks at a familiar interest area and in particular the student's chosen VET (Vocational Education and Training) subject. At Senior level, the project looks at an unfamiliar interest area of the student. For instance, a VET Hairdressing student may choose to investigate an hotel or a Building and Construction student may investigate her local AFL club.

Students start their investigative Intermediate unit 2 Numeracy project by selecting six (from a possible twelve) enquiry-based tasks from a grid, whereby at least one task comes from each of the 'Focus Areas' (Number, Measurement, Financial Numeracy and Probability and Statistics) and at least one task comes from each of the 'Three Industry Stages' (Inputs, Processing and Outputs). At Senior unit 2, eight (from a possible twelve) enquiry-based tasks are selected.

As VCAL providers, I believe that we should be genuinely excited by these new additions. Students will get the chance to visit workplaces and see how maths is used, and hopefully how extensively it is used. At the end of unit 2, students have created a portfolio that can be used as evidence in future workplace interviews and have hopefully effectively used their learnt skills in unit 1 in a real-world application.

The *Advice for Teachers* document provides a lot of support in planning out these projects. Resources include a *Project Plan Checklist Template*, completed examples of the templates and suggested enquiry-based tasks for a vast array of 'familiar' VET subjects and 'unfamiliar' industry areas.

Hopefully this overview has provided an initial insight into the new and updated VCAL Numeracy units. Remember that the VCAA website provides a lot of guidance and that you can contact your regional VLT (VCAL Liaison Teacher), who will advise of 2019 Quality Assurance details and Professional Development opportunities around the 2019 VCAL Numeracy units.

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 - Teaching and learning coordinator, Portarlington Primary School

LOWER PRIMARY

I was putting my sheet on the bed. When I went to put it on, one side was too short and one side was too long. When I turned it, it fit perfectly. What shape was my bed?

Describe and draw two-dimensional shapes, with and without digital technologies. (VCMMG120)

I was counting by the same number each time. However, the number of ones was the same every second number. What was I counting by?

Develop confidence with number sequences to and from 100 by ones from any starting point. Skip count by twos, fives and tens starting from zero. (VCMNA086)

MIDDLE PRIMARY

I have a rectangular prism for a chicken yard. The roof has no wire. How can I measure how much wire I need to cover it if I can't reach the top of it?

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

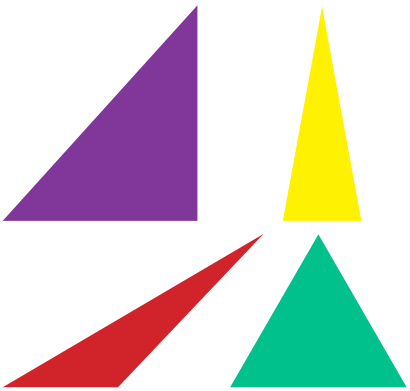
I was asked to measure my bed. I got 37 when I measured it accurately. My mum didn't believe me and measured it accurately and got 370. My dad didn't believe any of us and measured accurately and got 3700. How did we get three different measurements?

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

UPPER PRIMARY

When I put 4 + 4 x 3 into a calculator, the answer was 24. When I worked it out by hand, it was 16. How is this possible?

Explore the use of brackets and order of operations to write number sentences. (VCMNA220)



I had a triangle. My teacher told me I could flip or rotate it as many times as I liked to have it look the same. I did it by changing it once. How did I do it?

Describe translations, reflections and rotations of two-dimensional shapes. Identify line and rotational symmetries. (VCMMG200)

CASIO®

Prime Schools PLUS Program

To become a Prime Schools PLUS school, it is as easy as following these 5 steps:

1. Head to: http://www.casio.edu.shriro.com.au
2. Click on the Prime Schools PLUS tab
3. Select ***"Join"***
4. Complete the form and provide a copy of your school's current book list or a letter signed by your Head of Mathematics (or equivalent), verifying that your school booklists one or more of the CASIO models listed overpage
5. We will do the rest!

CASIO®

INSPIRED BY AUSTRALIAN TEACHERS FOR AUSTRALIAN STUDENTS

MAVSHOP

HTTP://SHOP.MAV.VIC.EDU.AU

MAV MEMBERS RECEIVE A 20% DISCOUNT ON ALL STOCK

2018 MAV SOLUTIONS TO THE VCAA EXAMS

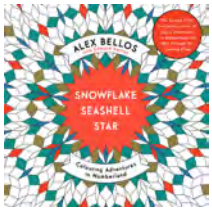
VCE

Ensure students prepare effectively for VCE Mathematics Examinations with the MAV solutions to the 2018 VCAA Examinations 1 & 2 for Mathematical Methods, Specialist Mathematics and Further Mathematics.

Includes: fully worked solutions for all sections, advice on solution processes, marking allocation and permission to reproduce copies for students.

INDIVIDUAL STUDY — $53 (MEMBER) $66.25 (NON MEMBER)

ALL STUDIES — $124 (MEMBER) $155 (NON MEMBER)



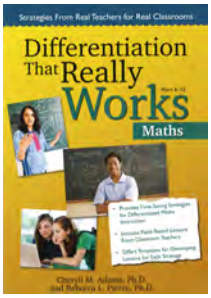
SNOWFLAKE, SEASHELL, STAR

4–VCE

Joyful contemplation of mathematical patterns has long been part of the human experience, from the philosophers of Ancient Greece to the artists of the Renaissance, via Islamic design and Hindu mandalas. Author Alex Bellos takes you on a calming and colourful journey into the magical world of mathematics.

In 80 glorious images, Alex will teach you how to convey the wonder of mathematics through colour and design. *Snowflake, Seashell, Star* is an incredible celebration of the overlaps between mathematics and art, learning and play, concentration and calm.

$16.90 (MEMBER) $21.13 (NON MEMBER)



DIFFERENTIATION THAT REALLY WORKS

6–VCAL

This practical book presents teaching strategies and lessons for differentiated mathematics instruction. It is packed full of time-saving strategies and lesson ideas created and tested by practicing professionals in their own heterogeneous classrooms. These lessons can be used as written or can be modified to meet the needs of a particular classroom.

$35 (MEMBER) $43.75 (NON MEMBER)

MAV SACS SUGGESTED STARTING POINTS

VCE

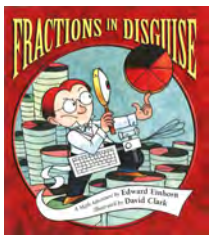
The MAV 2018 VCE Mathematics SACS materials are designed to provide suggested starting points for VCE Mathematics teachers for their School Assessed Coursework (SAC).

MAV SACS 2018 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, Methods and Specialist Mathematics.

NOTE: this resource is only available to current practising Victorian secondary teachers. It is for school use only. Not to be used by private tutoring services.

INDIVIDUAL STUDY — $144.50 (MEMBER) $180.63 (NON MEMBER)

ALL STUDIES — $51.60 (MEMBER) $64.50 (NON MEMBER)

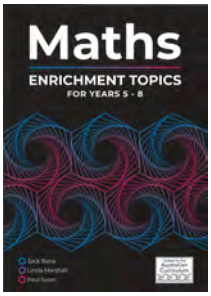


FRACTIONS IN DISGUISE

3–6

When a valuable fraction goes missing, George Cornelius Factor (a.k.a. GCF) vows to track it down. Knowing that the villainous Dr Brok likes to disguise his ill-begotten fractions, GCF invents a Reducer - a tool that strips away the disguise, reducing the fraction and revealing its true form. Equal parts of action and humor add up to a wholly entertaining introduction to simplifying fractions.

$12 (MEMBER) $15 (NON MEMBER)



MATHS ENRICHMENT TOPICS FOR YEARS 5-8

5–8

Suitable for both teachers and parents, the content of this book is linked to the Australian Curriculum in Mathematics, and designed for students to pursue very interesting maths topics that are often missed in standard classroom lessons. There are 17 topics with worksheets, the topics span a wide range of interests and difficulty levels. The topics are ideal for extension work and motivation.

$21.45 (MEMBER) $26.81 (NON MEMBER)

THE MATHEMATICAL ASSOCIATION OF VICTORIA

TO ORDER
HTTP://SHOP.MAV.VIC.EDU.AU
OR CALL +61 3 9380 2399

Prices are subject to change.