

## PRIMARY MATHEMATICS CHALLENGE 2010

### SET INVESTIGATION - OPTION 1

#### Data, Data everywhere...

Data is all around us, at home, at school, at work and at play. In mathematics we have to learn about how to read data, and how to produce data. In this investigation we would like you to go on a data hunt to see if you can explore, investigate and compare all the data that you and the people around you read and/produce.

You might like to investigate the data you read and produce;

- at home
- in your classroom
- in your school
- at play
- with your family
- at sport
- with your hobbies
- AND MORE!

**When you represent your findings the judges would like to see your thinking and learning about:**

- The different kinds of data you found that you read and produced. Tell us what the data was about and how it was represented
- Tell us **why** you read or produced this data. What did you use it for?
- Where did you find that you read and produced data the most?
- What forms of representation of data were most common? (graphical, numerical, visual) Why do you think this was so?
- Did you find there was some data you couldn't live with out? Is some data essential? If so - what and why?
- Did you find any "dangerous" data?
- Was there any data you really think you need for your life but found that you don't have?

## NOTES FOR THE TEACHER re DATA. DATA EVERYWHERE:

As part of the curriculum, children need to learn to read data and produce data.

The key aspects of **reading data** are:

- that children need to be able to read (analyse and interpret) all forms of data including graphical, numeracy and visual data

The key questions to consider when "reading data" are:

- What story does the data tell?
- How valid is the story? ( who made it up and do we need to listen to is?)
- Now we know the "story" what action do we need to take?

**Graphical data** conveys the "story" through the graphs. Examples of graphical data would include:

- bar, column, pie, line, scatter, dot, leaf and stem, box and whisker

**Numerical data** conveys the "story" through the numerals. Examples of numerical data would include:

- tables, lists, catalogues

**Visual data** conveys the "story" through visual symbols. One example of this kind of data would be the weather page in the paper

The key aspects of **producing data** are that children need to be confident with all six steps of the process

- framing the question
- developing and implementing a collecting strategy
- sorting and organising what they have collected
- representing the information (note - SACSA requires that ALL learners represent using technology. It is about CHOOSING which is the best form of representation for the particular purpose, rather than the drawing up of a graph)
- interpreting and analysing
- acting upon

## PRIMARY MATHEMATICS CHALLENGE 2010

### SET INVESTIGATION - OPTION 2

#### Finding our way

Everyday we have to use our spatial sense to find our way. We use our knowledge about location and arrangement as we put our clothes away in our drawer, as we find our way to the playground, and as we find our way around the shopping centre.

We now have lots of tools to help us find our way in the world but in this investigation we want to know which ones work best for what particular purposes and why you think so.

In this investigation we would like you to explore how these "spatial sense" tools work and compare their accuracy and usefulness.

Some of the "finding our way" tools you might like to investigate and compare include:

HISTORICAL TOOLS	MODERN TOOLS
Atlas Street directory Paper maps Compass Gyro compass Sextant	GPS (as a stand alone, on a phone) Google maps Whereis.com Google earth Sensis Radar

**When you represent your findings the judges would like to see your thinking and learning about:**

- What you found out about each tool and:
  - how it works
  - what purposes does it work best for
  - how accurate is it
  - what are the problems/issues with it
  - who invented it and where did it come from
- What would your advice be to other people about which are the best tools to use?
- Did you find any other "finding your way" tools that you can tell the judges about?

## PRIMARY MATHEMATICS CHALLENGE 2010

### SET INVESTIGATION - OPTION 3

#### Our changing place...

Lots of sites have had lots of building happening at their place in 2010 and building is ALL about mathematics!

In this investigation you have the opportunity to explore all the mathematics about the changing buildings and spaces at your site.

Here are just some beginning ideas you could consider exploring, but you are clever enough to think of many more!

<p><b>MEASUREMENT</b></p> <ul style="list-style-type: none"> <li>- How has the size of your school changed? Has the perimeter, area of the floor space, height or volume changed? How do you know? How could you prove it to someone who hasn't seen it?</li> <li>- How does the size of your new building compare to the existing buildings?</li> <li>- What measuring tools did/are the builders using as part of their work?</li> <li>- What has been the timeline for your building? How could you accurately represent what has been done over the period of time?</li> <li>- What impact has the new building had on the available outside space at your site? How could you prove this to someone who can't see for themselves</li> </ul>	<p><b>NUMBER</b></p> <ul style="list-style-type: none"> <li>- What is the quantity of the materials they used?</li> <li>- What was the cost for each component?</li> <li>- How has this added to the value of your buildings overall?</li> <li>- If one of your buildings was built in every primary school in SA, how much of each material would have to be produced?</li> </ul>
<p><b>SPATIAL SENSE</b></p> <ul style="list-style-type: none"> <li>- what does your building look like? How would you represent the 3D building to someone who couldn't see it? What ways of representing the building did the architects and builders use? Did they use birds eye views or cross sections or other ways? What would a bird's eye view of your site look like now as compared to before the building?</li> <li>- What image does Google Earth have for your site? Is it before or after your new buildings?</li> <li>- What is the position of the new buildings in relation to the existing building?</li> <li>- Investigate the positives and negatives of the building design. If you were the architect how would you improve the design? Represent the ideas so others can see what you are imagining?</li> </ul>	<p><b>DATA</b></p> <ul style="list-style-type: none"> <li>- what data did the builders need to collect/read before they could begin to work on your building?</li> <li>- Just how many buildings are happening in SA now? How many in Australia? How much material is this using? What are the costs?</li> <li>- How has the building programme impacted on the students, staff and families at your site? Could you collect and represent some data to show this impact?</li> <li>- What impact will the building have on the running of the school for example with additional cleaning costs, water use, electricity use, costs of furniture etc?</li> </ul>

**When you represent your findings the judges would like to see your thinking and learning about:**

- Which aspects of your "building" you explored showing:
  - why you chose those aspects to investigate (you need to do more than one)
  - what you did
  - what you learnt
- If there was going to be another building programme at your site, is there any advice you would want to give the principal/the person organising the building programme?

## **PRIMARY MATHEMATICS CHALLENGE 2011**

### **SET INVESTIGATION – OPTION ONE**

#### **Mathematics, Mathematics Everywhere!**

Mathematics is all around us, at home, at school, at work and at play.

Numeracy is the ability to choose and use mathematics in all of these places, and Numeracy is listed as one of the skills in the Australian Curriculum (a *General Capability*) that all learners have to develop during their time at school.

In this investigation we would like you to go on a mathematics hunt to see if you can explore, investigate and compare all the mathematics that you and the people around you use and develop as part of their daily lives.

You might like to investigate the mathematics you use and develop;

- at home
- in your classroom
- in your school
- at play
- with your family
- at sport
- with your hobbies -      **AND MORE!**

**When you represent your findings the judges would like to see your thinking and learning about:**

- The different kinds of mathematics you found and where it was used/developed
- Tell us **why** it was important in these places. What did you and other people use it for?
- What “type” of mathematics did you find the most of?
- Which aspects of mathematics were most common? Why do you think this was so?
- Do some people use mathematics more than others? If so, why?
- Did you find there was some mathematics you couldn't live without?
- Where did all this mathematics come from? Who made it up? Has it changed over time? Are there still people “inventing” mathematics now?

## **PRIMARY MATHEMATICS CHALLENGE 2011 SET INVESTIGATION - OPTION TWO Let's measure!**

Everyday we have to describe and compare the size of things - we call this measurement and measurement is a big part of our lives.

When you want to compare, use and describe the "size" of something, we can choose to estimate or we can choose to measure.

When we decide to measure, we can choose one of three strategies - direct comparison, direct measurement or indirect measurement.

People have measured in these ways and in all kinds of aspects for hundreds of years, and we now have lots of tools to help us estimate, measure and describe the size of things in our lives.

In this investigation we want to know which measuring tools/strategies work best for what particular purposes and why you think so.

We would also like you to explore how these "measuring" tools/strategies work and compare their accuracy and usefulness.

Some of the aspects of these "measuring" tools/strategies you might like to investigate and compare include:

- measuring tools/strategies and how they have changed over the history of time
- what measuring tools/strategies we use for different measurable attributes
- what measuring tools/strategies we use for direct comparison, direct measurement and indirect measurement
- what measuring tools/strategies are used in different workplaces and industries, in hobbies, at home, at play and more...
- what measuring tools/strategies your grandparents /parents used compared to what you use now
- who invented the measuring tools/strategies we use now and why did they need to invent them. Are they still inventing them?

**When you represent your findings the judges would like to see your thinking and learning about:**

- what you investigated
- what you found out
- how knowing all these "new things" will help you when you are needing to measure in your own life

## **PRIMARY MATHEMATICS CHALLENGE 2011 SET INVESTIGATION – OPTION THREE How does our Numeration system work?**

*Every single day we use our numeration system as part of our daily lives, so how does it really work?*

*If you had to explain our Base Ten numeration system to someone from another planet who had never seen it before, what would you say?*

**When you represent your findings the judges would like to see your thinking and learning about:**

- How our numeration systems work
- Who invented it and where did it come from
- Why do we need a numeration system? What would happen if we didn't have one?
- Does every one in the world use the same numeration system?
- Does our numeration system stay the same or is it changing?

When you want to know "how many" (quantify), inside our head our brain has to make a decision about which way to do this. It has to consider:

Should I estimate?

Should I approximate?

Should I count?

Should I calculate?

**The judges would also like to see your thinking and learning about:**

- when in your life you think you use each one of these four ways of quantifying (working out how many)
- if you chose to count, what are all the different ways to count? What types of counting are best for what particular purposes?
- if you chose to calculate, what are all the different ways of calculating. Which ones are best for what particular purposes?
- With calculating, does everyone in the world calculate in the same way?



## PMA MATHEMATICS CHALLENGE 2012

### SET INVESTIGATION - OPTION ONE

#### *From Paddock to Plate...*

#### (Australian Year of the Farmer)

2012 has been recognized as the **Australian Year of the Farmer**.

***As you know Mathematics is all around us, at home, at school, at work and at play and what we would like you to investigate is just where you find mathematics "from the paddock to the plate"!***

This whole idea of choosing and using mathematics in a range of contexts is what we call Numeracy, and Numeracy is listed as one of the skills in the Australian Curriculum (a General Capability) and in the Early Years learning Framework that all learners have to develop during their time in preschool and school.

In this investigation we would like you to go on a mathematics hunt to see if you can ***explore, investigate and compare*** all the mathematics that is used to get "from the Paddock to the Plate".

You might like to investigate the mathematics that is used and developed;

- on the farm
- in transporting the products from the farm to where they are processed
- in the processing process
- in transporting to the place of sale
- at the point of sale
- getting onto your plate

**When you represent your findings the judges would like to see your thinking and learning about:**

- The different kinds of mathematics you found and where it was used/developed
  - Tell us **why** it was important in these places. What did they use it for and why did it matter?
  - **What** "type" of mathematics did you find the most of?
  - Which aspects of mathematics were most common? **Why** do you think this was so?
  - Did some parts of the process use mathematics more than others? If so, **why**?
  - Did you find there was some mathematics they couldn't live without?
  - Where did all this mathematics come from? Who made it up? Has it changed over time?
- Is the mathematics they use now different to the mathematics they used when your grandparents were in preschool or school? For example do the farmers today use the same mathematics they used one hundred years ago?

## **PMA MATHEMATICS CHALLENGE 2012**

### **SET INVESTIGATION - OPTION TWO**

#### **"Mathematising at the Olympics"**

##### **IDEA ONE**

*Dr Evil has stolen all the mathematics equipment from London, and they have no mathematics equipment, ideas or thinking available to them.*

*Investigate what the impact on the Olympics in London in July 2012 would be....*

**When you represent your findings the judges would like to see your thinking and learning about:**

- what you learnt about the importance of mathematics
- what you learnt about where mathematics is used and applied, and what kinds of mathematics is used in different contexts

##### **IDEA TWO**

*Choose three Olympic athletes and investigate and compare all the mathematics they will use as part of their training and participation at the Olympics events.*

**When you represent your findings the judges would like to see your thinking and learning about:**

- what you investigated
- evidence of your comparisons and generalisations
- the importance and role of mathematics in the lives of these athletes

##### **IDEA THREE**

**STATEMENT:** *Only large countries can consistently win gold medals at the Olympics.*

Investigate this statement by exploring, analysing and interpreting the available data, searching for generalisations and drawing your conclusions

**When you represent your findings the judges would like to see your thinking and learning about:**

- the range of secondary data you explored, how useful you found it, what it showed
- your comparisons of the data
- your conclusion and the evidence to support your position

## **PMA MATHEMATICS CHALLENGE 2012**

### **SET INVESTIGATION - OPTION THREE**

#### **Calculating, Calculating, Calculating!**

*Every single day we use "calculating" as part of our daily lives, so how does it really work?*

*Calculating is where we use one or more of the operations (addition, subtraction, multiplication and division) to solve a situation where we need to quantify (work out how many).*

*If you had to explain "calculating" to someone else what would you say?*  
**When you represent your findings the judges would like to see your thinking and learning about:**

- What is calculating?
- What are the four operations and what is each one about?
- We have to be able to calculate in our head, on paper and with technology, so show us:
  - the mental calculation strategies for each operation
  - the written calculation algorithms for each operation
  - the strategies for using technology for each operation
- Who invented these strategies and where did they come from?
- Why do we need processes for calculating? What would happen if we didn't have them?
- Does everyone in the world use the same processes for calculating?
- Do our processes for calculating stay the same or are they changing?

***When you want to know "how many" (quantify), inside our head our brain has to make a decision about which way to do this. It has to consider:***

***Should I estimate? Should I approximate? Should I count? Should I calculate?***

***If you decide to calculate, you then have to decide whether to add/subtract/multiply or divide (or some combination) AND whether to do it in your head/on paper or with technology (or some combination)***

**The judges would also like to see your thinking and learning about:**

- When in your life you think you use each one of these operations (+ -  $\times$   $\div$ ) and calculating strategies (head, paper, technology)
- Which ones are best for what particular purposes?
- With calculating, does everyone in the world calculate in the same way?

## PMA MATHEMATICS CHALLENGE 2012

### SET INVESTIGATION - OPTION FOUR

#### *Wasted Water!*

In 2012 all of the States and Territories are still arguing about how to best look after our Murray River system.

How much do you know about the Murray River system and how we use it?

You could choose to investigate several aspects of our water use...

- ***Investigate, analyse and compare the usage/impact on water*** by:

- Different States and Territories
- Rural and metro regions of each State and Territory
- Different industries
- Leisure and recreation activities

Based on what you find out what would be your plan for the Murray River basin?

- ***How much water does your preschool/school use in a year?***

Analyse what your usage is, and for what purposes

Compare this with other sites' usage

How much of the water you use comes from the Murray and how much from other sources?

Develop, trial and evaluate some strategies for becoming "watersmart" at your site

- ***How much water do you personally use in a week?***

Analyse what your usage is, and for what purposes

Compare this with at least two other people's usage/purposes

How much of the water you use comes from the Murray and how much from other sources?

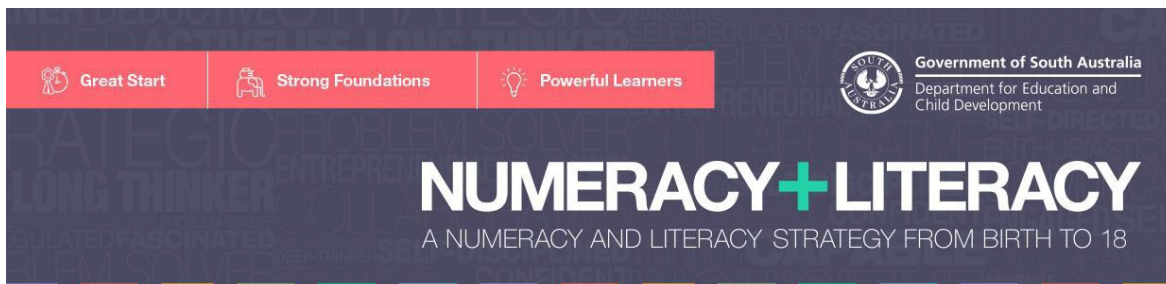
Develop, trial and evaluate some strategies for becoming "watersmart" in your everyday life

**When you represent your investigation and findings the judges would like to see your thinking and learning about:**

- The mathematical processes and thinking you used as part of your investigation and analysis
- Your conclusions about water use, and your plans and ideas
- How you would promote being "watersmart" to others using mathematical evidence

## **PMA POWERFUL LEARNERS:**

### **Mathematics and Numeracy Challenge 2013**



### **SET INVESTIGATION - OPTION ONE**

#### ***Our Mathematical Lives...***

Mathematics is all around us, at home, at school, at work and at play. In fact, we could not survive our daily lives if we did not use some mathematics!

When we choose and use mathematics in our lives, it is called Numeracy and the new Australian Curriculums (Early Years Learning Framework in Preschool, Australian Curriculum in school) say that every child from Birth to Year 10 should have a chance to learn more about how we can use successfully use Numeracy every day.

So what does mathematics look like in different people's lives?

In this Set Challenge we want you to become a Numeracy Detective to explore how, why and where mathematics is used and influences people's lives.

You might like to explore and compare the numeracy that you find in a day in the life of

- Some children of different ages (what mathematics does a baby, a four year old, a nine year old and a thirteen year old use)
- Different members of your own family (child, parent, grandparent, aunty)
- Different families in different suburbs, cities or countries
- A child compared to an adult
- A child in 2013 compared to a child in the past
- An adult in 2013 compared to an adult in the past
- Adults working in different jobs or careers
- Children who have different hobbies and interests

**When you represent your findings the judges would like to see your thinking and learning about:**

- ❖ Why numeracy mattered in the lives of the people you investigated. What wouldn't they have been able to do without it? Did it matter how "good" they were at Numeracy? Did they know they were using Numeracy?
- ❖ Remember Numeracy is about choosing and using mathematics, so the judges would love you to show us the different kinds of mathematics you found people choosing and using.

Mathematics is usually organized under different headings.

- The Content - the "stuff" you have to know about and how to do like Geometry, Measurement, Statistics, Probability, Algebra, Number.
- The ways of thinking mathematically (the Proficiencies) such as Reasoning, Generalising, Visualising, Problem Solving, Applying, Using, Proving, Justifying, Explaining

**What "type" of mathematics did you find the most of? Why do you think this was so?**

- ❖ If you were going to help the people you investigated become even better at Numeracy what do you think they would need to learn, and how do you think they could learn this best?

## PMA MATHEMATICS CHALLENGE 2013

### SET INVESTIGATION - OPTION TWO

#### "International Year of Statistics"

2013 is the International Year of Statistics around the world and it is a great time to investigate and celebrate why Statistics matter in our lives.

So what is Statistics?

*Statistics is about looking at how we collect, organize, analyse, interpret, represent and act upon data.*

*So what is data? Data is a collection of information!*

*(By the way, datum means one piece of information...)*

So now we know both those definitions the key question is **why do Statistics matter in our lives and the lives of people around us.**

Choose one of the following ideas to investigate further

#### IDEA ONE

**Data, data everywhere!**

We would like to you become a **Data Detective** and explore just where data is used in people's lives. You could choose to **investigate and compare**:

- The data produced and used in your house with another child's house (in your suburb, different suburb, city or country)
- The data produced and used in your site compared with a site in another location
- The data produced and used in different workplaces
- The data produced and used by people of different ages, or in different countries or in different times in history
- The data produced and used in different sports or hobbies

**When you represent your findings the judges would like to see your thinking and learning about:**

- What you learnt about the importance of data and Statistics, why did they matter in the lives of the people you investigated?
  - What kinds of data (visual, graphical, numerical) did you find?
- How were people using the data they produced or accessed? Why did they need it and what purposes did they use it for?
  - What mathematics tools were they using to produce or use data?
  - Did they produce or use the data accurately and appropriately?



## **IDEA TWO**

### **STATEMENT: *People use data to influence others***

Pick three pieces of data that you have had to use in your own life or the life of your family or learning space. How did the people who produced this data try to influence your thinking and actions? Were they successful?

Now - you be the "influencer"!

What is something that you would like to see changed at your preschool or school, home, sports club, hobby club, in the State or in Australia?

If you were trying to influence people to change what they thought or did about this issue, what data would you produce?

Now do it! Here's a reminder about the steps in producing data...

- **Frame your question(s)** What are you trying to find out? How does this question need to be framed to really get the thinking/information/action you are after?
- **Collect your data.** This means thinking about how you will collect it (online survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid
- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to influence others. So the important question becomes "**which form of representation or data display will best tell the story of this data**"? Remember it is usually best to use technology like Excel or Numbers to help you do this because you can quickly flip between different representations to make the decision about which data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this data set)
- **Interpret the data.** What "story" does the data tell? In this case does it influence people in the way you wanted to? If not, can you manipulate the data to do this? If you did this would it be ethical?
- **Act upon the data.** We usually collect data for a particular purpose - to use it because nobody in their real lives just collects data for no reason! In this case you are doing it to try and see if you can influence others, so you will need to find a way to share it with others to see if you were successful!

<p><b>When you represent your findings the judges would like to see your thinking and learning about:</b></p>
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- |   |
|---|
| <ul style="list-style-type: none"><li>- Your reflections on the way in which the data produced by others influenced you<ul style="list-style-type: none"><li>- Each of the six steps of the data collection and use process</li></ul></li><li>- Your conclusions about whether you were able to influence others thoughts and/or actions. You may also want to include their reflections on your data</li></ul> |
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## **PMA MATHEMATICS CHALLENGE 2013**

### **SET INVESTIGATION – OPTION THREE**

#### **Money, Money, Money!**

*Money is an important part of our everyday lives. We use it to exchange for goods and services so that we can survive and manage our everyday lives. So how does it work? What would happen if we didn't have any? What do you need to know to be able to use money effectively?*

**When you represent your findings the judges would like to see your thinking and learning about at least FOUR of the following:**

- What is money? Why do we need it? Do all communities use money?
- What forms does money come in? Has it always come in these forms? How has it changed over time?
- The National Financial Literacy framework (which says what all children need to learn about money) says that we need to learn how to
  - Plan
  - Earn
  - Spend
  - Save
  - Donate

What can you find out about each one of these? What are they, how do you do them and why are they important?

How do you think people in your family, learning space or community are going with these skills? How could you find out? If you were designing a learning programme for them to get better at these five areas, what and how do you think they would need to learn?

- One of the other things they say is that to be successful with money we have to know about the difference between wants and needs. Show us what you understand about these two ideas and why you think they might be important. Check out what other people think about these ideas too and compare them to your thinking.
- Do a "money study". Choose three people and then investigate and compare how, when, where and why they need to use money in their lives.
- Some people say "money is evil". What do you think? What evidence would you provide to back up your thinking?

## **PMA MATHEMATICS CHALLENGE 2013**

### **SET INVESTIGATION – OPTION FOUR**

#### ***International Year of Mathematics of the Planet Earth***

2013 has been designated as the International Year of Mathematics of the Planet Earth.

This year is about exploring and celebrating all the ways that Mathematics can be used to solve the world's issues.

To check out more of what there are talking about have a look at

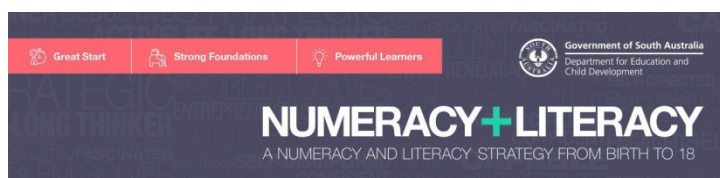
<http://mathsofplanetearth.org.au/category/schools/classroom-resources/>

In this Set task we want you to;

- Brainstorm all the issues you think mathematics has helped to solve in the past and the present. Then brainstorm all the issues you think mathematics **COULD** help to solve in the future
- Think about some of the issues in **your world** that you would like to solve. Pick at least three that are really important to you and explore and compare what mathematics you could use to help you solve them.
- Choose the one that is most important to you and make a plan for how you would put this mathematics into action.
- If it is possible you might even want to follow through and give your action plan a go! If this is not possible, who could you send your action plan to so that they could follow through? Send it and gather their feedback on your ideas

**When you represent your investigation and findings the judges would like to see your thinking and learning about:**

- ❖ your brainstorm information from the past, the present and the future
- ❖ your comparisons of the ways in which mathematics could help with your three issues and your reflections on this
- ❖ your action plan for one issue that shows the mathematical processes and thinking that you would need to use
- ❖ if you were able to give your action plan a go, we would love to hear all about that as well! Or tell us who you sent it to and what their feedback was

**Mathematics and Numeracy Challenge 2014**

Catholic Education SA

**SET INVESTIGATION - OPTION ONE*****Thinking Geometrically: Does it fit?***

Mathematics is all around us, at home, at school, at work and at play and Geometry is one of the key areas of Mathematics that we use as part of our daily lives. Geometry has so many interesting and exciting uses, we thought you might like to have a play with some of them...

When we are **thinking geometrically**, we ask ourselves lots of questions:

- *Where am I?*
- *Will this fit?*
- *How do I get there?*
- *Where is it?*
- *How does this need to be arranged for this purpose?*
- *What shaped object do I need for this purpose?*
- *Will we be able to see?*

For the **first part** of this challenge we ask you to start by selecting four different people to investigate. You could choose you, or some peers, or some adults in your family, community or anywhere you like. Then we would like to you **collect some evidence about how these people use geometrical thinking as part of their lives**. In your recording, make sure you compare and contrast what they are doing.

You may also like to investigate **which careers/jobs** use a lot of geometrical thinking and then let us know what you found.

Remember to include some information about what kinds of geometrical thinking each one needed to do. It would also be useful to include some information about **what "types"** of geometrical thinking you found the most of? Why do you think this was so?

For the **second part** of this challenge, we want you to focus specifically on the mathematical idea of **"does it fit"**.

When we think about how 2D shapes fit together it is called "tessellating". When we think about how 3D objects fit together it is called "stacking and packing"  
So in our everyday lives we do an awful lot of "stacking and packing"!

We are challenging you to choose at least three everyday "stacking and packing" situations and investigate the mathematics of why and how they work.

You might choose to explore the "stacking and packing" that is involved when we put:

- Toys into a toybox
- Food into a lunchbox
- Groceries into a shopping bag
- Food in a pantry
- Crockery or cutlery in the cupboard/drawer
- Clothes in a suitcase
- Clothes in a drawer
- Your stuff into a kindy/school bag
- Sport equipment in your sports shed

You might like to start this investigation by brainstorming your own list of everywhere in our lives we stack and pack.

Then we would like you to **explore the most efficient ways** of stacking these objects into these spaces, and then compare what you find for at least three of them. What mathematical knowledge, skills, understanding and thinking did you have to use to be able to do this?

What would be your "stacking and packing" advice for others? Are there any patterns or rules you noticed that would help other people know about how to stack and pack efficiently?

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!

## PMA MATHEMATICS CHALLENGE 2014

### SET INVESTIGATION - OPTION TWO

#### "Mathematics and Sport"

Numeracy happens when we choose and use our mathematics to navigate and deal successfully with situations in our life that have a mathematical property.

One of the SA Government Mathematics Committees have been talking about just how many sports people have to use Mathematics in their lives, and we are hoping that you might be able to help them with their research!

Choose two of the following ideas to investigate further.

#### **Mathematics and Sport**

We would like to you become a **Mathematics Detective** and explore just where, how and why mathematics is used in Sport. You could:

- Choose to **investigate and compare** the mathematics used in at least five different sports. This might mean that you could:
  - Explore the mathematics they use to design the sport
  - Explore the mathematics they use to play the sport
  - Explore the mathematics they use to get fit for the sport
  - Explore the mathematics they use to "score" the sport
  - Explore the mathematics they use to work out who wins
  - Explore the mathematics they use to promote the sport
  - Explore any other reasons they use mathematics...
- Investigate and compare the mathematics **used in at least two different sports**, and then justify which sport requires the "best" mathematicians.
- **Design a sport** which uses no mathematics in it at all
- **Compare and contrast the** mathematics that an everyday sports person and an elite sports person need and choose to use.
- Sport requires a range of participants to make it work - "players", umpires/referees, scorers, timers, line markers, fans and more. For at least three different sports, **investigate and compare** the different participants that are required and the mathematics that each of them will need to choose and use to make this sport work.

- **Interview** at least three sports people (could be an everyday sportsperson or an elite sportsperson) to see if they "notice" themselves using mathematics as they participate in sport. Document and communicate what you find. In your report tell us your view – do you think it's important for people to know where mathematics is in their lives? Why or why not?
- **Could you become a better mathematician by participating in sport** in some way? Document the evidence that would support your view.
- **How has Sport changed mathematics?** What mathematics, or mathematical tools and strategies has been "invented" as a result of changes and developments in Sport. Document what you find.
- This SA Government Committee **thinks that showing children and young people that Mathematics is used in Sport would be one way of demonstrating that mathematics is a really important part of our lives. They think that this would help children and young people be more interested in mathematics themselves.** What do you think about this? What do your peers think about this? Could you devise at least two ways of gathering their views and then document your process and what you found out. Make sure you include your summary that shows us whether you agree or disagree with the Committee's ideas.
- **What Statistics do we have about Sport in Australia?** Eg how many people play what, where, why, with who, when? How many people watch live? Which is the most viewed on TV? Which is most expensive, least expensive? What does the data show for this sport in Australia compared to other places in the world?

**Investigate some data about Sport – you could check out the Australian Bureau of Statistics website/Specific sports websites (or other sources) or you could produce some of your own data. Remember the**

1) Three key questions about producing data are:

- What story does the data tell?
- How valid is the story? (Who made it up and do we need to listen to it?)
- Now we know the story, what actions do we need to take?

2) The Six Steps of Producing data below

- **Frame your question(s)** What are you trying to find out? How does this question need to be framed to really get the thinking/information/action you are after?
- **Collect your data.** This means thinking about how you will collect it (online survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid
- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to share your findings with the judges. So the important question becomes "**which form of representation or data display will best tell the story of this data**"? Remember it is usually best to use technology like Excel or

Numbers to help you do this because you can quickly flip between different representations to make the decision about which data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this data set)

- **Interpret the data.** What "story" does the data tell? What questions does it raise?
- **Act upon the data.** We usually collect data for a particular purpose - to use it, because nobody in their real lives just collects data for no reason! Now you have collected this data how could you use it? Would you use to educate other people, or influence other people or make an argument for action?

***Whichever process you choose (looking at others data or producing your own) we want to see you clearly communicate what you find and see evidence of each of the Key questions/Steps. We would also love to know about what you think about how Statistics is used in Sport!***

**When you represent your findings the judges would like to see your thinking and learning about:**

- What you learnt about the importance of mathematics, why did it matter in the lives of the sports people you investigated?
- What kinds of mathematics you found in sport. Did the participants and designers of sport need to use their measurement thinking, number thinking, geometry thinking, algebraic thinking or their data thinking the most?
- How were people using the mathematics in their sports? Why did they need it and what purposes did they use it for?
  - What mathematics tools were they using as part of their sports?
- Clear evidence of your thinking and reasoning about the particular challenges you have chosen to do

## PMA MATHEMATICS CHALLENGE 2014

### SET INVESTIGATION - OPTION THREE

#### I want to be a powerful learner!

*The SA Government has made a book which says that every child and young person in SA needs to become a powerful learner of mathematics.*

We need you to be a **DATA RESEARCHER** and help them work out how we can make this happen.

This is a data investigation, so in your investigation entry **we would really like to know what children and young people in your preschool or school think about the following ideas:**

- *What is a powerful learner?*
- *What would a powerful learner of mathematics be able to do, know, understand and think about?*
- *Do you think kids are powerful learners of mathematics already?*
- *Can every kid be a powerful learner of mathematics?*
- *What do you think teachers could do to help every kid become a powerful learners of mathematics? What would a learning space look like? What would the teacher be doing? What would the learners be doing?*
- *What could parents do to help kids become powerful learners of mathematics?*
- *Do children and young people like learning to be mathematicians? Tell us why or why not?*
- *If they don't, what do they think would help to make them enjoy it?*

#### **Data researchers go through the following steps**

- **Frame your question(s)**  
What are you trying to find out? How does this question(s) need to be framed to really get the thinking/information/action you are after?  
In this Challenge investigation there are some suggested questions listed, but how would you ask them to get the optimum results
- **Collect your data.** This means thinking about how you will collect it (online survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid



- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to share your findings with the judges. So the important question becomes "**which form of representation or data display will best tell the story of this data**"? Remember it is usually best to use technology like Excel or Numbers to help you do this because you can quickly flip between different representations to make the decision about which data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this dataset)  
**OR perhaps this information would be best displayed through an infographic? Do you know what an infographic is?** If not check out [www.coolinfographics.com](http://www.coolinfographics.com) or [www.dailyinfographics.com](http://www.dailyinfographics.com) to see what they are. You can also use lots of different websites and apps to make your own infographics if you decide this is a powerful way to represent your data. Just type "how to make your own infographic" into google search and you will see lots of great options.
- **Interpret the data.** What "story" does the data tell? What questions does it raise?
- **Act upon the data.** We usually collect data for a particular purpose - to use it, because nobody in their real lives just collects data for no reason! In this case the purpose of your data is to share with the government and the education departments just what kids really think about mathematics and powerful learners?  
 So it will be important to include some kind of communication that we can send to the head of the "powerful learners" unit, so they can see and hopefully use your great ideas. It might be a letter, a blog, a video or...

**When you represent your findings the judges would like to see:**

- ❖ Your information and evidence from all six steps of being a data researcher which shows us what you found as well as the reasons you chose to do each step in a particular way.
- ❖ Your communication for the head of the "powerful learners" unit,

## PMA MATHEMATICS CHALLENGE 2014

### SET INVESTIGATION – OPTION FOUR

#### *Mathematising at the Royal Adelaide Show*

The Royal Adelaide Show is nearly here for 2014, and there are lots of exciting mathematical challenges awaiting there!

**Investigate at least two of the following:**

- You have **\$300 to spend on showbags and rides** at the Royal Adelaide Show. Use the wish list feature of the Royal Adelaide Show website to calculate how you would spend it. <http://theshow.com.au/showground/royal-adelaide-show/showbags-carnival/showbag-and-ride-wish-list.jsp> The Wish list also provides you a map of the locations of these bags. Calculate the **most efficient route** for buying these showbags and doing the rides. Your recordings would show us what's on your wish list, their location, the route you designed and your proof that it was the most efficient route.
- If a teenager (15 years old) spent \$300 at the show, how much **time would it take them to earn this money** through their job at a fast food shop?

The information on the Fair Work Australia website has the following data about pay rates for 15 year olds in the fast food industry.

Basic rate	\$9.26 per hour
Saturday	\$11.11 per hour
Sunday	\$12.97 per hour
Public Holidays	\$20.38 per hour
Evenings	\$10.00 per hour
Late work	\$10.37 per hour

Our teenager only has two weeks to earn this money, and they are not allowed to work for more than three hours on any one day and they still have to attend school and other commitments. What would be the most efficient way for them to earn this money to spend at the show?

Your learning evidence needs to show us how you worked it out, why you think this would be the most efficient and your proof.

- There is a lot happening in the main arena and for free at the show. Check out the sample itinerary information at the following link:  
<http://theshow.com.au/showground/royal-adelaide-show/plan-your-show-day/itineraries.jsp>  
 We are challenging you to **plan the perfect FREE day** for a five year old, a fifteen year old in a wheelchair, and a fifty year old. Make sure you record their daily timetable and why you think this would make the "perfect day" for them. The full range of free activities is available at the A-Z index at  
<http://theshow.com.au/showground/royal-adelaide-show/plan-your-show-day/free-at-the-show.jsp> Your learning evidence would show us the three itineraries and why you think this would be the "perfect day" for each person.
  
- Pretend/Decide what you would like to do at the show in 2014. You have only four hours available and you want to do at least "twenty" attractions/events. We want you to plan the **most efficient route** for your visit using the map of the showgrounds that is available at the following link:  
<http://theshow.com.au/showground/royal-adelaide-show/plan-your-show-day/maps.jsp>  
 Your investigation will show us the 20 "things" you chose to do, the route you planned, and how you proved it was the most efficient. Using this route, how much time would you have available at each attraction/event? Show us how you worked it out.
  
- If you had \$100 available to spend, which collection of showbags would give you the **best value for money?** Would it be to buy 100 of the \$1 bags or 4 of the \$25 bags?  
 You could use the showbag guide from the paper, or the information on the website to assist you.  
 The judges would really like to see how you worked it out and your proof of why this is the "best value" for money.
  
- If you bought one of every showbag available for children **what would be the combined mass of the bags?** Would you be able to carry it?  
 Explain how you worked it out.  
 What would be the most showbags you could buy and still be able to carry them to your car or bus by yourself?
  
- This year at the Show there will be **30,000 litres of milk produced by the Show Dairy. Investigate and prove**
  - How many bottles of milk this could provide
  - How many bowls of cereal this could provide

- How many cows are at the show and how much milk they will each produce, as well as how much they would have to eat to produce this milk
  - If you put 30,000 litres of milk at your school, where would it fit? In one classroom, on the basketball court.....
  - Choose two families you know. Compare how long it would take each of them to consume 30,000 litres of milk. Record how you worked this out and your comparisons to share with the judges
- Investigate the rides at the Show. If you went **on every** ride, how much time would you need to allow? In your learning evidence make sure you show us your mathematical thinking and your proof.
- **The Show is 175 years old this year** and they are celebrating! Check out the history of the Royal Adelaide Show at <http://theshow.com.au/showground/royal-adelaide-show/history.jsp>  
We would like you to compare and contrast the history of the Royal Adelaide Show and SA. Choose at least ten events in the history of both the show and SA and then represent your comparisons.
- **We want you to be a Statistician.**  
Choose four Shows in Australia and compare and contrast at least eight categories of Statistics about them. (eg: how many people attend/enter, how many events, number of attractions, amount of food/showbags/toilets and more!)
- Then the most important part - what story does this data tell you?  
What's the same, what's different, what's interesting and why?  
The judges look forward to reading your findings
- We want you to be a **"Numeracy Detective" at the Show**. Numeracy happens when we choose and use mathematics to deal with a situation that has a mathematical property.
- Choose at least five events/attractions/rides/displays and compare and contrast the Mathematics they would need to choose and use to run their event/attraction/ride/display effectively
  - Investigate the mathematics YOU would need to use to spend a day at the show. In your learning evidence document all the mathematics and then let us know which parts of mathematics you think you needed most and why. Did you need your measurement thinking, or geometry thinking or algebra thinking or statistics thinking or number thinking?
- **How far will they go?** At the Show some of the rides travel quite large

distances, and we would like you to investigate more about one of them:

- **The Big Dipper Super Loop Coaster** travels 365m of track. How far will the roller coaster carriages travel over the ten days of the Show? What proof could you provide to justify your thinking
- The gondolas on the **Freakout** travel 21 metres up into the air across an arc of 120 degrees. We would like you to make a model of the Freakout which shows what an arc of 120 degrees would look like. Make sure to include a photo or video of your model and your evidence and proof that it is an arc of 120 degrees.
- Choose three of the rides that interest you and compare how far they **will travel over the course of the Show**. Record your comparisons so we can see your thinking about why the distances are different or similar

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!

## **PMA MATHEMATICS CHALLENGE 2014**

### **SET INVESTIGATION - OPTION FIVE**

#### ***So what do mathematicians do?***

### ***WHAT DO YOU THINK?***

In this Challenge Option, we would like you to investigate both of these questions and then share your findings and thinking with the judges. You could present it in any way you wish - a documentary, as a graphic novel, as posters, ebooks, through an app, as a debate

#### **CHALLENGE ONE:**

Mathematics matters... Do you think it does?

Could we live without mathematics? Is there anyone in the world who doesn't have to use mathematics in their lives?

Would the world be a better or worse place without mathematics?

#### **CHALLENGE TWO:**

What is a  
mathematician?

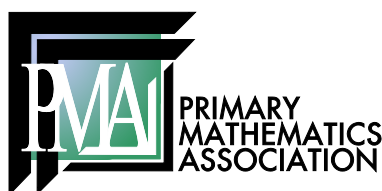
What do they look  
like?

What do they do? How do they spend their time?

Investigate at least three different mathematicians and compare what they do and achieve.

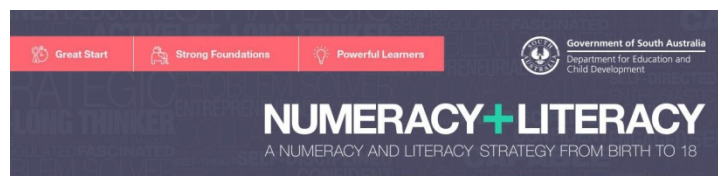
**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!



## **PMA POWERFUL LEARNERS:**

### **Mathematics and Numeracy Challenge 2015**



Catholic Education SA

## **SET INVESTIGATION - OPTION ONE**

### ***Which Shape Wins?***

Shapes are all around us, at home, at school, at work and at play. Understanding the properties of Shape and then using those properties to help us in our lives is an important aspect of learning about Geometry.

***So what do you know*** about shapes, their properties, where we find them and why they are important?

In the world at the moment, mathematicians would argue that there are five kinds of shapes - 1D, 2D, 3D, 4D, 5D. Do you know about all of these yet? What does the "D" stand for?

Well - here is your chance to become a Shape Detective!

For the **first part** of this challenge we would like you to investigate each kind of shape (1D, 2D, 3D, 4D, 5D) and explore

- What is it? How would you describe it to someone who couldn't see it? What makes it special?
- Who invented the idea of this shape (identifying it, its name, its properties) and when was this?
- What are the properties of this family of shapes?
- Are there different kinds of this shape? For example - in 2D are they all from the same family or are there different families?

In your recording, make sure you compare and contrast the shapes so that we can easily see the similarities and differences between each type of shape. We would also be really interested to see a timeline that shows when these shapes were invented. (identified/named)?

For the **second part** of this challenge, we want you to focus specifically on which shapes are the most used in our world and why.

Your job is to provide a mathematical argument which presents your evidence about:

- Which shape you believe is used most in the world
- Why this is true?
- What would happen in the world if that shape didn't exist

For the **third part** of this challenge we want you to tell us which shape you find most interesting, beautiful or important and why.

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!



## PMA MATHEMATICS CHALLENGE 2015

### SET INVESTIGATION - OPTION TWO

#### "Mathematics and Art"

Numeracy happens when we choose and use our mathematics to navigate and deal successfully with situations in our life that have a mathematical property. In many countries they have what they call STEAM initiatives, where they look at all the ways that Mathematics and the Arts are intertwined and support each other. We think there should be a STEAM project in South Australia and we need your help with our research!

**Choose two of the following ideas to investigate further.**

#### **Mathematics and Art**

We would like to you become a **Mathematics Detective** and explore just where, how and why mathematics is used in the Arts. Remember there are five aspects of Arts - Music, Dance, Drama, Media Arts and Visual Arts so that is a lot of Art to consider!

You could:

- Choose to **investigate and compare** the mathematics used in at least five different Artworks. This might mean that you could:
  - Explore the mathematics they use to construct the Artwork
  - Explore the mathematics they use to display/perform the Artwork
  - Explore the mathematics they use to build their skills for the Artwork
  - Explore the mathematics they use to promote the Artwork
  - Explore any other reasons they use mathematics...
- Investigate and compare the mathematics used in at least two different Arts forms, and then justify which Art form requires the "best" mathematicians.
- Design a piece of Art which uses no mathematics in it at all
- Compare and contrast the mathematics that an everyday Artist and an elite Artist would need and choose to use.
- Art uses a range of specialised equipment and resources in the development of the Artworks. **Investigate and compare** the different resources that are required for five different Arts Products and the mathematics that each of them will need to choose and use to create this art product.
- Interview at least three Artists (could be an everyday Artist or an elite Artist) to

see if they "notice" themselves using mathematics as they create their Artworks. Document and communicate what you find. In your report tell us your view - do you think it's important for people to know where mathematics is in their lives? Why or why not?

- **Could you become a better mathematician by participating in Art in some way?**  
Document the evidence that would support your view.
- Both Mathematics and the Arts require people who can be creative and innovative. Compare and contrast how creativity and innovation help you be a successful Artist and a successful Mathematician
- **How has Art changed mathematics?** What mathematics, or mathematical tools and strategies have been "invented" as a result of changes and developments in Art Document what you find.
- **What Statistics do we have about Art and Artists in Australia?** Eg how many people are involved in the Arts, where, why, with who, when? How many people "view" Art? Which is the most popular form of Art in terms of participants/audiences? Which is most expensive, least expensive to create? Which is most expensive, least expensive to be "an Audience" at What does the data show about Art and Australians compared to other places in the world?

**Investigate some data about the Arts - you could check out infographics about the Arts, the Australian Bureau of Statistics (or other sources) or you could produce some of your own data.**

Remember the:

1) Three key questions about "Reading data" are:

- What story does the data tell?
- How valid is the story? (Who made it up and do we need to listen to it?)
- Now we know the story, what actions do we need to take?

2) The Six Steps of Producing data are:

- **Frame your question(s)** What are you trying to find out? How does this question need to be framed to really get the thinking/information/action you are after?
- **Collect your data.** This means thinking about how you will collect it (online survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid
- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to share your findings with the judges. So the important question becomes "**which form of representation or data display will best tell the story of this data**"? Remember it is usually best to use technology like Excel or Numbers or an infographic maker to help you do this because you can quickly flip between different representations to make the decision about which

data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this data set)

- **Interpret the data.** What "story" does the data tell? What questions does it raise?
- **Act upon the data.** We usually collect data for a particular purpose - to use it, because nobody in their real lives just collects data for no reason! Now you have collected this data how could you use it? Would you use to educate other people, or influence other people or make an argument for action?

***Whichever process you choose (looking at others data or producing your own) we want to see you clearly communicate what you find and see evidence of each of the Key questions/Steps.***

<p><b>When you represent your findings the judges would like to see your thinking and learning about:</b></p>
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- |   |
|---|
| <ul style="list-style-type: none"><li>- What you learnt about the importance of mathematics, why did it matter in the lives of the Artists you investigated?</li><li>- What kinds of mathematics you found in Art? Did the creators and audience of the Artworks you investigated need to use their measurement thinking, number thinking, geometry thinking, algebraic thinking or their data thinking the most?</li><li>- How were people using the mathematics in their Artworks? Why did they need it and what purposes did they use it for?<ul style="list-style-type: none"><li>- What mathematics tools were they using as part of their Artworks?</li></ul></li><li>- Clear evidence of your thinking and reasoning about the particular challenges you have chosen to do</li></ul> |
|---|

## **PMA MATHEMATICS CHALLENGE 2015**

### **SET INVESTIGATION - OPTION THREE**

#### **The Story of Mathematics**

*There are lots and lots of fantastic "picture books" and short novels that help us learn more about Mathematics. Have you seen them and explored them?  
If not - then this might be the Challenge for you.*

The **first part of this challenge** requires you to choose three books that are designed to help children learn more about Mathematics. To help you out PMA has compiled a long list of great books to explore - email Deb at [primarymaths@bigpond.com](mailto:primarymaths@bigpond.com) to get the list!

You are then asked to select three of these that you think are interesting, and then to compare and contrast them by exploring:

- What was the mathematics that this book was hoping children would learn
- The reactions of at least two children to the book and whether it helped them with their mathematics
- How the book could have been improved

The **second part of this Challenge** is about you creating your own picture book that would help children learn more about Mathematics. You could:

- Create a brand new one of your own
- Do an innovation on one of the texts that you read

**When you represent your findings the judges would like to see:**

- ❖ Your information and evidence that shows how you compared and contrasted the three books in relation to each of the three key questions
- ❖ Your Picture book

## **PMA MATHEMATICS CHALLENGE 2015**

### **SET INVESTIGATION - OPTION FOUR**

#### ***Mathematics and Work***

*Mathematics is all around us, at home, at school, at work and at play. In fact, we could not survive our daily lives if we did not use some mathematics. When we choose and use mathematics in our lives, it is called Numeracy. In this Challenge we want you to specifically focus on how people are numerate at work, that is exploring the Mathematics that is used at work in our society.*

In this Set Challenge, we want you to explore and compare the numeracy that is used in eight different work environments. The following information might start you with your thinking...

<http://www.mathscareers.org.au/>

Once you have your ideas about which work environments you want to explore, then you need to consider how you will gather this information.

*Remember to consider The Six Steps of Producing data:*

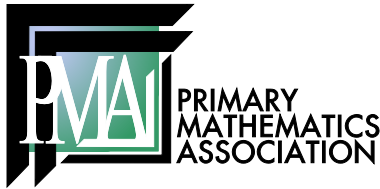
- **Frame your question(s)** What are you trying to find out? How does this question need to be framed to really get the thinking/information/action you are after?
- **Collect your data.** This means thinking about how you will collect it (online survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid
- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to share your findings with the judges. So the important question becomes "**which form of representation or data display will best tell the story of this data**"? Remember it is usually best to use technology like Excel or Numbers or an infographic maker to help you do this because you can quickly flip between different representations to make the decision about which data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this data set)
- **Interpret the data.** What "story" does the data tell? What questions does it raise?
- **Act upon the data.** We usually collect data for a particular purpose - to use it, because nobody in their real lives just collects data for no reason! Now you have collected this data how could you use it? Would you use to educate other people, or

influence other people or make an argument for action?

*The judges will want to see you clearly communicate what you find and see evidence of each of the Key Steps.*

**When you represent your findings the judges would like to see:**

- ❖ Why numeracy mattered in the work lives of the people you investigated. What wouldn't they have been able to do without it? Did it matter how "good" they were at numeracy if they wanted to be successful in that career or job? Did they know they were using Numeracy?
- ❖ Remember Numeracy is about choosing and using mathematics, so the judges would love you to show us the different kinds of mathematics you found people choosing and using. Mathematics is usually organized under different hearings:
  - the Content, the "stuff you have to know about and how to do like Geometry, Measurement, Statistics, Probability, Algebra, Number
  - the ways of thinking mathematically(the Proficiencies) such as Reasoning, generalizing, visualizing, problem solving, applying, using Proving, justifying, explainWhat types of mathematics did you find most of? Why do you think this was so?
- ❖ Make sure you justify and prove your thinking!



## **PMA MATHEMATICS CHALLENGE 2015**

### **SET INVESTIGATION - OPTION FIVE**

***Best mathematics invention ever!***

### ***WHAT DO YOU THINK?***

In this Challenge Option, we would like you to investigate both of these questions and then share your findings and thinking with the judges.

You could present it in any way you wish - a documentary, as a graphic novel, as posters, ebooks, through an app, as a debate

#### **CHALLENGE ONE :**

Mathematics matters... Do you think it does?

Could we live without mathematics? Is there anyone in the world who doesn't have to use mathematics in their lives?

Would the world be a better or worse place without mathematics?

#### **CHALLENGE TWO:**

What is a mathematician?

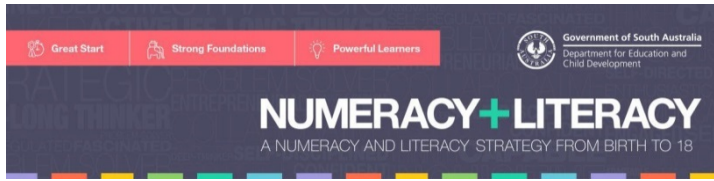
What do they look like?

What do they do? How do they spend their time?

Investigate at least three different mathematicians and compare what they do and achieve.

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!



## SET INVESTIGATION - OPTION ONE

### *What does scale mean?*

There are scale drawings and scale models all around us!

***So what do you know*** about scale and why it is important?

What is the definition of "scale" in mathematics? What does it mean? Make a visual presentation (eg: poster/video) that would explain what scale is and why it is important.

**Then choose at least two of the following questions** to explore and represent

- Investigate and document ten places that we use "scale" in our lives
- Make a 1/5 model of yourself using string or wool or frieze tape. Then make a multi-media presentation that would explain to another child how to do this
- Make a scale model of one feature from your school or preschool. Tell us why you chose that particular scale
- What is a scale drawing? What are the "rules" for creating a scale drawing? Create a scale drawing to show us those "rules" in action. Then make a multi-media presentation that would explain to another child how to do this
- Investigate and find at least three jobs that use "scale" as part of their work lives. Could they do their job without scale? Why/ Why not?



- Scale models are a hobby for some people. Check out the images at the following link <https://www.flickr.com/search/?q=scale%20models&ytcheck=1>  
Investigate four hobbies that involve scale models and explain what people do.  
Find a way to interview at least two people about these hobbies.
- Check out at least five different kinds of maps. How do they use scale?  
Do "geographers" and "mathematicians" use scale in the same kind of way?  
Explain your thinking

**When you represent your findings the judges would like to see:**

- ❖ Your visual presentation about the definition of scale
- ❖ Your response to at least two of the questions
- ❖ Make sure you justify and prove your thinking!

## PMA MATHEMATICS CHALLENGE 2016

### SET INVESTIGATION - OPTION TWO "Convincing Others"

Every day people use "data" to inform others and convince others of their point of view or to take action. In this Set Challenge we would like you to consider how you would use data to convince others about an idea or issue that is important to you.

#### GETTING STARTED:

What is an issue you are really concerned about in your local area / life?

What is your personal "point of view" or "position" about this issue?

What data would you collect and use to convince others of your point of view and get some action on this issue?

Remember the:

3) Three key questions about "Reading data" are:

- What story does the data tell?
- How valid is the story? (Who made it up and do we need to listen to it?)
- Now we know the story, what actions do we need to take?

4) The Six Steps of Producing data are:

- **Frame your question(s)** What are you trying to find out? How does this question need to be framed to really get the thinking/information/action you are after?
- **Collect your data.** This means thinking about how you will collect it (online survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid
- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to share your findings with the judges. So the important question becomes "**which form of representation or data display will best tell the story of this data and convince others of your personal point of view or position**"? Remember it is usually best to use technology like Excel or Numbers or an infographic maker to help you do this because you can quickly flip between different representations to make the decision about which data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this data set)

- **Interpret the data.** What "story" does the data tell? What questions does it raise?
- **Act upon the data.** We usually collect data for a particular purpose - to use it, because nobody in their real lives just collects data for no reason! That's exactly what you are doing? You are using your data to educate other people, to influence other people and to make an argument for action

**SO WHAT DO YOU NEED TO DO?**

- *Choose an issue of importance to you*
- *Develop your personal "point of view" or "position"*
- *Investigate, select and/or produce data to convince others of your "position"*
- *Present your data to someone who you think can act/deal with your issue*

**When you represent your findings the judges would like to see your thinking and learning about:**

- Your personal position on this issue and why it is important to you
- The data you have produced and/or found that you are going to use to convince others
  - Your justification for why you chose this particular form of data display
    - Information about who you presented to and why you chose them
      - What happened after you showed them your data
- Your reflections on whether the data was a useful tool in convincing others about your "point of view"

## **PMA MATHEMATICS CHALLENGE 2016**

### **SET INVESTIGATION - OPTION THREE**

#### **What makes a good mathematics task?**

*Many teachers believe that tasks or challenges are a great way to get children and young people thinking and exploring mathematics.*

*Do you think they are right?*

The **first part of this challenge** requires you to check out some mathematics tasks/challenges that are designed to help children learn about and with mathematics. Check out some examples at the following website

<http://nrich.maths.org/frontpage> or you could choose any other resource you or your educator know about.

You are asked to select five of these tasks/challenges that you think are interesting, and then to compare and contrast them by exploring:

- What was the mathematics that this task/challenge was hoping children would learn
- The reactions of at least two children to this task/challenge and whether it helped them with their mathematics
- How the task/challenge could have been improved so that it was better at helping children learn that piece of mathematics

The **second part of this Challenge** is about you creating **two of your own mathematics challenges** that would help children learn more about Mathematics.

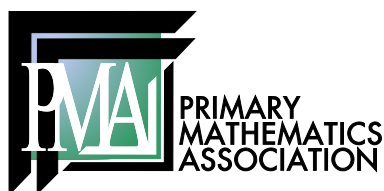
You could:

- Create brand new ones of your own
- Do an innovation on one of the challenges that you have already explored

Then you need to test your challenges out with two children to see if they will be successful at learning the aspect of mathematics you have chosen.

#### **When you represent your findings the judges would like to see:**

- ❖ Your information and evidence that shows how you compared and contrasted the five tasks in relation to each of the three key questions
- ❖ Your two mathematics tasks and an explanation of what mathematics they are designed to help children learn. Make sure you tell us what age child you are targeting your learning challenges at.
- ❖ What happened when you tested your tasks out with two other children
- ❖ Your reflections on how you would improve your tasks further
- ❖ Some advice for teachers about what makes a successful mathematics task/challenge. Do they work? Why/Why not?



## PMA MATHEMATICS CHALLENGE 2016

### SET INVESTIGATION - OPTION FOUR

#### *Thinking Mathematically*

*In the Australian Curriculum: Mathematics (the list of what children need to learn about and how to do in Mathematics in Australia) they list some mathematical thinking skills that are really important for children to develop and learn how to use.*

In this Set Challenge, we want you to explore and investigate these mathematical thinking skills by:

- Finding out what each one is and creating a multimedia definition that other children will understand
- Research why each skill is important to thinking and acting like a mathematician
- Give at least one example of each skill in action in your life (school life or home life)
- Developing a presentation (eg: letter, email, video) for your next teacher about why they should definitely be teaching them to you in your mathematics learning sessions next year

The Mathematical thinking skills we would like you to explore are:

Reasoning	Justifying	Creating a proof
Generalising	Visualising	Conjecturing
Explaining mathematically		

**When you represent your findings the judges would like to see:**

- ❖ Your response to the first three challenges
- ❖ Your presentation to your teacher for next year
- ❖ Make sure you justify and prove your thinking!

## **PMA MATHEMATICS CHALLENGE 2016**

### **SET INVESTIGATION – OPTION FIVE**

***Being an innovative mathematics thinker!***

Watch <https://www.youtube.com/watch?v=5Uh1KxcpWz0>

### **WHAT DO YOU THINK?**

In this Challenge Option, we would like you to investigate the three questions below and then share your findings and thinking with the judges.

You could present it in any way you wish – a documentary, as a graphic novel, as posters, ebooks, through an app, as a debate

#### **CHALLENGE ONE :**

What is innovation?

What skills do you need to think innovatively?

What is the difference between creativity and innovation?

Our Government is currently saying that "Innovation matters"... Do you think it does and why/why not?

#### **CHALLENGE TWO:**

What are three mathematics innovations that have changed the world?

Present your information about what they were and why you believe they were significant to the world.

#### **CHALLENGE THREE:**

Consider what you are learning at school now. Which aspects do you think are helping you become an innovative thinker and why?

Think of three ways that your teachers could change their classroom programme to help you learn how to think innovatively and include these ideas in your presentation.

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!

## **PMA MATHEMATICS CHALLENGE 2016**

### **SET INVESTIGATION - OPTION SIX**

#### ***So what is STEM and does it matter?***

### **WHAT DO YOU THINK?**

In this Challenge Option, we would like you to investigate these three questions and then share your findings and thinking with the judges.

You could present it in any way you wish - a documentary, as a graphic novel, as posters, ebooks, through an app, as a debate

#### **CHALLENGE ONE :**

What is STEM? Check out this youtube clip as a starter to your investigations.

<https://www.youtube.com/watch?v=zqB-Diy8imo>

Why are governments saying that it is important for every child in Australia to learn about STEM?

Does anyone think STEM is not a good idea? Why?

What is your personal position and why?

#### **CHALLENGE TWO:**

Why do they join these four areas together? Collect at least ten examples that demonstrate how Science, Technology, Engineering and Mathematics are connected.

#### **CHALLENGE THREE:**

Consider what you are learning at school now. Which aspects do you think are helping you learn STEM and why?

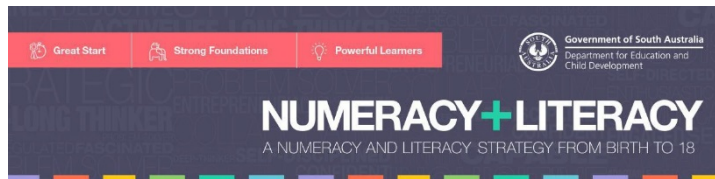
Think of three ways that your teachers could change the learning you engage in to help you learn more about STEM, and include these ideas in your presentation.

#### **When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!

## **PMA POWERFUL LEARNERS:**

### **Mathematics and Numeracy Challenge 2017**



Catholic Education SA

## **SET INVESTIGATION - OPTION ONE**

### ***"What's the cost?"***

In the last twelve months in SA there has been lots of fuss about electricity! That's because we have had several situations where we "lost" our power supply and this caused lots of issues for people in their work and home lives.

In this Challenge we would like you to investigate this issue and make some conclusions. The following statements have all appeared in the media in the last six months. Investigate at least two of the following statements and provide us with your conclusions and justifications about how valid they are.

- ❖ SA has the highest electricity prices in Australia
- ❖ SA relies too heavily on wind and solar power compared to other States and Territories in Australia
- ❖ SA families can't afford to pay their electricity bills
- ❖ SA families are not using their heaters or air conditioners as it costs too much money

**When you represent your findings the judges would like to see:**

- ❖ How you investigated the statements
- ❖ Your conclusions - to what degree was the statement accurate or not?
- ❖ The data you collected to justify your conclusions
- ❖ Based on your findings what you think about the way the media has covered this issue



## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION TWO** **"Inform and Convince"**

Our world is full of data displays! Sometimes they are infographics, sometimes they are tables, lists, graphs or visuals. They are everywhere and people use them every day to inform others and convince others of their point of view or to take action. In this Investigation we want you to find out more!

Choose at least four of the following Challenges to investigate:

- In a typical day would a child see and use more infographics, or more numerical data, or more visual data or more graphical data? Is the answer to this question different for children of different ages? Is it different for an adult?
- Which form of data display has your school used most this year to inform and convince members of your community? How do you know? Why do you think they made this decision?
- If you were going to "inform" someone about something, what would be the best kind of data display - an infographic, a numerical data display, a visual data display or a graphical data display? Why? Would it be the same answer if you were trying to "convince" someone about your point of view or to take action? What's your justification?
- Walk around your community and notice every data display you can find. Sort and compare the types of data display and then represent what you find to share with the judges. What were three questions you had after seeing the results?
- Think about the different data displays that people have to use at work. Which "job" do you think would have to use the most data displays? Compare at least four different jobs to justify your decision.
- Who invented each of the forms of data displays - graphical, numerical, visual, infographic? When, where and why? Investigate and develop the "Top Ten Things everyone should know about the history of data displays"
- You are going to teach other children how to read a data display. Pick one form of data display and produce a 90 second video that explains how to read this kind of data display accurately

- Create a representation of your "Day of Data" that shows all the data that you need to either read or produce over the course of a day in your life
- Choose at least three kinds of media text (newspaper, magazine - paper or online, website) and do a data audit that demonstrates and contrasts what types of data they contained. Represent your findings of the data audit in a way that clearly tells the story of what you found.

**When you represent your findings the judges would like to see your thinking and learning about:**

- Why you chose a particular challenge
- How you went about investigating it
- Your conclusions and justifications as listed within the specific Challenge

NB: If you haven't played with designing infographics before you might like to try and compare these two tools:

- Canva <https://www.canva.com/>
- Piktochart <https://piktochart.com/>

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION THREE**

**What are the best ways to learn how to be a powerful thinker and user of mathematics?**

*Teachers and researchers have spent a long time arguing about the "best" ways to help children learn and understand mathematics so that they can be powerful thinkers about and with mathematics as they use it in their world  
We think they should start by asking the experts - that's you!*

In this Investigation we want you to be an "action researcher" and investigate and compare:

- What a range of children at your site think about the way they are learning mathematics at the moment. There's a lot to think about here. What will you ask them? What would be the most efficient way to ask them? How many children do you think you would need to talk to so that you had a valid sample? Check out the procedure for "producing and using data" as one way to guide your thinking
- The advice from a range of children at your site about what teachers could do to help you understand and learn mathematics in the best way possible. It might mean ideas about how learning spaces are arranged, the timing of mathematical learning, who makes the decisions about what and how things are learnt, the type of learning experiences, who children learn with and from, where children learn the mathematics or any other aspect of how mathematics learning is designed. This should include children's advice about what teachers should:
  - Keep doing
  - Stop doing
  - Start doing

**When you represent your findings the judges would like to see:**

- ❖ Evidence of the process you used to gather your data. We would like to see evidence of all the steps you took:
  - How you framed your question
  - How you decided the most efficient way to collect your information and how you decided who to collect it from
  - How you decided to represent the information so that you could interpret and compare
  - How you interpreted the information
  - How you used your information to compare what children thought
- ❖ Your advice for the teachers

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION FOUR**

#### ***"Living a healthy life"***

***The Australian Government recently released several reports about our eating and exercise habits and they are worried that we are not leading healthy lives. What do you think?***

In this Challenge, we want you to explore and investigate these ideas

- What does being healthy mean? How do you know if you are healthy? Does healthy mean different things to different people? (different ages, different cultural backgrounds etc)
- Life expectancy is one measure the government uses of how healthy our society is. What is "life expectancy" a measure of? Has it changed in Australia over the last 20 years? How does Australia's "life expectancy" compare to other countries? Tell us five things you noticed and your thinking about these comparisons
- What are five other ways you can "measure" your healthiness?
- One thing the government is talking about doing is adding a "sugar tax" to the price of foods which have sugar in them. What do you think about this?  
How many foods would this effect? What would this do the price of your family's shopping for the week? Do you think it would help people in Australia become healthier? Present your thinking and justifications in a letter to the Prime Minister
- How could Mathematics help you lead a healthier life? Give us ten examples and explain your thinking
- Represent a timeline of a week in the life of a "healthy person"
- Compare and contrast the shopping basket of a person buying the ingredients for a healthy meal for four people, compared to an unhealthy meal. What's your conclusion - is it cheaper to buy healthy foods or unhealthy foods?

**When you represent your findings the judges would like to see your thinking and learning about:**

- How you went about investigating each aspect of this Challenge
- Your conclusions and justifications as listed within each question

## PMA MATHEMATICS CHALLENGE 2017

### SET INVESTIGATION – OPTION FIVE

#### *Using infographics to tell your story*

In this Investigation the judges would like to see your thinking and conclusions about the questions in bold below.

The New Royal Adelaide Hospital is opening later this year. Check out some information about it below

<http://www.sahealth.sa.gov.au/wps/wcm/connect/63aedef80404e16aebb79fbdeb8488407/New+RAH+quick+facts+inforgraphic.pdf?MOD=AJPERES&CACHEID=63aedef80404e16aebb79fbdeb8488407>

*What were three things that surprised you about this data?*

*What was one thing it got you wondering about?*

*Do you think this infographic was a powerful way to provide this information to the public? Why or why not?*

*Was the data valid? How do you know?*

*From the data provided in this infographic, how does the size of the RAH compare to the size of your school? Share with us how you investigated this and your conclusions*

This link will take you to an infographic that compares the old hospital and the new hospital

<http://www.sahealth.sa.gov.au/wps/wcm/connect/4dab2880404e175bbbaafbdeb8488407/Present+RAH+vs+new+RAH+infographic.pdf?MOD=AJPERES&CACHEID=4dab2880404e175bbbaafbdeb8488407>

*What were three things you noticed about the comparisons represented on this infographic?*

*Using technology create an infographic that compares 20 interesting facts about your school and*

- a school that your grandparents would have attended OR
- a school in another country OR
- what you think a school will be like in 2027

*Give your infographic to at least one child and one adult and design a way to gather their feedback on:*

- how powerful they thought it was in telling the story of the comparisons you made
- what they found interesting

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION SIX**

#### ***So what is STEM and does it matter?***

##### ***WHAT DO YOU THINK?***

In this Challenge Option, we would like you to investigate these three questions and then share your findings and thinking with the judges.

You could present it in any way you wish - a documentary, as a graphic novel, as posters, ebooks, through an app, as a debate

##### **CHALLENGE ONE :**

What is STEM learning? Check out this youtube clip as a starter to your investigations.

<https://www.youtube.com/watch?v=zgB-Diy8imo>

Why are governments saying that it is important for every child in Australia to learn about STEM?

Does anyone in our community think STEM is NOT a good idea? Why? How did you find out?

What is your personal position and why?

##### **CHALLENGE TWO:**

Why do they join these four areas together? Compare and contrast:

- what mathematicians, scientists, engineers and users of technology do
- how mathematicians, scientists, engineers and users of technology think

##### **CHALLENGE THREE:**

Type the words "STEM activities" into a search engine and check out some of the learning ideas you find. Pick three of these that interest you and analyse each one using the questions below:

- Do they meet your definition of STEM from Challenge One?
- Do the learning ideas help you think like a mathematician, a scientist, an engineer and a technologist at the same time?
- Do the learning ideas just let you practice things you already know and can do, or do they make you learn new things as part of working with this idea?

Select what you think is the "best" example of a STEM investigation and tell us why you think it is the best.

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the questions mentioned in the challenge
- ❖ Make sure you justify and prove your thinking!

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION SEVEN**

#### ***Roads, Roads, Everywhere...***

The RAA (Royal Automobile Association) is very worried about the condition of the roads in SA.

<http://www.raa.com.au/community-and-advocacy/media-releases/1184>

**What are the roads like in the area where you live?**

**One of the challenges is that we just have so many roads to try and look after.**

**I wonder just how many kms of roads we do have...**

In this Challenge Option we would like you to explore and investigate :

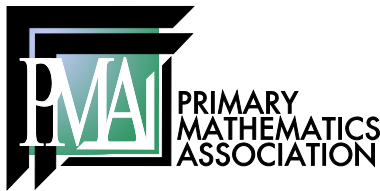
- How many kilometres of road are in your suburb or town? How do you know?  
What would your evidence be?
- Who is responsible for maintaining those roads?
- How long does it take for one kilometre of road to be repaired? How much does it cost? What do they use to resurface a road? What quantity of material is needed to resurface a road?
- Does it cost more/take more time to maintain a road in the city or in the country?
- So what does this mean for how long it would take to look after the roads in your suburb or town? What would it mean for the cost of maintaining your roads?
- Investigate your local area to determine which road you think is a priority for repair. Justify your conclusion

**The judges would like to read/view all about how you investigated these ideas.**

**Make sure you also share your conclusions and justifications with us!**

**The last step is to write to the person responsible for maintaining that road to let them know what you found and include a copy of your correspondence with your Challenge entry**





## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION EIGHT**

#### ***Critical and Creative Thinking in Mathematics***

In Australian Curriculum (the list of what every child in Australia is entitled to learn), it tells us that learning to think critically and creatively is an important capability for every child to learn.

In this Challenge Option we would like you to explore and investigate the following ideas. The judges would like to see your evidence of the aspects listed in bold text.

Brainstorm and record what you think each of these ideas is:

- Thinking creatively
- Thinking critically

Now go and check out what's on the Australian Curriculum list for your level of schooling at this link:

<http://www.australiancurriculum.edu.au/generalcapabilities/critical-and-creative-thinking/continuum#layout=columns>

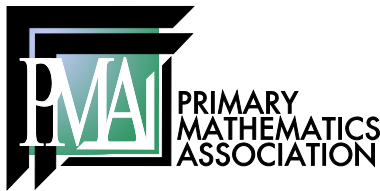
Is it what you thought it would be? **Compare and contrast your ideas and the Australian Curriculum list and tell us three things you noticed.**

Think about the mathematics learning you have been doing in your learning space:

**Represent ten examples of how you think investigating mathematical ideas could help you get even better at thinking creatively and thinking critically.**

**Make an advert (written or viewed) that would convince teachers about why they need to help you learn how to use critical and creative thinking in mathematics**





## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION NINE**

#### ***Mathematics is Fascinating!***

The discipline of Mathematics has been invented over hundreds and hundreds of years by mathematicians all over the world. (sometimes people argue over whether it was invented or discovered!)

One definition of mathematics says that it is the science of patterns, rules and relationships, and that we look for those patterns, rules and relationship as we explore and use quantities, size, location, data, shapes and transformations

**What aspects of mathematics fascinate you? What mathematics do you wonder about?**

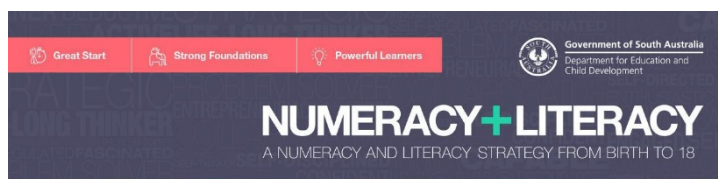
**Choose at least three different aspects of mathematics that you are curious about and explore:**

- What it is and how it works?
- What are the patterns and relationships that help you think powerfully about this aspect of mathematics?
- Who invented it? Where did the idea come from?
- In English there are some aspects we use every day like talking with each other and listening to each other but there are other parts like being fascinated with authors from the past that we explore just for fun and to expand our ideas.

Is the aspect of mathematics you are exploring something we use in our lives or something we can explore for fun and to expand our ideas? If it is something we use in our lives, when and where do we use it?

- What are three questions you are still curious about in relation to this aspect of mathematics?

**The judges look forward to reading/viewing your responses to each of these questions.**

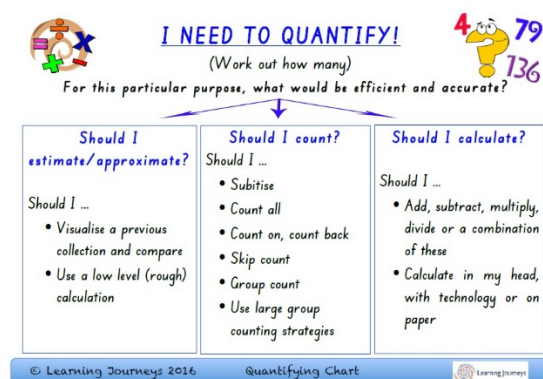


## SET INVESTIGATION - OPTION TEN

### "Does Calculating Matter?"

In Mathematics there are a number of "procedures" (Thinking Questions) which can provide a thinking framework for how to resolve mathematical situations. We use one of these Procedures when we want to quantify something - when we want to work out how many.

Have a look at the poster below. (there is a larger copy on the last page of this booklet) It provides one way of exploring the decisions we need to make when we are quantifying



So the Thinking Questions help me understand that when I need to work out how many I need to ask myself a series of questions to make some decisions about which kind of quantifying strategy is going to be most efficient and provide the level of accuracy required for the particular purpose. For example: I need to calculate the cost of a Learning Excursion per person. This is definitely a quantifying situation...

How accurate do I need to be?	Very accurate because it is about what we are going to charge people
For this purpose should I estimate/approximate, count or calculate.	Well I can't estimate/approximate because I have to give each family an exact cost. I need to combine and share quantities so it will need to be calculating not counting
Should I add, subtract, multiply or divide	I will need to add the costs together and then divide by the number attending
Should I do it in my head, on paper or with technology	There are more than twenty items, large quantities and high level of accuracy required - technology

In this Challenge we would like you to investigate a range of aspects of Calculating so that you can develop a better understanding of when, why and how it works.

**In this investigation we would like you to explore and document your thinking and learning about EACH of the following questions:**

- When do you use each quantifying strategy in your own life?  
(estimate/approximate/count/calculate) Which strategy do you use most and why?
- We now want you to focus in on the "calculating strategies". Collect data and then provide us with a report which answers the following questions AND gives us your theories about why you got the responses you did.
  - What kind of calculations (+-x÷) do people use most in their lives?
  - Why do people need to calculate?
  - When do people need to calculate?
  - Do people use mental, written or technological calculation most in their lives?
- In the Australian Curriculum: Mathematics, it says that children at different year levels are entitled to learn how to "recall facts"
  - *In Reception it is about recalling the partition facts to 10 (e.g. 9 and 1 is 10, 8 and 2 is ten)*
  - *In Year 3 and Year 4 child it is about "recalling the addition and related Subtraction facts" (e.g.:  $2+1=3$ ,  $1+2=3$ ,  $3-1=2$ ,  $3-2=1$ ) and "recalling the Multiplication and related Division facts" (e.g.:  $3\times 2=6$ ,  $2\times 3=6$ ,  $6\div 3=2$ ,  $6\div 2=3$ )*

Do you think it's important to have recall of facts in today's world?

Present your theory and data to back up your ideas. You may like to collect data from other people to support your argument!

**When you represent your findings the judges would like to see:**

- ❖ Your response to each question
- ❖ The learning evidence you gathered along the way
- ❖ The data you collected to justify your conclusions
- ❖ Make sure you show us your reasoning for your theories!

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION ELEVEN** **"Mathematics matters"**

For this Investigation you are going to need to think like an author as well as a mathematician!

**Your challenge is to produce an advertisement.**

It can be for any communication medium - for TV or You Tube, for the web - video or static, print - magazine or newspaper, or for social media platforms like Twitter, Instagram or SnapChat

There are two options about the "message" you are advertising. Your ad either needs to:

- Convince children that becoming a powerful mathematical thinker matters
- OR
- Explains what mathematics is and why it matters

Once your advert is produced we would like you to trial it out on a sample group and gather some feedback

**When you represent your findings the judges would like to see your thinking and learning about:**

- A copy of your advert
- A description about how you decided what would be the most powerful ways to convey the message and why you chose the particular communication platform
- A report on how your trial of the ad went, who you asked, how many and why AND the feedback you received
- Based on the feedback you received what would you change if you were making the advert again

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION TWELVE**

#### **How big is big?**

*Size is a really important part of our lives. Just think about how often in your day you have to explore, use or describe the size of something.*

In this Investigation we want you to explore and investigate size in three different ways. **The judges will be looking to see your thinking and learning about each of the questions listed.**

- 1) **Who invented the way we work out the size of things?** In Australia we have the National Measurement Institute that decides the rules for how we measure things. Across the world we have the "International Bureau of Measurement" in France that makes rules about how we measure things across the world. Spend some time exploring their websites and resources and then provide us with a report:
- on five things you learnt about measuring
  - three things it has you wondering about

National Measurement Institute

<http://measurement.gov.au/Pages/default.aspx>

There is also a branch of the Institute in Adelaide in Edwardstown if you wanted to visit or give them a call.

"Bureau International des Poids et Mesures"

<http://www.bipm.org/en/worldwide-metrology/metre-convention/> It is definitely worth checking out the "international prototype of a kilogram" - very cool! <http://www.bipm.org/en/bipm/mass/ipk/> And it is about to be replaced - did you see by what?

- 2) When someone says "the blue one is bigger than the red one" - what do they mean? **Is there only one kind of big?**

When we say something is big, we are usually paying attention to a particular measurable attribute, for example its height or its mass or its volume.

We would like you to investigate and document:

- How many different measurable attributes are there?
- What are they and how do they work?

- When was each one invented? Are they still inventing them?
- When do we use each of those measurable attributes in our life?
- What kinds of measuring tools or strategies do we have to help us measure each one?

We would like you to present the information about the measurable attributes in the most efficient way which will allow you to compare and contrast the attributes.

3) We would like you to explore the idea of "actual size" **through ONE** of these options...

You could have a read of one of the picture books that focus on "actual size". Here are some below for you to check out. If you don't have the book, check out one of them on You Tube [https://www.youtube.com/watch?v=imPT5A\\_C8hI](https://www.youtube.com/watch?v=imPT5A_C8hI)  
Then your challenge is to produce one of your own!



By Steve Jenkins



By Toyofumi Fukuda

OR perhaps you would like to explore "actual size in another way? This website allows you to compare the "actual size" of countries in the world by clicking and dragging them on top of each other to compare. **Then your challenge is to prepare an infographic that shows us what you found.**

[http://thetruesize.com/#?borders=1~!MTMzODg2NTQ.MTgwNTY5Ng\\*MTA3NDM4NTk\(MTU5NDY5ODQ~!CONTIGUOUS\\_US\\*MTAwMjQwNzU.MjUwMjM1MTc\(MTc1\)MA~!IN\\*NTI2NDA1MQ.Nzg2MzQyMQ\)MQ~!CN\\*MTAwODEwNzk.NzM4MTE5OQ\(MjI1\)Mg~!AU\\*NTIyMzU.ODk4Nzk2Nw\)Mw](http://thetruesize.com/#?borders=1~!MTMzODg2NTQ.MTgwNTY5Ng*MTA3NDM4NTk(MTU5NDY5ODQ~!CONTIGUOUS_US*MTAwMjQwNzU.MjUwMjM1MTc(MTc1)MA~!IN*NTI2NDA1MQ.Nzg2MzQyMQ)MQ~!CN*MTAwODEwNzk.NzM4MTE5OQ(MjI1)Mg~!AU*NTIyMzU.ODk4Nzk2Nw)Mw)

OR perhaps you would like to explore "actual size" by looking at some infographics about the size of something.

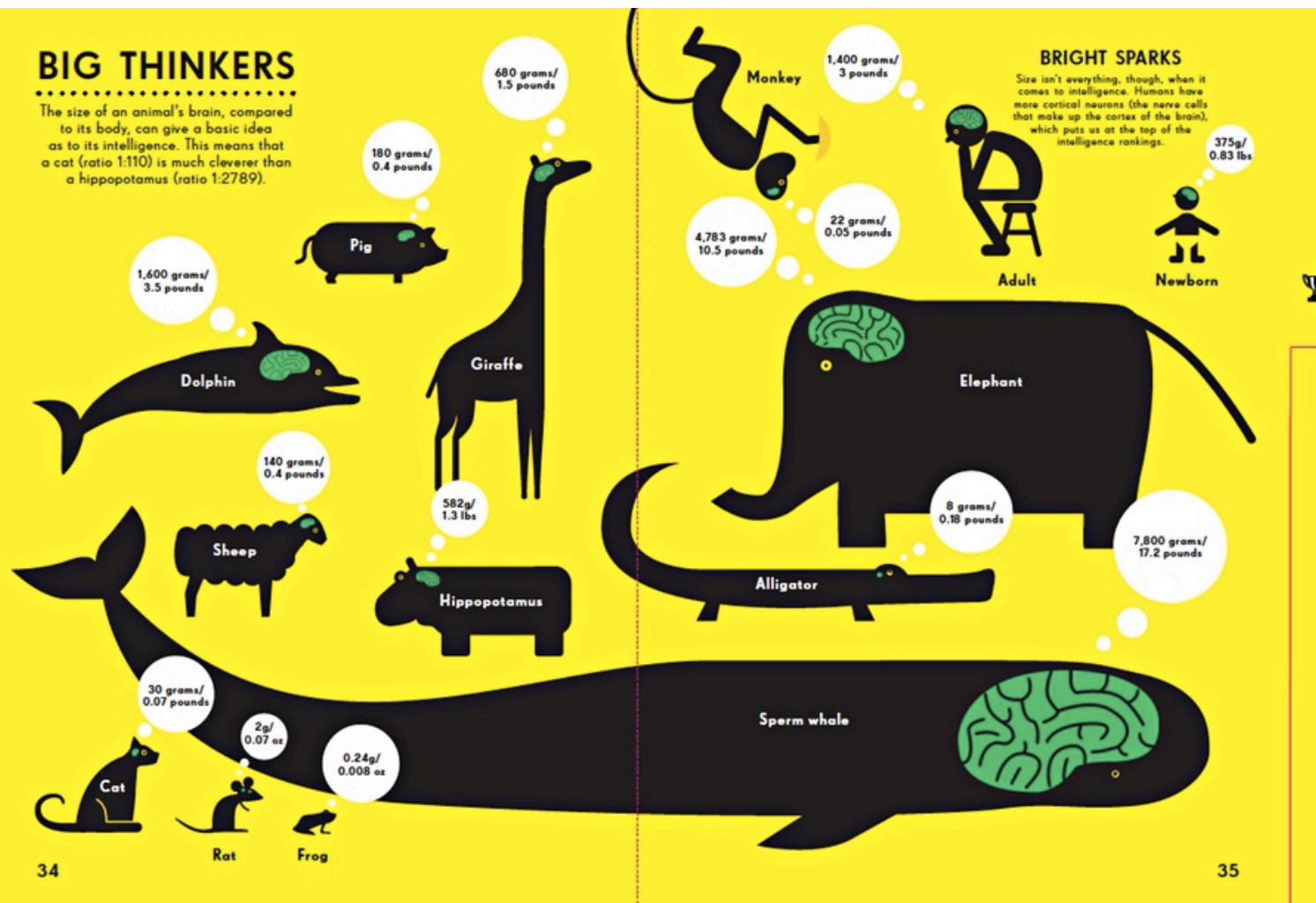
Check out the one on the next page about the size of an animal's brain!

**Then your challenge is to prepare your own infographic about SIZE!**



## BIG THINKERS

The size of an animal's brain, compared to its body, can give a basic idea as to its intelligence. This means that a cat (ratio 1:110) is much cleverer than a hippopotamus (ratio 1:2789).



## BRIGHT SPARKS

Size isn't everything, though, when it comes to intelligence. Humans have more cortical neurons (the nerve cells that make up the cortex of the brain), which puts us at the top of the intelligence rankings.

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION - OPTION THIRTEEN** ***"Who was the most important mathematician and why?"***

***Was Mathematics discovered or invented? Did they "dig it up" or "make it up"?***

***This is something that lots of mathematicians have argued about over a very long period of time!***

In this Investigation the first challenge is to do your own research about this matter and then communicate your findings in a powerful way. **When you represent your findings the judges will be able to see your theory about whether you think they "dug it up" or "made it up" and your reasoning for the response you chose.**

The second challenge within this Investigation is to tell us who you think has been the most important mathematician in history and why. **When you represent your findings the judges would like to be able to see:**

- Which Mathematicians you considered and investigated
- Your theory and reasoning e.g.: which Mathematician is the most important and why
- A description of what your Mathematician achieved



## PMA MATHEMATICS CHALLENGE 2017

### SET INVESTIGATION - OPTION FOURTEEN

#### *Reflecting on Symmetry*

Symmetry is a key idea in Mathematics. We want you to explore it and investigate some key questions. Your entry will include your response to each of the questions below. Make sure you think about how you can most powerfully communicate these ideas to the judges and everyone else around the State who is interested in your mathematical thinking and ideas!

- **First of all**, start by sharing with us what you currently know and are wondering about? What do you already know about symmetry and what are you curious about?
- **Then investigate**...What is the definition of "symmetry" in mathematics? What does it mean?

*Then choose at least two of the following questions to explore and represent. For the questions you choose you need to include information about:*

- *Why you chose this question*
- *What you did to investigate it*
- *What you found*
- *What you are still wondering about*

1. Investigate 10 places that we use symmetry in our lives
2. How does symmetry work with Numbers?
3. How does symmetry work with 2D shapes and 3D objects?
4. How does symmetry work with transformations?
5. How does symmetry work with data?
6. Investigate and find at least three jobs that use "symmetry" as part of their work lives. Could they do these jobs without symmetry? Why/ Why not?
7. The golden ratio is one version of symmetry that people often use to define beauty. What is it and how does it work? Do you agree? Check out this article as one example <http://www.thisisinsider.com/golden-ratio-beauty-handsome-george-clooney-2017-7>

8. "Symmetry is an important aspect of Art" Do you believe this statement is true or not? Do some investigating and tell us what you think and your reasoning about why. Check out the Symmetry Artist at

<https://www.mathsisfun.com/geometry/symmetry-artist.html>

9. Choose five pieces of Artwork from different artists that use Symmetry and explain the symmetry from a "mathematicians" point of view

10. There are lots of symmetry challenges online. Here are just a few links...your challenge is to investigate these (and others you can find) and choose the one to share that you think would really help children in your class learn about how symmetry works. Make sure you tell us:

- What are the three key things you think children need to learn about symmetry
- Which learning experience you chose that you think helps with this best
- How that learning experience works and why you think it would be the best learning tool.

<https://nrich.maths.org/public/search.php?search=symmetry+stage+1>

<https://www.youcubed.org/?s=symmetry>

<http://www.resolve.edu.au/year-5-frieze->

[patterns?fromexplorerresources=true&search\\_api\\_views\\_fulltext=symmetry&edit-submit-explore-resources=Apply](patterns?fromexplorerresources=true&search_api_views_fulltext=symmetry&edit-submit-explore-resources=Apply)

<https://au.pinterest.com/explore/symmetry-activities/>

11. Where does symmetry exist in nature? Explore ten examples and share with us where, what and how they worked

**When you represent your findings the judges would like to see:**

- ❖ Your thinking about each of the first two questions mentioned in the challenge
- ❖ Your thinking about at least two of the "choice" questions about symmetry
- ❖ As you represent your learning, make sure you justify and prove your thinking!

## **PMA MATHEMATICS CHALLENGE 2017**

### **SET INVESTIGATION – OPTION FIFTEEN**

### *Let's Build it!*

*South Australia has some amazing architects who are using their mathematical thinking to use shape creatively and innovatively to design spectacular buildings. For example have you seen these two?*

- The **d'Arenberg Cube** in McLaren Vale check it out at <http://www.darenberg.com.au/cube/>



- The **SAMHRI** building on North Terrace check it out at <https://www.sahmri.org/building-information/>



In this Challenge **for the first part of the Investigation** we would like you to compare and contrast the way in which the architects and builders have used different shapes to design and build five different buildings:

- The d'Arenberg Cube in McLaren Vale
- The SAMHRI building on North Terrace
- One of the buildings at your school
- Your home
- One other interesting building of your choice (could be located anywhere in the world!)

Present your comparisons and analysis in a way that makes it easy for the reader to compare the buildings and to learn about:

- The types of shapes that were used in the buildings and why
- How the choice of shape affected the way the building looked at the end
- Did the choice of shape affect the cost?
- Does the choice of shapes affect whether people "like" the building?

**In the second part of this Challenge**, you are to be an architect of the future! We want you to design a new building which will be built on North Terrace to hold a Mathematics museum. Do your design and then create the 3D model. We can't wait to see what you come up with.

**In your Investigation evidence the judges will be looking to see:**

- ❖ Your comparisons of the five buildings which show your responses to the four questions
- ❖ Your design for your own building and an explanation of why you used the shapes you did
- ❖ Your model of your own building

## PMA MATHEMATICS CHALLENGE 2017

### SET INVESTIGATION - OPTION SIXTEEN

#### *Which shape doesn't belong?*

Do you know how to classify shapes? How do mathematicians think about shapes when they are exploring and using them?

It's interesting...at school we sometimes talk about "this is a circle", but if we were talking like mathematicians we would more accurately say "This shape meets the rules for a circle...so it is a circle!"

In this Challenge Option we want you to explore "what makes a shape a shape?"

In the first part of the investigation we would like you to gather together a collection of 1D (one dimensional), 2D (2 dimensional) and 3D (three dimensional) lines, shapes and objects and then explore the PMA Shape Classification Chart to see the range of ways in which you might be able to sort, organise and classify your collection.

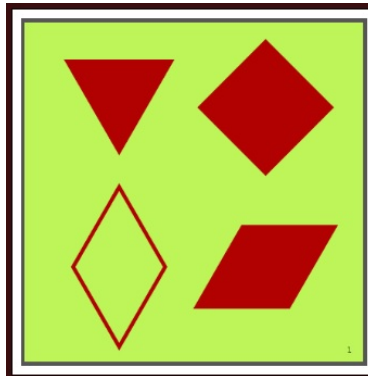
In the second part of the investigation we would like you to explore the ideas that are presented in a fantastic Mathematics book called "Which shape doesn't belong?" by Christopher Danielson



This book is designed to get us thinking about the attributes of shapes and what we can notice about them.

He presents a few of the pages on one of his blogs which can be found at <http://matharguments180.blogspot.com.au/2015/01/387-which-shape-doesnt-belong.html>

Here is one example



Remember the purpose of this book is get us thinking powerfully about shapes - that is not worrying so much about their names but exploring and comparing their attributes. That is really thinking and exploring the exactly what it is that makes them part of a particular family(ies) of shapes.

**The fantastic thing about these pages is that there is NO RIGHT ANSWER! You can use what you notice to justify and reason in lots of different ways.**

Have a look at this webpage where they have taken Mr Danielson's ideas and then encouraged a whole range of people to make up their own pages of which shape doesn't belong. Check it out at:

<http://wodb.ca/shapes.html>

### **SO - NOW IT'S UP TO YOU!**

We would like you to make your own "Which Shape Doesn't Belong" book. It can either be a digital or paper text, but needs to include at least "six pages".

Once you have produced your book, you need to share it with at least three other learners to see who they think and learn with it.

**In your Investigation evidence the judges will be looking to see:**

- ❖ Your definition of what "dimension" means and why it is important for classifying shapes
- ❖ Five things you noticed when you used the PMA Shape Classification Chart that you didn't know before and why you found these particular things interesting
- ❖ Your "Which Shape Doesn't Belong" book
- ❖ The feedback you gathered from three learners about your book and your reflections on what you would change about your book to make it an even better learning tool for others.

*NB: You can access the Shape Classification Chart from the PMA website at <https://primarymaths.wixsite.com/pmasa/learner-activities-programme> or you can access an A1 paper copy by calling Deb on 8182 3288*

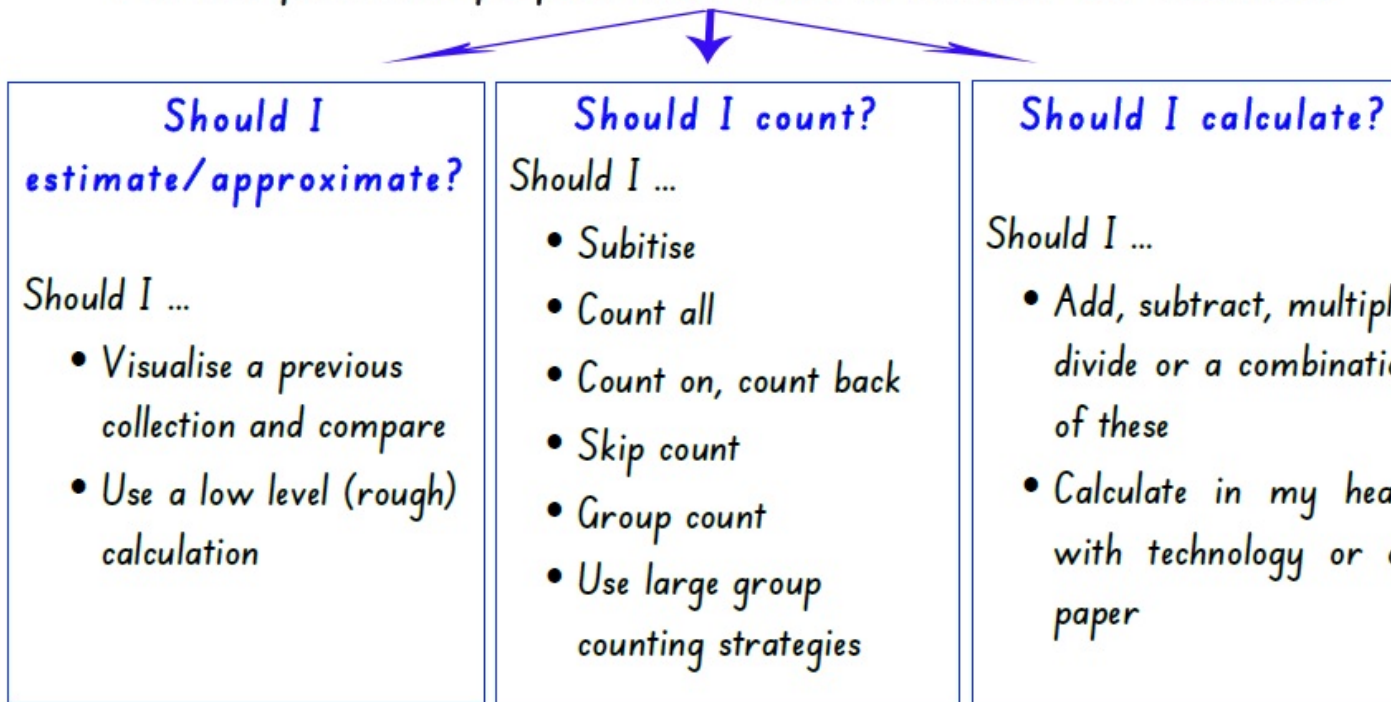


# I NEED TO QUANTIFY!

(Work out how many)



For this particular purpose, what would be efficient and accurate?





## SET INVESTIGATION – **OPTION ONE**

### *"Building our Number Sense"*

*At the moment there are several # that are going crazy for mathematics learners. In this Set Investigation we are asking you to take on the challenge of exploring at least two of the ideas below.*

- **Option one** is **#unit chats** where your challenge will be to design some images that will make people wonder about "how many". The person who started this has also written a new book called "how many" by Christopher Danielson. Your learning challenge will be to make one of your own. Check out what we mean at the #unitchats or at <https://mathforlove.com/lesson/unit-chats/>
- **Option two** is **#fraction talks**. Again your challenge is to create some fraction images that would get people talking. Check out these examples at <http://www.fractiontalks.com/> <https://mathforlove.com/lesson/fraction-talks/>
- **Option three** is **"would you rather math"** In this game they give you two choices and you have to decide which one is the best option. Your challenge is to design some for other learners. Check some out at <http://www.wouldyourathermath.com/>

In each option you need to test out the images you develop with at least three other learners and document what they say and if it helped them learn more about your learning intention

***When you represent your findings the judges would like to see your thinking and learning about:***

- *How you went about investigating the two options you chose for this Challenge*
  - *The images you created*
  - *What happened when you tested them out with your peers*
- *How you would change/develop your images further to make them provoke even more mathematics learning*
- *Your thoughts about whether these are useful learning strategies for teachers to use - do they help learners understand quantifying and fractions?*



## SET INVESTIGATION - OPTION TWO

### "Eat well for less"

*This term there has been a new TV show about how much money people spend on food shopping. On the programme they said that a typical family in Australia spends \$13 000 a year on food.*

*Do you think this could be right?*

In the **first part** of this challenge we would like you to investigate the cost of feeding a family in Australia. We would like you to investigate at least two of the following questions:

- Is the cost the same in each State and Territory?
- Is the cost the same if you live in the country, in remote areas or in a metropolitan location?
- Does the cultural background of the family affect how much money it costs per year?
- What are the five biggest factors that impact on the cost of feeding a family for a year?
- What would be the minimum and maximum costs you could achieve over one year?

In the **second part** of this challenge we would like you to create a way of "teaching" people how to be "better shoppers and budgetters"! Your imagination is the only barrier!

In the **third part** of this challenge we would like you to explore the following question: "Does mathematics help you be a better shopper?"

**When you represent your findings, the judges would like to see your thinking and learning about:**

- How you went about investigating each aspect of this Challenge
- What you found out in relation to each of the key questions in the 1<sup>st</sup> part of this Challenge and what you are thinking about this now
  - The mathematics you had to use to investigate these questions
    - Your "teaching tool" (part 2)
- Your conclusion and justifications for the 3<sup>rd</sup> part of the challenge

## SET INVESTIGATION -

### OPTION THREE

### *"Entrepreneurs and Mathematics"*

In South Australia we have a new government and a new Education Minister, Hon Mr John Gardner MP. One of the things that he and his government are passionate about is helping young people be and become an entrepreneur. So, what does this really mean?

In the **first part** of this Challenge we would like you to be a researcher and investigate:

- What is an entrepreneur? Share with us two examples of people who you think match your understanding of an entrepreneur and whom you admire. (remember to tell us why you admire them!)
- What skills, knowledge and dispositions does an entrepreneur need to be successful
- **Do entrepreneur's need to think like mathematicians to be the best they can be? If so, how?**

Now you know more about what an entrepreneur is...in the **second part** of this Challenge we want to know whether you agree with our Minister. Is becoming an entrepreneur an important part of what you should be learning at school? Share your idea and your justifications.

In the **third part** of this Challenge we want you to explore your year level list of "learning" from the Australian Curriculum (the list of what every child in Australia is entitled to learn). You will need to look at the Learning Areas/Subjects list as well as the General Capabilities list of everything you are entitled to learn.

We want you to share with us what you find. Is the Australian Curriculum helping you learn how to be an entrepreneur? What is your opinion? Remember to justify your opinion.

In the **fourth part** of this Challenge we want you to explore a mathematics educator.

Eddie Woo is a mathematics teacher and the 2018 Australia Day Local Hero. Check out his citation at the bottom of this link <https://www.australianoftheyear.org.au/2018-award-recipients/>

Eddie runs a you tube channel called WooTube. Check it out at the following link

[https://www.youtube.com/channel/UCqOEGvLTyy-LLT1oUSO\\_0FQ](https://www.youtube.com/channel/UCqOEGvLTyy-LLT1oUSO_0FQ)

Does Eddie meet your definition of an entrepreneur? Justify your thinking...

In the **fifth part** of this Challenge we want you to explore just who can be entrepreneurs.

Sometimes people talk about it as if entrepreneurship is only something you can demonstrate as an adult.

Check out this newspaper article for some amazing young entrepreneurs.

<https://www.adelaidenow.com.au/business/work/australias-top-25-rising-stars-revealed-celebrating-our-amazing-kids-and-teens/news-story/f28207962929aa8605e4ab201a55487e>

Do these young people meet your definition of an entrepreneur? Justify your thinking...

In the **sixth and final part** of this Challenge...

Make an advert (written or viewed) that would convince teachers about why they need to help you learn how to use entrepreneurial thinking in mathematics.

Test it out on three teachers at your learning place and include their responses in your Challenge learning evidence.

**When you represent your findings, the judges would like to see your thinking and learning about:**

- How you went about investigating each of the six parts of this Challenge
- Your responses and justifications for each of the questions listed in each of the six parts of this Challenge
  - Your advert
- The responses of the three teachers to your "entrepreneur" advert

## **SET INVESTIGATION – OPTION **FOUR****

### **What kind of “big” is the most important?**

*When you say something is “big” or “small” you always have to know what measurable attribute you are referring to if you want to be able to convince others about what you are thinking and saying.*

*For example – “if I say my pool is bigger than yours”, which measurable attribute do I mean? Do I mean it is deeper (linear – depth), larger perimeter (perimeter), warmer (temperature), holds more (capacity) or is longer (linear –length)? There are **LOTS** of different kinds of **BIG**!*

In this Investigation we want you to explore and investigate the three questions below. The judges will be looking to see your thinking and learning about each of the questions listed.

**1) What ARE all the measurable attributes?**

What are they and how do they work?

What kinds of measuring tools or strategies do we have to help us measure each one?

We would like you to present the information about the measurable attributes in the most efficient way that allows you to compare and contrast the attributes.

**2) Are there different measurable attributes** depending on whether you are thinking like a mathematician, a scientist or a musician or an artist or a chef or ?????  
Are the measurable attributes always named, defined and used in the same way?

**3) The third part of the investigation is to explore which measurable attributes people use most in their everyday life** and then create a range of data displays that powerfully show what you found out!

**SET INVESTIGATION - OPTION FIVE****"Who uses the most mathematics in their work lives?"**

For this Investigation you are going to need to think like a researcher as well as like a mathematician!

Your challenge is to compare and contrast the mathematics that a range of "workers" use in their work lives so that you can crown someone the "Champion of Mathematics"!

In this investigation you need to get started by thinking like a researcher and **choosing ten different careers/jobs** that you want to compare and contrast. Your challenge is then to investigate what mathematics they need to use to be successful in that job.

Then you need to think like a mathematician to make some decisions about how to display what you have found in the most powerful way.

You need to **create some form of data display** which will compare and contrast the type and amount of mathematics each job uses.

How will you **decide who is the "Champion of Mathematics at Work"**? Will it be the person who uses the most amount of mathematics or the person who uses the most different kinds of mathematics (from the different sections of mathematics like Measurement, Geometry, Number, Data, Algebra)?

**When you represent your findings the judges would like to see your thinking and learning about:**

- Who is your "Champion of Mathematics at Work" and your justification for choosing them
  - Your data display and the raw data that you used to create it
  - Your reflections in your report about what you did and how it went
  - Did your findings surprise you? Why? Why not?

## SET INVESTIGATION - OPTION **SIX**

### "Mathematicians make a difference"

**Mathematicians are all around us every day, everywhere...changing our lives for the better!**

**What do you think when you read the sentence above? Do you agree or disagree?  
What leads you to have this opinion currently?**

In this investigation we want you to investigate this statement further...

Your **first challenge** is to find out what at least twenty other people think about this question. When you are designing the collecting process you will need to make sure the sample is diverse and representative. When you have the raw data, your next step is to create a data display which clearly shows what you found.

Your **second challenge** is to identify five mathematicians in our State and then to begin investigating what they do and if they make a difference to our lives.

If you are not sure what mathematicians do, you might like to investigate the following resources from AMSI (Australian Mathematical Sciences Institute)

Check out the choose maths "Career ambassadors" <https://choosemaths.org.au/careers/>

A list of all the jobs advertised for mathematicians

<https://mathsadds.amsi.org.au/> [https://amsi.org.au/publications\\_category/publications/maths-adds-pub/](https://amsi.org.au/publications_category/publications/maths-adds-pub/)

Or - check out these "maths take you places" posters to see all kinds of "mathematicians" at work from coders, to sports statisticians to marine and climate scientists to chefs to motor mechanics

[https://mathsadds.amsi.org.au/publications\\_category/publications/posters/](https://mathsadds.amsi.org.au/publications_category/publications/posters/)

Or check out this link which has all the mathematics jobs advertised in SA in the last month

<https://au.indeed.com/Mathematics-jobs-in-South-Australia?vjk=d5490deaf0085ed9>

Have a look at this link which has one of our SA mathematicians (Amie Albrecht) talking about how they used mathematics to save energy on trains [https://youtu.be/yGzVEKT\\_Im4](https://youtu.be/yGzVEKT_Im4)

So now you have investigated the lives of 5 mathematicians what do you think now?

Do mathematicians change our lives for the better every day or not?

Your **final challenge** in this Investigation is to make a 90 second video presentation which tells us your opinion (mathematicians do make a difference / don't make a difference in our lives) and convince us you are right!

Show your video to at least five of the people you collected data from originally and see if your video can convince them to agree with you!

**When you represent your findings the judges would like to see your thinking and learning about:**

- Your original data collection process and your data display. Make sure you show us your thinking about your sample, and your choice of data display as well as your interpretation of what it showed
- Which five mathematicians you investigated and what you found out. Why did you choose these particular people?
  - Your video presentation
  - Your reflections in your report about what you did and how it went
  - Did you change or keep your original opinion?
- How did your "five people" respond when you showed them your video clip?

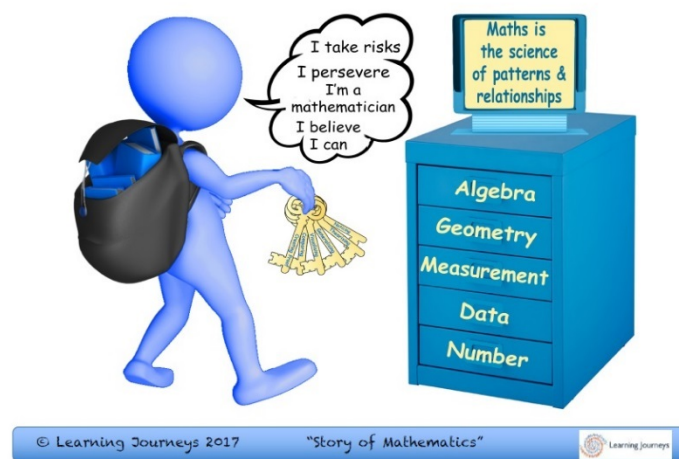
## SET INVESTIGATION – OPTION **SEVEN**

### “Mathematics is NOT just numbers!”

So many people think mathematics is just about numbers – it is definitely NOT! That would be like saying communicating is just about the alphabet.

When they invented mathematics (they started a long time ago and keep inventing more everyday) they organized it into different sections so that people could easily explore and understand it. Today when we look at how the mathematics learning is organized in schools there are five different aspects of mathematics.

What do you think the five aspects of mathematics are?  
Check out this poster and see if you agree



In this investigation your job is to investigate **how many people know all five aspects of mathematics are important?** Can they name them? Do they think they are all important? Why, why not? Do they think its important to help children learn about and be powerful with all five aspects?

For this investigation you will need to consider the six “thinking questions” that help us produce and use data for a purpose (It is also attached as a poster on the next page for you)

- **Frame your question(s)** What are you trying to find out? How does this question need to be framed to really get the information you are after?
- **Collect your data.** This means thinking about how you will collect it most efficiently (online



survey tools like Survey Monkey or Zoomerang, paper surveys, oral surveys, checklists, observation sheets) and also how much data (how many people to ask, how much information to collect) to make sure your data is valid

- **Sort and organize your data.** Remember the way you choose to collect the information will really determine how easy it is to be able to sort and organize the information!
- **Do I need to represent the data to share with others?** In this challenge you definitely do as you are trying to share your findings with the judges. So the important question becomes **"which form of representation or data display will best tell the story of this data and show us what your survey participants thought about this question.** Remember it is usually best to use technology like Excel or Numbers or an infographic maker to help you do this because you can quickly flip between different representations to make the decision about which data display is best (eg: does the column graph or the donut or the scatter plot convey the message more clearly, is this graph mathematically appropriate for this data set)
- **Interpret the data.** What "story" does the data tell? What questions does it raise?
- **Act upon the data.** We usually collect data for a particular purpose - to use it, because nobody in their real lives just collects data for no reason! That's exactly what you are doing? You are using your data to inform and influence other people!

***So - now its time to get started!***

<b>When you represent your findings the judges would like to see your thinking and learning about:</b>
<ul style="list-style-type: none"><li>- Whether you knew all five aspects of mathematics at the beginning?</li><li>- What you did and what you found when you followed the six thinking questions for producing and using data<ul style="list-style-type: none"><li>- Your data displays</li><li>- Your justification for why you chose this particular form of data display</li></ul></li><li>- Your interpretation of the data - what did it show? Did most people know all five aspects? Did they think all five were equally important?</li><li>- What actions do you think we would need to take now we know this data?</li></ul>



# "I need to produce and use data!"



Why do I need to produce and use data? What's my purpose?

**Framing the Question(s) – What will my question(s) be?**

What purpose do I want the data for?

What question(s) will ensure I get the information I need?

**Collecting – what collecting strategies will I use?**

Will I use a survey/questionnaire/observation (online/paper)/app/software or ?

How will I collect the responses?

What will be the most efficient ways of collecting the responses/information so that they are easy to organise?

**Sorting and Organising – How can the information I have been collecting be sorted and organised so that I can easily consider what it says.**

If I have been an efficient "collector" this will be much easier.

For my particular purposes, does the data need to be represented or just interpreted?

**Representing – for what purpose do I need to represent this information and who will be the audience?**

Given this context – which will be the most appropriate form of representation to get the message across?

Using technology can I quickly check out which representations are

- mathematically appropriate (eg: line graphs for continuous data not discrete data)
- most efficient (eg: do I want to show frequency, range or spread or all and if so which forms are best)
- most valid (eg: does the scale I have chosen emphasise or skew the authentic story of the data?)

**Interpreting/Reading the Data – What does my data mean? What story does it tell?**

For this context am I interested in examining the overall finding, comparisons, mean, mode, median, frequency, range, spread?

**Acting – Did my data help me achieve my purpose?**

Now I know this "story" what action should I take?

Data is collected for a purpose so how will I use what I have found out?

What have I learnt about the processes of collecting and using data?

## **SET INVESTIGATION -**

### **OPTION EIGHT**

### *"Exploring STEM"*

*STEM is a really important word in Australia right now. - everybody is talking about! So this Investigation is about digging deeper and finding out more...*

In this Challenge Option, we would like you to investigate these three questions and then share your findings and thinking with the judges.

You could present it in any way you wish - a documentary, as a graphic novel, as posters, ebooks, through an app, as a debate

#### **CHALLENGE ONE :**

Choose five different "STEM jobs" and compare and contrast the ways in which they need to...

- Think like a technologist
- Think like an engineer
- Think like a mathematician
- Think like a scientist

Choose the most powerful form of data display to represent what you find. Remember to tell us why you think the data display you chose IS the most powerful one!

Check out this list of STEM careers and jobs <http://stemaustralia.edu.au/careers.html>

Or these (although you might notice something interesting here...)

<https://careerswithstem.com.au/read-it-here/>

#### **CHALLENGE TWO:**

Are you doing a STEM learning challenge in your learning place now? If so, you could use that as the basis of your investigation OR you could type the words "STEM activities" into a search engine and check out some of the learning ideas you find there.

Either way we would like you to pick two STEM learning challenges that interest you and carry them out!

Then we would like you to analyse how the learning experience was for you:

- Did the learning ideas help you think like a mathematician, a scientist, an engineer and a technologist at the same time? In what ways? Did you have to use all four aspects of STEM in an equal way? Why/ Why not?
- Did the STEM learning ideas just let you practice things you already knew and could already do, or did they require you to learn new things as part of working with this idea?
- In our world, thinking in these four powerful ways (as a mathematician, an engineer, a scientist and a technologist) helps people to identify, resolve and explore problems and challenges in our world. What important "situation/problem/question" did the two STEM

challenges you explored help you resolve?

### **CHALLENGE THREE**

Based on your experiences, do you think STEM is an important thing to be doing? Should they be calling it STEM or just helping children become powerful technologists, mathematicians, scientists and engineers?

Write a draft letter (as an email or a videoblog) to the Minister for Education and let him know your opinion and why.

**When you represent your findings the judges would like to see:**

- ❖ Your thinking and evidence from each of the challenges.
- ❖ Your draft email/videoblog
- ❖ Make sure you justify and explain your thinking as you go!

## **SET INVESTIGATION – OPTION **NINE****

### ***"Packaging, packaging and more packaging"***

*Packaging is a hot topic right now as supermarkets all around Australia try to find ways to minimize the amount of "rubbish" caused by packaging.*

The people who design packaging have to use lots of mathematics to make it happen and in this challenge we want you to find out more about what they do.

In this Investigation there are two key parts.

The **first challenge** is to explore the packaging already in use. We want you to explore the following questions:

- What kinds of packaging are used in supermarkets?
- Which forms of packaging are most used? What are they made of? What is their design?
- Identify the top five types of packaging you saw and analyse what mathematics they would have had to use to develop each one. Make sure you use an efficient data display to powerfully tell the story of what you found out.
- Which form of packaging do you think is best from an environmental point of view? Which form of packaging do you think is best from a usability point of view? How do you know? What data do you have to back up your opinion?

In the **second part** of this Challenge we would like you to be a packaging designer. Pick one of the products from the supermarket that you explored that you thought needed "better" packaging. In your learning evidence make sure you tell us why you chose this particular product.

Then get started on your **new design** for the packaging - it needs to be cost efficient, efficient to transport and pack, and have minimum impact on the environment.

At the end we want to be able to see your design, your prototype and a display of the mathematical content and mathematical thinking you had to use to get this design job done!

**When you represent your findings the judges would like to see:**

- ❖ Your response to each of the questions listed in the Challenges
- ❖ Your new packaging design and a prototype and why you think it meets the specifications
- ❖ Your list of the mathematics you had to use to create your packaging design and prototype
- ❖ Make sure you justify and prove your thinking!

## **SET INVESTIGATION - OPTION ONE** **"RETRO SET INVESTIGATION"**

*PMA has been using Set Investigations as part of this Challenge as a tool to get you thinking and learning about mathematics since 2010. With over 50 learning challenges now contained in this resource, it's time to dip back in!*

In this Set Investigation RETRO Category, you will need to access the Set Investigations Collation 2010 to 2018 and then choose a Set Investigation that intrigues you!

The "Retro" booklet will have been sent to your Challenge Co-ordinator, however if you can't locate it - email Deb on [primarymaths@bigpond.com](mailto:primarymaths@bigpond.com) to have it sent direct to you.

*Getting started:*

- Choose a Set Investigation (all the topics are listed overleaf to help you check them out quickly!)
- Follow the challenges and guidelines as listed for the Set Investigation you have chosen
- Start investigating...

We will look forward to exploring your investigation in late October!

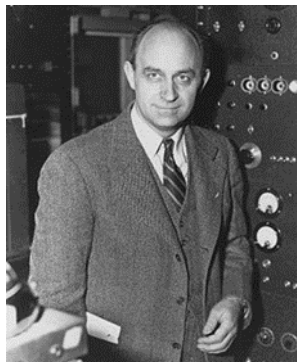
<p> Data, Data Everywhere  Finding our way  Our changing place  Mathematics, Mathematics Everywhere!  Let's measure!  How does Base Ten work?  From Paddock to Plate  Calculating, Calculating, Calculating  Wasted Water  Our Mathematical Lives  International Year of Statistics  Money, Money, Money  Mathematics and Planet Earth  Thinking Geometrically: Does it fit?  Mathematics and Sport  I want to be a powerful learner!  So what do mathematicians do?  Which shape wins?  Mathematics and Art  The Story of Mathematics  Mathematics and Work  Best mathematics invention ever!  What does scale mean?  Convincing Others  What makes a good mathematics task?  Thinking Mathematically  Being an innovative mathematics thinker!  What's the cost?  Inform and convince  What are the best ways to learn how to be a powerful thinker and user of mathematics?  Living a Healthy Life  So what is STEM and does it matter?  Roads, Roads, Everywhere...  Critical and Creative Thinking in Mathematics  Mathematics is Fascinating! </p>	<p> Does Calculating matter?  Mathematics matters!  How big is big?  Who was the most important mathematician and why?  Reflecting on Symmetry  Let's Build It!  Which shape doesn't belong?  Building our Number Sense  Eat well for less  Entrepreneurs and Mathematics  What kind of "big" is the most important?  Who uses the most mathematics in their work lives?  Mathematicians make a difference  Mathematics is not just numbers!  Exploring STEM  Packaging, Packaging and more packaging! </p>
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## SET INVESTIGATION - OPTION TWO

### "Fermi, Fermi, Everywhere!"

*Do you know about Fermi situations or problems?*



*They are a special kind of challenge named after this man Enrico Fermi. He was the first one to start thinking about these kinds of challenges and they often defined as being about "exploring maths situations where we will never know the exact answer to"*

What Fermi situations highlight is that the most important part of mathematics is not always finding the answer, instead it is about the learning adventure and about the mathematical thinking you use to develop and justify your theories about the possible resolutions.

Some examples might be:

*How many people could you fit into your classroom?*

*If all the people in your school (or suburb or town) joined hands and stretched themselves out in a straight line, how long would it reach?*

In this Investigation there are two key parts.

The **first challenge** is to explore two different Fermi situations.

This means your learning adventure would include:

- Selecting two Fermi situations
- Explore and resolve each one by developing your theory (your response to the situation) and your justifications and proofs that would support your theory

Try some of these links as sources of Fermi situations:

- <https://www.edgalaxy.com/journal/2012/5/29/an-excellent-collection-of-fermi-problems-for-your-class.html>
- [https://riverbendmath.org/modules/Fermi\\_Questions/Activity\\_Directions/](https://riverbendmath.org/modules/Fermi_Questions/Activity_Directions/)
- <http://www.physics.umd.edu/perg/fermi/fermi.htm> (the first 31)
- <https://www.teachertoolkit.co.uk/2017/04/28/fermi-questions/>

Or once you get the hang of them, you could design your own!

In the **second part** of this Challenge we would like you to compare your Fermi Situations and explore:

- Compare what aspects of mathematics(which of the five drawers of mathematics) you had to use as you resolved each Fermi situation
- Compare what kinds of mathematical thinking you had to use as you resolved each Fermi situation



- Did you have to learn any "new" mathematics or ways of thinking mathematically to resolve each Fermi situation

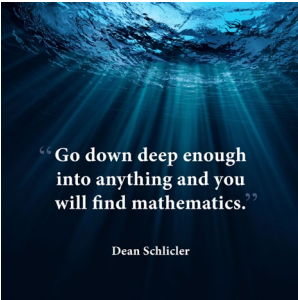
**When you represent your findings the judges would like to see:**

- ❖ The two Fermi situations you chose and an explanation of why you chose them
- ❖ Your learning evidence that shows how you resolved them
- ❖ Your theory and justifications for the two Fermi situations
- ❖ Your explorations of the comparisons of the two Fermi situations, presented in a way that makes the comparisons easy to see.

## SET INVESTIGATION – OPTION **THREE**

### *Let's hit the Mathematics Trail!*

*Do you know about Mathematics Trails? Ever been on one?*

	<p><b><i>A mathematics trail is a walk with various stops where you have to hunt for some mathematics in the world around you.</i></b></p> <p>For example, PMA has some mathematics trails that run along North Terrace in the city. One example of the questions is below...</p> <p><i>Walk to the north east corner of North Terrace and King William Street and you will find an important statue which has an animal and a person</i></p> <p><i>Explore what the statue is about and record what you find out. Your maths challenges at this stop are:</i></p> <ul style="list-style-type: none"> <li>- <i>How old could the person who made this statue be now?</i></li> <li>- <i>What would the surface area of the animal be? (Yr 3-7)</i> <ul style="list-style-type: none"> <li>- <i>Which leg is longer? (JP)</i></li> </ul> </li> <li>- <i>Would the person on the statue be taller or shorter than your teacher?</i></li> </ul>
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In this Investigation there are two key parts.

The **first challenge** is to design a mathematics trail for some other learners at your site.

This means you need to consider:

- Where ? In your school/preschool, in your suburb or at a special place of interest
- Who? Who is it for? You have to decide the audience for your mathematics trail so you can make sure the questions are appropriate and challenging for them!
- What text type will you use? Will it be a written or oral trail they follow? How do they record their responses? Through video, on paper, or?

Our only rule for your Mathematics trail is that it has to challenge the participants to play with and notice all five aspects of Mathematics (Geometry, Number, Data, Algebra and Measurement) and some of the Mathematical Thinking Skills (Noticing, Generalising, Visualising, Comparing, Reasoning, Justifying, Creating Proof)

In the **second part** of this Challenge we would like you to give your Mathematics Trail to your intended audience and get them to try it out.

Then you need to gather some data from the trail participants that will allow you to report to us about

- What they enjoyed
- What they learnt
- What didn't work and what they would like you to improve

**When you represent your findings the judges would like to see:**

- ❖ A copy of your Mathematics trail
- ❖ Some information about how you chose the place for your trail, how you went developing the trail (challenges and successes) and things you learnt while you were getting it organized.
- ❖ Some information about how you gathered the data from your participants (Remember to use the "Thinking Questions" for Producing and Using Data - see below)
- ❖ Your report on what the Participants said (remember to represent this as a mathematician, not as an author!)
- ❖ Your reflections - what mathematics did you learn, what did you learn about making mathematics trails and what would you do differently next time



# "I need to produce and use data!"



Why do I need to produce and use data? What's my purpose?

**Framing the Question(s)** – What will my question(s) be?

What purpose do I want the data for?

What question(s) will ensure I get the information I need?

**Collecting** – what collecting strategies will I use?

Will I use a survey/questionnaire/observation (online/paper)/app/software or ?

How will I collect the responses?

What will be the most efficient ways of collecting the responses/information so that they are easy to organise?

**Sorting and Organising** – How can the information I have been collecting be sorted and organised so that I can easily consider what it says.

If I have been an efficient "collector" this will be much easier.

For my particular purposes, does the data need to be represented or just interpreted?

**Representing** – for what purpose do I need to represent this information and who will be the audience?

Given this context – which will be the most appropriate form of representation to get the message across?

Using technology can I quickly check out which representations are

- mathematically appropriate (eg: line graphs for continuous data not discrete data)
- most efficient (eg: do I want to show frequency, range or spread or all and if so which forms are best)
- most valid (eg: does the scale I have chosen emphasise or skew the authentic story of the data?)

**Interpreting/Reading the Data** – What does my data mean? What story does it tell?

For this context am I interested in examining the overall finding, comparisons, mean, mode, median, frequency, range, spread?

**Acting** – Did my data help me achieve my purpose?

Now I know this "story" what action should I take?

Data is collected for a purpose so how will I use what I have found out?

What have I learnt about the processes of collecting and using data?

## SET INVESTIGATION – OPTION **FOUR**

### *Reasoning, Reasoning and more Reasoning*

In Australian Curriculum: Mathematics (the list of what every child in Australia is entitled to learn and wonder about in Mathematics), it tells us that learning how to reason in mathematics is an important capability for every child to learn.

**So what is reasoning in mathematics?**

In this Investigation there are four key parts.

The **first part of the challenge** is to investigate what reasoning means? What is the definition and how does it work? To get you started, here is what the curriculum says about it...

Analyse	Justify	Create a proof
Generalise	Infer	Evaluate
Explain	Compare and contrast	Deduce
Adapt known to the unknown		

In this **first part** of the Challenge you need to:

- Generate your own definition of reasoning
- Choose the five most important "words" of reasoning for you and your learning team (from the list above). Explain why you chose these five words and give an example of each word in action.

**It's time to get reasoning!**

Lots of mathematics educators around the world have spent time thinking about who they could get children thinking and reasoning as part of their mathematics learning adventures. **In this second part of the Challenge** we want you to explore two of them:

- Estimation 180 by Andrew Stadel <http://www.estimation180.com/days.html>
- Esti-mysteries by Steve Wyborney <https://steveWyborney.com/2018/11/esti-mysteries-estimation-meets-math-mysteries/>

Have a play with both of them and then explore these questions which are all about comparing the learning on the two websites:

- Compare the mathematics you need to use when playing on each one. Do you have to use all five aspects of mathematics? (Geometry, Measurement, Data, Number, Algebra)
- Compare the mathematical thinking you need to use when playing on each one?
- Do you have to reason when you use these two websites? What kinds of reasoning and how? Is one better at encouraging reasoning than the other?
- Both websites show the "answer estimation" at the end. Do you think this is helpful or a hindrance?
- What feedback would you give the authors of these websites? What are three things they could do to improve the learning opportunities

Represent your findings in a way that makes your comparisons easy to see.

The **third part of this Challenge is to design:**

- Two of your own Estimation 180 images
- Two of your own Esti-mysteries images

In the **fourth and final part** of this Challenge we would like you to give your own Estimation 180 and Esti-mysteries images to some other learners at your site and get them to try it out.

Then you need to gather some data that will allow you to report to us about

- What they enjoyed
- What they learnt
- What didn't work and what they would like you to improve

**When you represent your findings the judges would like to see:**

- ❖ Your definition of reasoning, your five top "reasoning" words and your five examples
- ❖ Your comparisons of the two websites that show your findings about all five questions
- ❖ The four images you designed (2 Estimation 180 images and 2 Esti-mysteries images)
- ❖ Some information about how you gathered the data from your participants (Remember to use the Thinking Questions for producing and using data - included earlier in this booklet)
- ❖ Your report on what the Participants said (remember to represent this as a mathematician, not as an author!)
- ❖ Your reflections - what mathematics did you learn during the Challenge, what did you learn about making reasoning images and what would you do differently next time

## SET INVESTIGATION – OPTION FIVE

*It's anniversary time!*

*This year there have been some significant anniversaries around the world and in our own State. In this learning option, you have the opportunity to choose one of these anniversaries that interests you and use your mathematics to investigate and explore it more.*



*It is fifty years since the Apollo 11 craft landed on the moon and astronauts took their first steps on its surface.*

In this Challenge we want you to explore at least three of the following **including the question in blue**:

- Create a data display that shows at least five comparisons about the size of the Apollo 11 rocket and the Apollo 11 Lunar landing module
- Make a scale model of one of the craft
- Create a timetable or timeline which shows the key events of the Apollo 11 flights
- Create a scale model which compares the size of the moon to the size of the Earth
- How did they measure the distance from the Earth to the moon? Was it with direct measurement or indirect measurement? Why? Do they still do it the same way now?
- What navigation and measuring devices did they use to make this mission a success? Are any of these devices still used today? If so, how have they changed or developed?
- **How did mathematics impact on this event? Which aspects of mathematics and mathematical played the most important role? Why? Justify your thinking.**



**EPIC FLIGHT CENTENARY**


*"The year was 1919. The war was finally over. Prime Minister Billy Hughes offered 10,000 pounds for the first Australian airmen to fly home from England in 30 days. Six crews took up the challenge in planes that were not very reliable! And who won? South Australian brothers Ross and Keith Smith, backed by mechanics Wally Shiers (SA) and Jim Bennett (Vic)"*

In this Challenge you have the chance to investigate and explore this amazing achievement. There is lots of fantastic information at these links and we are sure you will find much more information on your own learning adventure!

<https://epicflightcentenary.com.au/articles/> We want you to explore at least three of the following **including the question in blue**:

- Make a scale model of the Smith brothers plane and one other plane that is used today. Create a data display



	<p>which shows at least ten comparisons between the planes.</p> <ul style="list-style-type: none"> <li>- This race happened in 2019. What would a typical timeline for a day have looked for a child your age in 2019? Compare and contrast this with how you spend your time and represent these comparisons to share with us</li> <li>- The prize was 10 000 pounds. What was a pound? Investigate more about what kind of money was used back then. When did it change to the money we use today and why? What could you have bought with 10 000 pounds in 2019? If they were running that race today in 2019, what would a comparable prize be in our money of today?</li> <li>- Investigate and then represent the route they took? How far was it? Why did they take that route? Was it the fastest route? If you were taking this Challenge today, would you go the same route? Explain your thinking.</li> <li>- How much time did they spend in the air on this flight? Explain your theory and your justification.</li> <li>- What measuring, weather and navigation devices contributed to their success? Are these devices still used today? If so, how have they changed and why</li> <li>- How did mathematics impact on this event? Which aspects of mathematics and mathematical played the most important role? Why? Justify your thinking.</li> </ul>
 <p>The poster is titled 'UN Convention on the Rights of the Child In Child Friendly Language'. It features colorful illustrations of children and animals (a giraffe, a lion, a zebra, and a monkey) at the bottom. The text is organized into columns, listing various rights in a child-friendly manner. Logos for UNICEF and the United Nations are visible in the top right corner.</p>	<p><i>Thirty years ago, world leaders gathered to develop and sign a children's bill of rights. You can download this poster from the PMA Challenge page at:</i></p> <p><a href="https://www.primarymathematicssa.com/learner-activities-programme">https://www.primarymathematicssa.com/learner-activities-programme</a></p> <p><i>To get you started on this Challenge...Watch the video called "Just a kid" which is halfway down the page at this link</i></p> <p><a href="https://www.unicef.org/child-rights-convention">https://www.unicef.org/child-rights-convention</a></p> <p><i>There is also lots of other information about this Bill of Rights on the same page.</i></p> <p><b>In this Challenge we would like you to investigate and then prepare some data displays which address at least three of the following questions:</b></p> <ul style="list-style-type: none"> <li>- Do all children at your site have access to these "rights"?</li> <li>- Do all children in South Australia have access to these "rights"?</li> <li>- Compare the "rights" that children have in Australia with the "rights" children have in at least two other countries</li> <li>- Which "rights" do the children at your site think are most important and why?</li> <li>- In the video, "just a kid", they finished by asking you "children are standing up for their rights, what are we waiting for?" What do children at your site think is the most important "right" that needs action now in 2019?</li> </ul>



## **SET INVESTIGATION - OPTION SIX**

### *The New Road - on, below or above?*

The Government in SA has just announced that they are going to complete the final section of the North South Corridor in the coming years. You can see the full length of it at the following link : <https://dpti.sa.gov.au/infrastructure/nsc> If you click on different parts of the route you can see where each part is up to in its development.



There is one part of the project that is particularly tricky. This is the part from the River Torrens through Anzac highway to meet the new part at Darlington. They are proposing three options:

- Build it **ON** the road - so widen the existing road
- Build it **UNDER** the road - so create a tunnel
- Build it **ABOVE** the road - as a superway similar to the South Road Superway section above Gran Junction Road

In this Challenge you are asked to do some investigation for the Government about what would be the best option.

In the **first** part of your investigation we would like you to create two data displays that powerfully share at least ten "fascinating facts" about this North South Corridor development. But there is a catch!

The first data display has to "sell" this development as positive action.

The second data display has to "sell this development as a negative action.

Remember the same raw data can be manipulated to tell different stories, and here is your chance to become a data manipulator!

In the **second part** of your investigation we would like you to investigate which would be the "best" option for this River Torrens through Anzac Highway from your point of view. To do this you will

need to think about what “best” means to you and then gather data to support your position.

In your learning evidence we would like to see:

- Your theory about “best”
- Your justification, why you think this is best
- The data that supports your theory

In the **third and final part** of your investigation we want you to prepare a data display that shows what people in your community think would be the best option (on, above, below). This will mean you need to design a data gathering process (remember to consider the Thinking Questions for producing and using data that are available earlier in this booklet) that will collect this raw data and include in your learning evidence both the raw data and any data displays you create.

Prepare a message for the Minister for Transport and Infrastructure, Stephan Knoll that would let him know what the public in your community think. Your message could be in any form that you think is most powerful. It could be an email, a video message, a speech for a public rally or a letter or any other form of communication you think will get your message across!



**When you represent your findings the judges would like to see:**

- ❖ Your two Fascinating Fact data displays
- ❖ Your theory, justification and data about your view of the “best” road option
- ❖ Some information about how you gathered the data from your community, your raw data and any data displays you choose to use
- ❖ Your message for the Minister

## SET INVESTIGATION - OPTION **SEVEN** EY *Big and Small...*



### Have you got your "sizing" glasses on?

Are you ready to notice the size of all the things around you? Remember there are different kinds of "big" (measurable attributes), so there are lots of things to think about! If you want to know more about the different kinds of "big" you can download the Measurable Attribute poster from the PMA Challenge webpage

<https://www.primarymathematicssa.com/learner-activities-programme>

In the **first part** of this challenge we want you to investigate how many measurable attributes (kinds of big) there are. Make a visual display of all the ones you can find or know about!

Then in the **second part** of this Challenge we want you to investigate:

- what would be the smallest object, the smallest space and the smallest event at your site?
- What would be the largest object, largest space and the largest event at your site
- What would be the smallest object, space and event in your city or town or suburb?
- What would be the largest object, space and event in your city or town or suburb?

### When you represent your findings the judges would like to see:

- ❖ Your visual display of all the measurable attributes you found
- ❖ Your four theories/ideas about all the smallest and largest things - and remember to tell us what kind of big and small it was!
- ❖ Your justifications or proofs to back up your theories - how did you decide?
- ❖ Make sure you include some images of the objects, spaces and events that "win" in each question so that the judges can really see what you are thinking 😊