March 2012 Volume 37 No 1

TEACHING MATHEMATICS

Regulars

From the President	Rodney Anderson	3
From the Editor	Rodney Anderson	4
Student Problems		28

Features

QAMT 2012 Dates		4
Brian Schmidt	Maths for the Future	6
Graph Paper		9
Blast from the Past		15
Teaching Ideas		17

Front Cover

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Teaching Mathematics is the official journal of the Queensland Association of Mathematics Teachers Inc. The journal is published four times a year (March, June, September and November) and is provided as a right to all members of the association.

The aims of the journal reflect, put into effect, and communicate the objectives of the association:

- to promote interest in mathematical education at all levels;
- to encourage and promote research in the teaching of mathematics;
- to speak and act on matters related to mathematical education.

Educators, administrators, parents and students are invited and encouraged to contribute articles which relate to the teaching of mathematics at any level. These may be of any length from interesting 2-line snippets, through short letters concerned with topical issues to longer in-depth articles. Critical comments and advice about the future directions of the journal are always welcome.

Materials should be sent to the Editor, Rodney Anderson. The preferred way is by email. Contact details are as follows:

Rodney Anderson
Moreton Bay College

Phone: 07 3390 8555
Fax: 07 3390 8919
Email: andersonr@mbc.qld.edu.au

Microsoft Word is the preferred format. All receipts will be acknowledged - if you haven't heard within a week, e-mail Rodney to check. Copy dates are: mid-February; mid-May; mid-August; mid-October.

The views expressed in articles contained in Teaching Mathematics belong to the respective authors and do not necessarily correspond to the views and opinions of the Queensland Association of Mathematics Teachers.

If you have any questions regarding Teaching Mathematics, contact Rodney Anderson. Publications sub-committee members are listed below. Feel free to contact any of these concerning other publication matters.

Rodney Anderson (Convenor)	Moreton Bay College	07 3390 8555
Gaynor Johnson (Newsletter)	QAMT Office	07 3365 6505

Books, software etc. for review should be sent to Richard Porter; information to go in the newsletter should be sent to Gaynor Johnson at the QAMT Office. Newsletter copy dates are the beginning of each term.

Contact the QAMT office for advertising enquiries.

Advertising Rates	1 Issue	2 Issues	3 Issues	4 Issues
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Full page	$110	$220	$308	$396
Insert (single A4 or folded A3)	$220	$440	$660	$770

QAMT also now offers a colour advertising service for the covers.

From the President

Rodney Anderson

It certainly has been a very busy start to the school year. How is the National Curriculum implementation proceeding in your school? Letters to the Editor are always welcome. I hope to ring as many schools as possible over term 1 and term 2 to discuss the National Curriculum.

Please read the extract of the speech (page 7) Professor Brian Schmidt (Australian National University) and Nobel Laureate as he makes many important points about mathematics and the use of mathematics in everyday life.

As a member of QAMT, could you inform your colleagues in your educational institution to become a member of QAMT? Being a member of QAMT has many benefits (cheaper registration costs for conferences and workshops, receive journals and newsletters and much more).

The annual conference which is being held at SeaWorld resort on the Gold Coast is looking like being a wonderful (as all QAMT conferences are) conference. Charles Lovitt is the keynote speaker and Rex Boggs is giving the plenary by a practising teacher.

Rodney Anderson
President, QAMT

From the Editor

Rodney Anderson

A reminder that we encourage contributions from members for the Journal, since after all, it is your Journal. This is a chance to share your ideas and practices with other members. We also welcome suggestions for particular topics that you would like to read about.

E-mail suggestions and submissions to andersonr@mbc.qld.edu.au

Incentive to contribute articles/teaching ideas to the journal

QAMT MEMBERSHIP DRAW

1 For every article/teaching idea contributed, the author will receive a ticket in a Membership Draw

2 If you are contributing an article/teaching idea for the first time, the author will receive two tickets in a Membership Draw.

3 The next winner of the Membership Draw will be announced in journal V37 N4.

QAMT Dates
Professional Development
Planning for 2012

Friday, 18th May
National Mathematics Day
A chance for teachers to share and promote good mathematics teaching and learning with each other, with students, with colleagues and with the wider community.

Access AAMT for activities & PD - www.aamt.edu.au

Saturday, 19st May
Early Years Conference
"Active Maths"
A one day event to hear relevant research on young children's mathematical development and share ways in which we can assist young children to gain powerful mathematical ideas. Workshops will include teaching learning activities; resources; developing mathematics curriculum and assessment.

Time: 9am-3:30pm
Venue: Jindalee State School
Cost: $55 members & students
$99 non members

To provide or suggest workshops and presentations contact Sue Allmond - j.allmond@uq.edu.au

Friday, 20th July
Problem Solving Competition
The UQ/QAMT PSC is open to all students of secondary schools in Queensland.
Cost: $2 per student
Contact: Michael Bulmer - m.bulmer@uq.edu.au
www.maths.uq.edu.au/qamt

22nd to 24th June
Annual Conference
"Motivating Mathematics"
Welcome Function: Friday, 22nd June 7-9pm
Dinner: Saturday 23rd June
Conference: Saturday 23rd and Sunday 24th June
Venue: SeaWorld Resort, Gold Coast
Cost: $330 presenters,
$440 members,
$550 non-members includes membership

Keynote speakers followed by presentations, breakout sessions and workshops. Sponsorship & trade are welcome.

Please contact Rodney Anderson andersonr@mbc.qld.edu.au to provide or suggest workshops and presentations. Visit qamt.org for updates.

Thursday, 2nd August
Australian Maths Competition
Australian Maths Trust
Details www.amt.canberra.edu.au

August and September
DET & QAMT Year 8 Quiz
A quiz style competition with 3 members to a team suggested dates are

Round 1:	Week beginning 30th July
Round 2:	Week beginning 19th August
State Grand Final:	Friday, 14th September
Entry fee:	$22 per team

State Co-ordinator: Peter Cooper, spcooper@uq.net.au

Saturday, 25th August
Implementing the Australian Curriculum

Time:	9am – 4pm
Venue:	Somerville House
Cost:	$44 members & students
	$99 non members

To provide or suggest workshops and presentations contact Gaynor Johnson at qamt@uq.net.au

Brian Schmidt is a Nobel laureate and Australian National University professor. He delivered this speech at the Australian Mathematical Sciences Institute forum in Canberra on Tuesday 7 February.

MATHEMATICS is a uniquely powerful toolbox of humanity. Unlike other things, mathematics is logically self-consistent and things are either right or wrong.

Once something is proven right, it is not in question. It is this certainty that makes mathematics such a valuable tool for us.

Everyone in Australia - and I mean everyone - needs to be mathematically literate, or numerate as we like to say, and our country needs many people to be more than numerate: we need people to be highly skilled.

For me, the tools of mathematics go hand in hand with the astronomy I undertake. Each day I spend more time using mathematics than any other activity. I took eight classes at university in mathematics, almost as many classes as I did in physics, and twice as many as I took in astronomy.

Now, you may be thinking that I am special - but let's just look at my family. My father is a biologist, studying the populations of fish stocks in Alaska and now Canada - he uses sophisticated mathematics every day to understand exactly how to ensure that fish stocks remain at healthy levels into the future - as people fish, or dams release water, or glacial run-off slows or speeds up. Ah, but he is a scientist, you say. True.

My wife is an economist - whom I met at Harvard. Her education in economics has almost as much maths in it as mine. Solving challenging coupled differential equations, undertaking sophisticated statistical tests - all to ensure that economies work efficiently at allowing their people to be prosperous - it is way more than simply bean counting.

But we all have PhDs. My Australian cousin and her husband who work in the mining industry as engineers - maths is the fundamental basis of their work, and, for that matter, Australia's ability to extract minerals and become one of the world's most wealthy countries.

My other cousin and his wife are farmers in Western Australia who do precision farming, where fertilisers and seeds are linked to a GPS system, and planted out at optimum values - all calculated by them using, you guessed it - maths. Farming runs on tiny margins - a few percent – and this sophistication allows them to make money when others go bankrupt.

My brother-in-law in Sydney is a drainer - when he gets his trigonometry wrong, #@&% literally happens. His son is a commercial airline pilot - maths is a matter of life and death for him, and of course, his passengers. I could go on and on. My family is much like any other one in Australia.

Most people who have skilled jobs in Australia have mathematics at the core of that skill base. But everyone needs maths. In the modern world, math forms a fundamental basis of interaction with the world. Is my superannuation enough? Can I afford this home loan? Which telephone plan gives me the best value? Do the numbers the politicians quote on TV add up? To answers these questions - questions we all need answers for in order to be successful citizens - requires a competence in mathematics.

I made my first trip to Australia in 1980. If one looks at the GDP per capita of Singapore, compared to Australia, Australia was twice as rich. In 2010, despite the great economic conditions and strong Aussie dollar, Singapore was richer. And here is a country with no commodities other than its people, and useful location at the junction of the Indian and Pacific Oceans.

Over this period, Singapore has been among the top performers in educating its population as measured by the PISA tests. Australia has not performed poorly, but not as well as the best countries. The OECD says better educational outcomes are a strong predictor for future economic growth.

Imagine if Australia could combine our innate physical wealth with one of the world's most educated workforces. The prospects for our country would face would be staggering. So if I cannot convince you with the economics - let me appeal to something else. New Zealand is one of the highest performing nations now at educating its population - significantly outperforming us. Do we really want to get walloped in this trans-Tasman competition? I would be happy with a draw at the top of the table.

So, how do we improve ourselves? Let's look at the OECD's findings here. It isn't rocket science, although it could lead to some. The best school systems were the most equitable – in which students do well regardless of their socio-economic background. High performing school systems tend to prioritise teacher pay over smaller class sizes. High performing systems allow schools to design curricula and establish assessment policies but don't necessarily allow competition for students.

So a fundamental mathematical education for all of our citizens, founded on the basics, is a crucial ingredient for our future prosperity. But we need not be afraid to move on with the times as well. When I was in Stockholm I got to meet the other Nobel Prize winners. We appeared on the BBC for an hour-long program called Nobel Minds.

When we were asked if there was anything we should be teaching our kids, remarkably, we all agreed on the same thing - this was three physicists, a chemist, two biologists, and three economists: we need to teach the idea behind uncertainty - and with it probability.

Facts and figures are usually filled with uncertainty and to understand what is going on requires us to come to terms with errors, uncertainties, and the notion of probability. I am reminded of this continually with the obsession that we have in Australia for running polls of the popularity of the Government and the opposition.

I have counted 33 Polls over the past 12 months - Nielsen and Newspoll - that have asked questions such as: Who do you prefer as the next prime minister? These polls typically survey just over a 1 000 people, and they have what is described in the fine print as a sampling error of around three per cent. A week ago The Australian Newspoll reported the Prime Minister's numbers have flatlined. Yesterday, we saw Nielsen report a six per cent jump.

This is great for newspapers. Every poll is news, because the sampling error makes every poll different. The two results I just reported, when looked at the rate the polls are done, are completely consistent. A three per cent change is reported to be statistically significant in the newspapers - what does that mean? That means that 68.3 per cent of the time polls will give a number that falls within a +/- three per cent band. One in three polls will lie outside of this band, or 10 polls per year.

The six per cent change reported as highly statistically significant, I'll translate for you. Only one in 20 times would such a deviation occur by random chance. But it was the biggest fluctuation of the year! And we had 33 polls. It is expected to have such a fluctuation by random chance.

The trends shown in the polls are valid, but for heaven's sake – how about doing less frequent polls with more people surveyed - so we actually learn something, rather than having confected stories every two weeks about random fluctuations in samples? The media are feeding on the public's ignorance of statistics in this instance. Maybe that is too strong - I do not even think the media knows what it is doing in this instance.

I also see the ignorance of statistics [and] uncertainty as one of the principal problems behind the climate change debate around the world. It is imperative to understand uncertainty to understand the climate change debate, but since the public doesn't have these concepts, scientists skate around the issues, simplifying the truth to the point where it is no longer right.

While mathematics is perfect, it doesn't always make it easy to predict the future, even with perfect knowledge. The Earth's climate is what we call a giant non-linear system – often referred to as a chaotic system. Infinitesimal changes lead to significantly different outcomes. We can characterise general behaviour but it is hard to gauge its behaviour exactly. In this case, our uncertainties are more than infinitesimal. We have real uncertainties. But we persist with figures that are meant to demonstrate global warming is one such example.

Climate models have uncertainty and the Earth has natural variation … which not only varies year to year, but correlates decade to decade and even century to century. It is really hard to design a figure that shows this in a fair way - our brain cannot deal with the correlations easily.

But we do have mathematical ways of dealing with this problem. The Australian academy reports currently indicate that the models with the effects of CO_2 are with 90 per cent statistical certainty better at explaining the data than those without. Most of us who work with uncertainty know that 90 per cent statistical uncertainty cannot be easily shown within a figure - it is too hard to see.

And this leads to problems. Today's Australian newspaper reports that the warming of the Earth has slowed over the last decade - that is the temperature versus time data shows a levelling off - "Warming data show shades of grey". Yes! And it - and almost everything else we do in life - is shades of grey. But this does not mean it is not happening, it is just that our understanding is not exact.

Since predicting the exact effects of climate change is not yet possible - we have to live with uncertainty - and take the consensus view that warming can cover a wide range of possibilities, and that the view might change as we learn more.

But the good news is from an economics point of view: there are mathematical ways to deal with uncertainty in policy, to maximise the gain while minimising the pain. Ask Warwick McKibbin here at the ANU, who wrote a book on the subject a decade ago with a colleague, and presented one possible way of best dealing with risk. The book is a good read for those inclined - quite mathematical – and is still as relevant today as it was in the past.

Climate change will continue to be an issue - we can do our best to deal with it now - or we can always pass the responsibility, and the consequences, to future generations.

So grounding ourselves back to the present, the place where people are compelled to act, I had the opportunity to sit next to Jac Nasser – chairman of BHP Billiton at lunch today - and we were discussing some of the biggest problems facing Australian companies and that is skill shortages - inevitably for people who are competent at mathematics.

So if we are complacent, hoping the commodity boom will continue to keep Australia prosperous, not addressing the skills shortage through improving our mathematics skills, we are likely to kill the goose that is laying the golden eggs now, our mining industry.

The future for Australia is bright, but it is not guaranteed. Capitalising on Australia's opportunities will not just happen, it requires strategic science and education policies that adapt to the changing world. We have to be willing to make major changes to how we go about our business.

But what needs to be done is quite simple. Let's learn from the OECD's report. We need to have in place a curriculum that ensures that every Australian child - regardless of what school they go - achieves a level of numeracy that will make them successful citizens, and able to work in a wide variety of jobs. This curriculum needs to allow all students who want to develop a higher level skill set in math, to do so. And this curriculum needs to be taught by teachers with competency in those things we teach.

We are not there yet - too many of our kids leave school without a core numeracy. Too many of our kids - who are able and willing to excel at Maths - are taught by teachers without the level of competency required for the subjects they teach. Solving this skills shortage has to be our highest priority. Our kids cannot afford to have the opportunities lost - that result from having a poor mathematical education - and the nation can ill afford to lose talent which is in such short supply.

The above is an extract that was published in the Australian newspaper on 9 February 2012.

ASX Sharemarket Game

Dear Educator

The ASX Schools Sharemarket Game, sponsored by financial services company Citi, is an exciting way for students to experience the real world of share investing. Designed to support your existing curriculum, it has been played by Years 7-12 students across Australia since 1983, and provides an interactive learning experience to teach financial literacy skills.

ASX Schools Sharemarket Game – putting theory into practice in a fun and engaging real-life situation
With a hypothetical $50,000 to invest over 10 weeks, students create their own virtual share portfolio, place orders online and compete against other students for a total prize pool of over $25,000. The Game is highly realistic using live share prices to reflect real market conditions. This helps students apply the theory they learn in the

classroom and gain a better understanding of the sharemarket first-hand. Engaged students become active learners and develop their research and teamwork skills.

"The Game provides a hands-on real-life scenario on a complex and demanding topic that teachers could not otherwise recreate in the classroom. As a teacher, it is fulfilling to see your students actively involved in their learning and working cooperatively to support their fellow students while engaged in academic conversation." Megan, Year 9 Business Studies teacher

Teacher resources – making it easy to teach the Game
You can be as involved as you want in teaching the Game. You could, for example, register your students and let them play the Game as an extra-curricular activity. If you decide to incorporate the Game into your course, then a series of resources are available: detailed lesson plans including teacher notes, assignment ideas and worksheets, as well as tutorials, videos, and posters. You will find these resources in the DVD enclosed, and online at www.asx.com.au/teacherresources

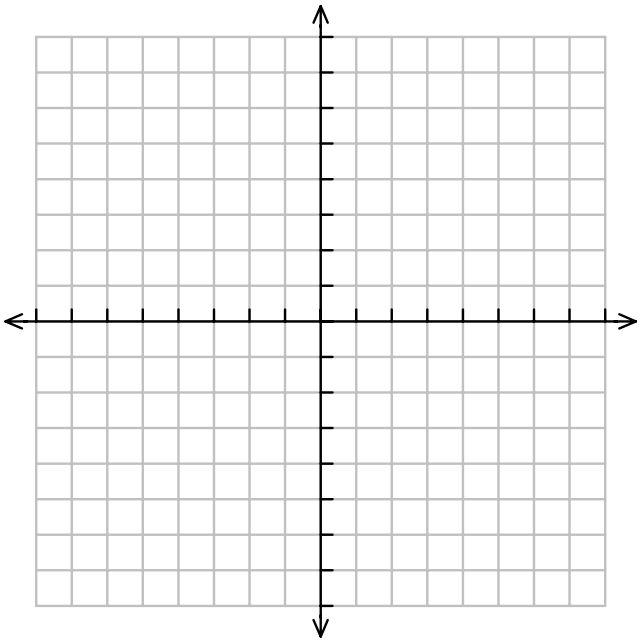
Registrations for Game 1 open on 9 February 2012
Registration is free and is open from 9 to 29 February. Game play starts on 1 March and finishes on 9 May. To register and view the full terms and conditions, visit www.asx.com.au/schoolinfo
With laptops now more widely available for Years 9-12 students, it is easier to access and play the Game and we hope you and your students will join us for Game 1, or Game 2 later this year.
For further information, please call 131 279 or email school.smg@asx.com.au.

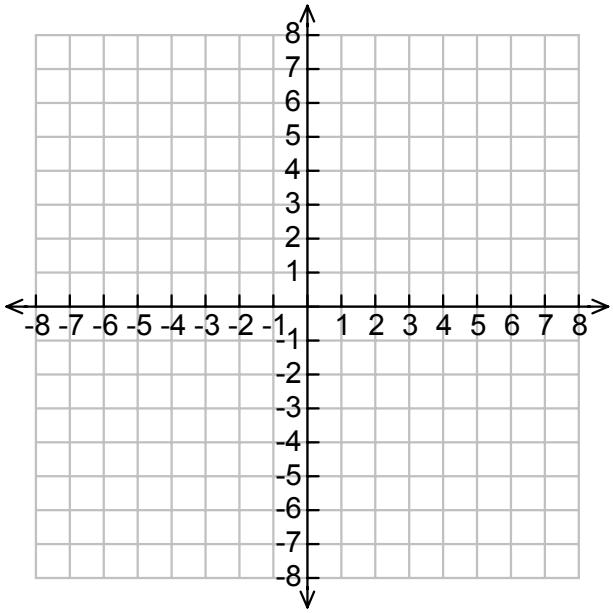
Yours sincerely,
Tony Hunter

Head of ASX Investor Education
Australian Securities Exchange

Graph Paper

The following graph and grid paper can be downloaded from www.qamt.org

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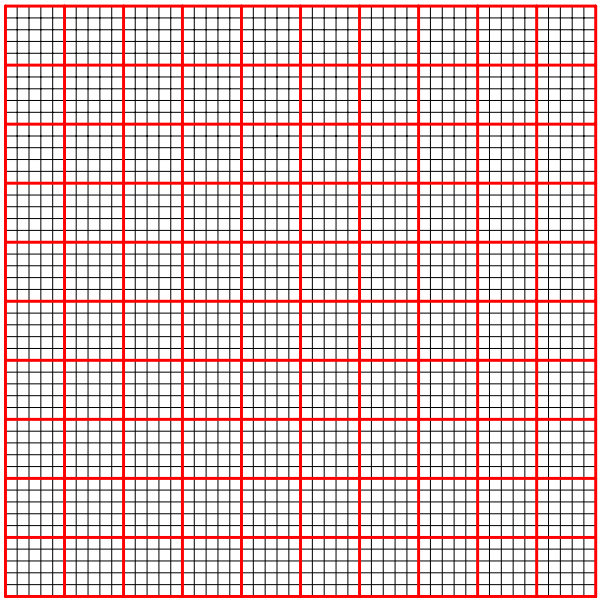

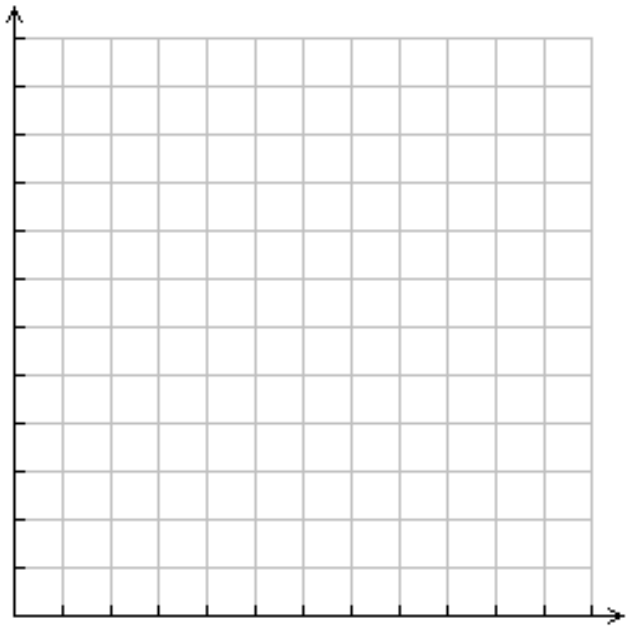

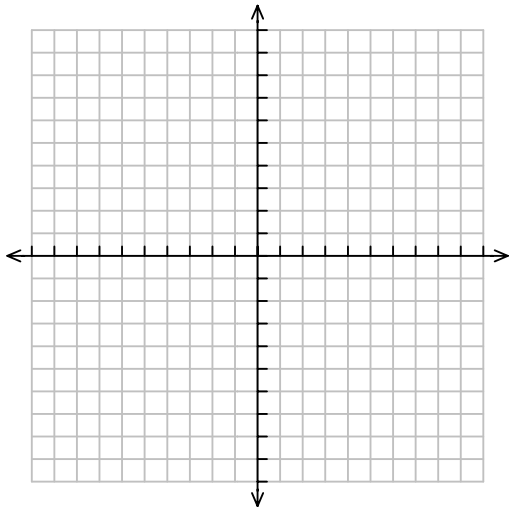

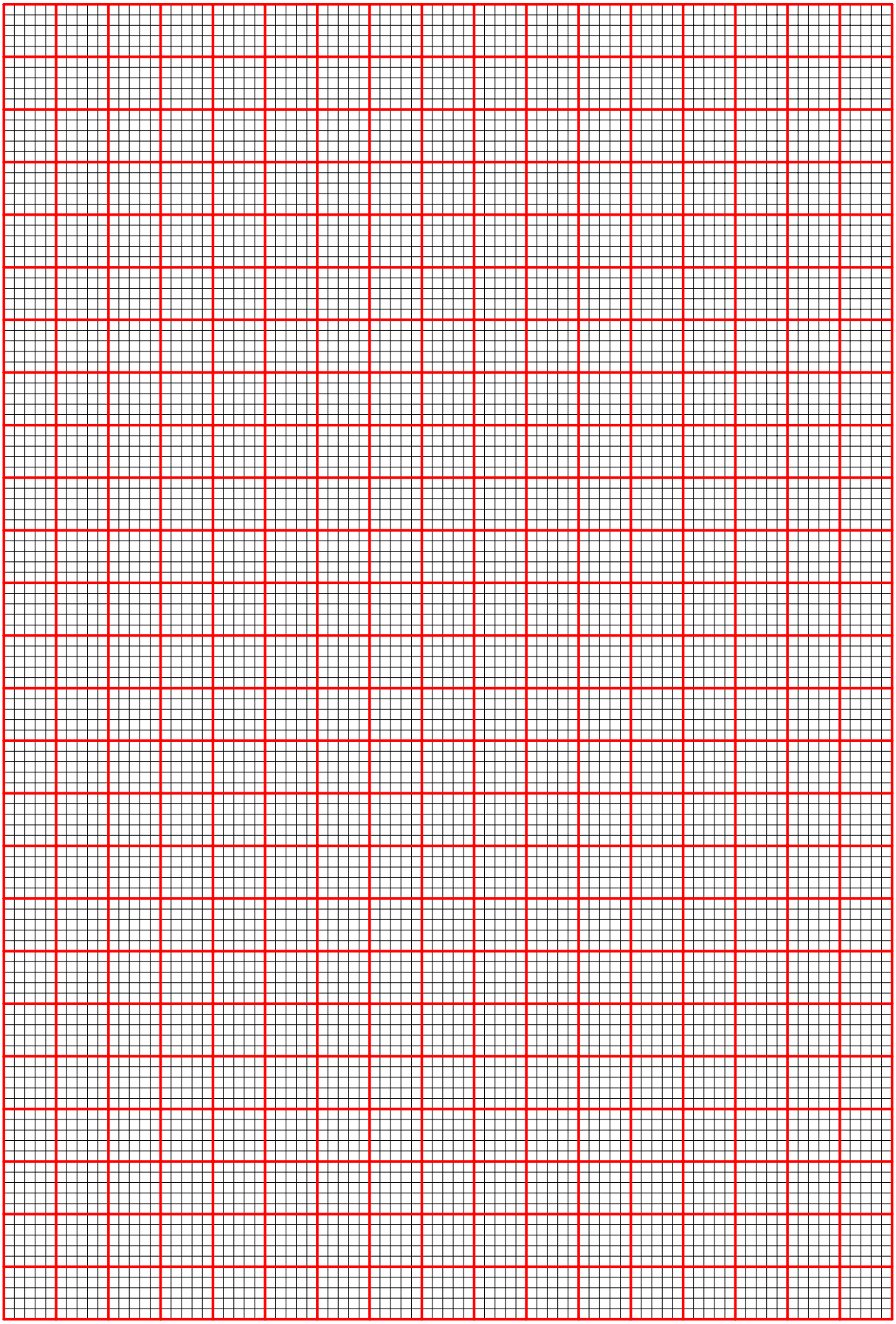

BLAST FROM THE PAST

The following is from the Newsletter, Volume 10, Number 3, September, 1975.

SOME THINGS TO LOOK FOR IN BUYING A SIMPLE CALCULATOR FOR SCHOOL USE

Contributed by B. McBryde
Research and Curriculum Branch, Dept. of Ed.

1. Is it robust? (and is it guaranteed for a year?)

2. Can you get an AC adaptor?

3. Is a Ni-Cd pack available? If not, how long will the calculator run with dry cells (2 dry cells for 30 hours use is good value - 5 dry cells for 8 hours use is a trifle uneconomic).

4. Is the keyboard colour coded?

5. Does it have a large, clear display? (This may be achieved either by having a large display unit or a small display unit and a magnifying cylindrical lens in front of it).

6. Is the ON-OFF switch clearly visible?

7. Is it pocket size and if so, can you keep it out of undesirable pockets?

8. What happens if you key in $1 \div 0 =$?

9. Does it have a clear entry key? How about a reverse key? And a change sign key?

10. Can you key in $^{-}10 - {}^{-}4 =$ and get the correct answer?

11. If it has a square root key, try $\sqrt{^{-}4}$?

12. Does it have separate keys for +, - and =?

13. It must have the facility to allow floating point arithmetic. Can you specify the number of decimal places?

14. How does the overflow mechanism work? (What is the result following overflow?)

15. Where does the -ve sign appear in the display, near the number or removed from it?

16. When you take $5 \div 3$, do you get 1.6666666 (for an 8 digit display) or 1.6666667?
How about $1 \div 3 \times 6$. Do you get 2?
Try $1 \div 81$, you should get 0.0123457 (with an 8 digit display).
Now multiply by 100. If you get 1.2345679 then you have a better calculator than one that simply gives 1.23456.

17. (If you want them). Does it have a memory, (with separate read memory and clear memory buttons) and a square root key?

18. How much does it cost? Beware of the low price bargain with keys that "bomb" after a few hundred pushes or unreliable electronics that cost more to repair than the cost of the calculator. (Does the firm have a repair facility in Brisbane?) Remember that in the school situation the calculator will have a great many amateur users. It is sometimes better to go for a larger AC/DC model with high reliability than for a pocket size "cheapie".

This checklist is by no means all-embracing - it simply lists some of the things you should look for. The "right" answers to the questions will depend on the use to which you intend to put the calculator. The use must be determined before you shop around.

Reprinted with permission from
"The Computer in the General Curriculum"

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A Reminder

Saturday, 19st May
Early Years Conference
"Active Maths"
A one day event to hear relevant research on young children's mathematical development and share ways in which we can assist young children to gain powerful mathematical ideas. Workshops will include teaching learning activities; resources; developing mathematics curriculum and assessment.

Time: 9am-3:30pm
Venue: Jindalee State School
Cost: $55 members & students
$99 non members

To provide or suggest workshops and presentations contact Sue Allmond - j.allmond@uq.edu.au

Presenters include: Judy Hartnett, Rhonda Horne, Kym Fry, Robin Proffitt-White, Paul Herbert, Nikki Cox, Sally Moyses, Jan Cavanagh, Robyn Anderson, Katie Makar, Eduardo van Klinken, Geoff Todman

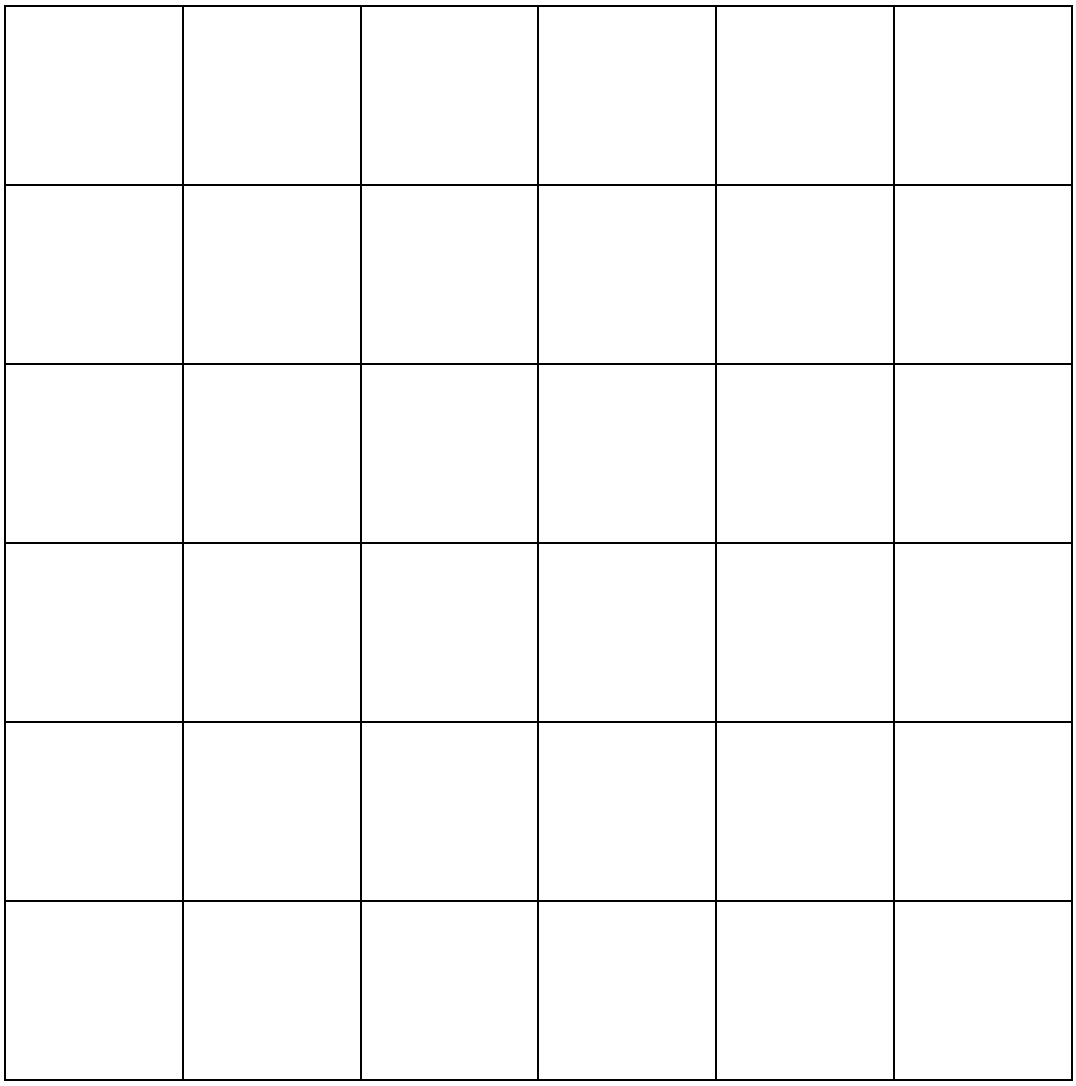
Trade displays: iTc, Ed Ex, Genie, SDS, Cambridge

Teaching Ideas

Dice Connect Four

Tierney Kennedy
Back to Front Maths

This activity is taken from www.backtofrontmaths.com.au/teachers



Task:
Choose numbers to go into the game board above so that you have the best chance of winning "dice connect four". The idea is to get any four squares in a row (up, down or diagonal) before your classmates do. To play the game two dice will be rolled. You may perform any operation that you like on the dice (+-x÷) and cross those answers off your board. Each number may only be used once.

Key Questions:
What number combinations are possible?
What answers are therefore possible?
Which answers appear the most often and should therefore be part of your game board?
Why? Prove it!

Transit of Venus

Stephen Broderick
St Ursula's College

Last Chance for the Transit of Venus (6th June, 2012)
This year will be an astronomical bonanza for Australians with the total eclipse of the Sun on the 14th November (see Figure 3) and the transit of Venus in June. Venus will transit the face of the Sun on 6th June 2012 over a period of 6 hours from 8:33 am to 2:44 pm. Transits come in pairs separated by 8 years, the previous one was in 2004 and the next pair of transits will be in 2117 and 2123. Make sure you don't miss it this year!

Edmund Halley (of Halley's Comet fame) was the first to use a transit of Mercury in an attempt to accurately determine the Earth Sun distance known as the astronomical unit.(AU) Halley was not that impressed with the result he obtained and he concluded that the transit of Venus would be the only occasion for accurately measuring this distance. Unfortunately for Halley the next Venus transits would not occur until 1761 and 1769. Alas he missed both the transit of Venus and the comet he predicted to return in 1758.

On April 5th, 15232 a transit of Venus and a solar eclipse will be observed simultaneously (see Figure 1).

Fig 1

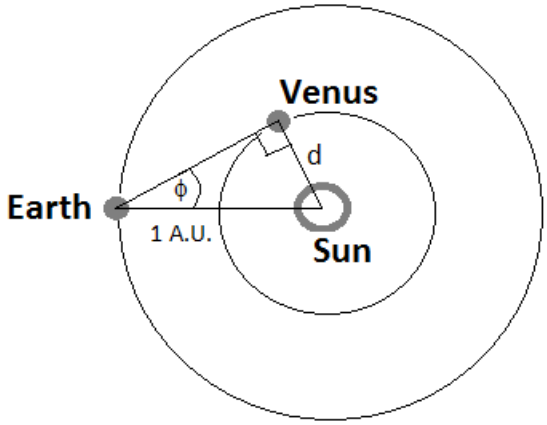
Solar viewing cards can be used to safely view the transit across the Sun for up to 3 minutes at a time. These cards block out 99.99% of sunlight and allow the viewer to see the photosphere of the Sun. Large sunspots can also be safely viewed. Solar viewing cards cost approximately $5 and can be obtained from:

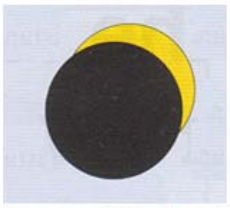
Sirius Optics in Brisbane **www.sirius-optics.com.au**

Bintel in Sydney **www.bintel.com.au**

What two facts were known before the transit?

Fact 1 (Maximum elongation of Venus) Figure 2 below represents Venus at maximum elongation when it is farthest from the Sun. It is quite easy to measure this angle and astronomers have determined the angle to be approximately 46.054^0.





Brisbane 14th Nov 2012
6:57 am (maximum eclipse)

Figure 3

Since the Earth, Venus and the Sun make a right angle triangle, then by using trigonometry:

sin (Ø) = $\frac{d}{1\ AU}$

Therefore sin (46.054^0) = $\frac{d}{1\ AU}$

d = sin (46.054^0) × 1AU

d = 0.72 AU

So astronomers knew the distance from Venus to the Sun was 0.72 AU and the distance from Venus to the Earth must be 0.28 AU. Unfortunately, they didn't know the length of 1 AU. The transit of Venus was needed to provide this missing information.

Fact 2 (Parallax of the Sun)

Astronomers also knew that the parallax of the Sun (see Figure 4) was 0.534^o. The second diagram (Figure 5) represents all the information that was known prior to the transit.

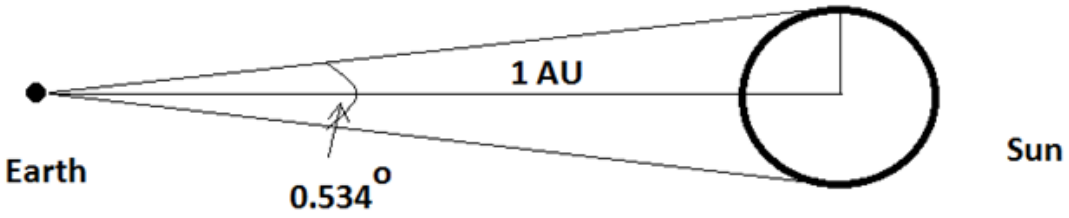


Fig 4

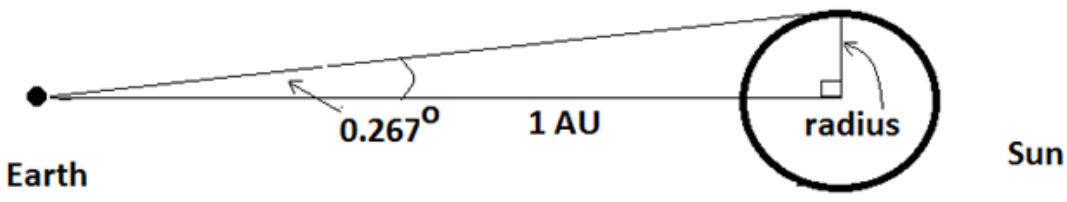


Fig 5

Using the tangent ratio:

$$\tan \text{Ø} = \frac{opposite}{adjacent}$$

$$\tan (0.267^{o}) = \frac{radius}{1\ AU}$$

radius = tan (0.267^{o}) × 1 AU

radius = 0.00466 AU

What was determined after the transit?

Data from the transit of Venus was used to determine the diameter of the Sun. Once the diameter was known, then the Earth- Sun distance was calculated. Furthermore the distances to the planets could also be determined. Spectroscopic studies of transits also provide information about a planet's atmosphere as light from the Sun or a star pass through the atmosphere of the planet producing a spectrum which can be used to identify gases in the planet's atmosphere. In fact approximately 85% of astronomical information has been obtained through spectroscopy. Currently the Kepler B space probe has determined approximately 1 600 possible exoplanets by using the transit method.

Figure 6 represents the position of two observers at different latitudes (separated by 1,000 km) on Earth during a transit of Venus.

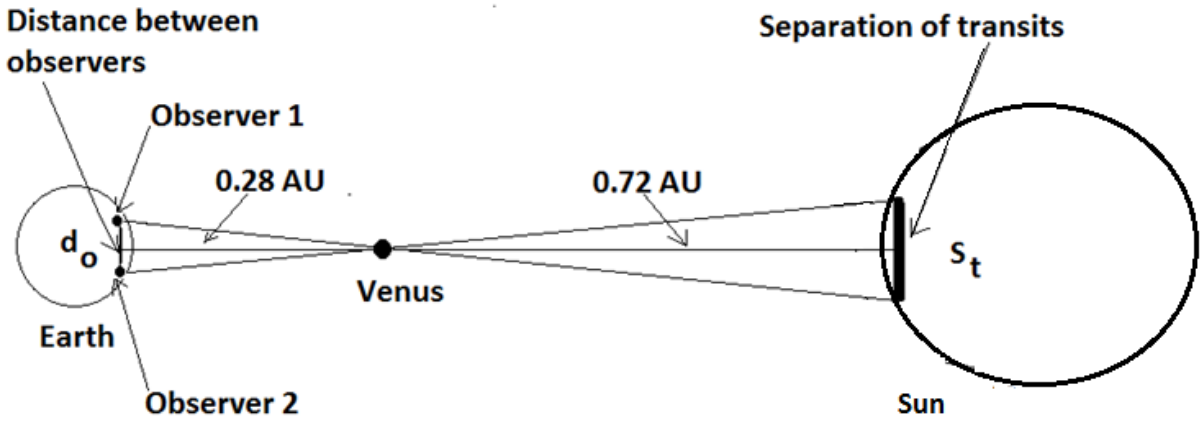


Figure 6
not to scale

Using similar triangles the following relationships can be obtained.

$$\frac{d_o}{0.28} = \frac{S_t}{0.72}$$

Now since the distance between the two observers is 1,000 kilometres,

$$S_t = \frac{1\,000 \times 0.72}{0.28}$$

S_t = 2 571.43 kilometres.

Now each observer plots the path of Venus as seen from their location on a scale diagram. The diagram in Figure 7 represents the two paths overlayed on the one diagram 100 cm in diameter. It is not drawn to scale.

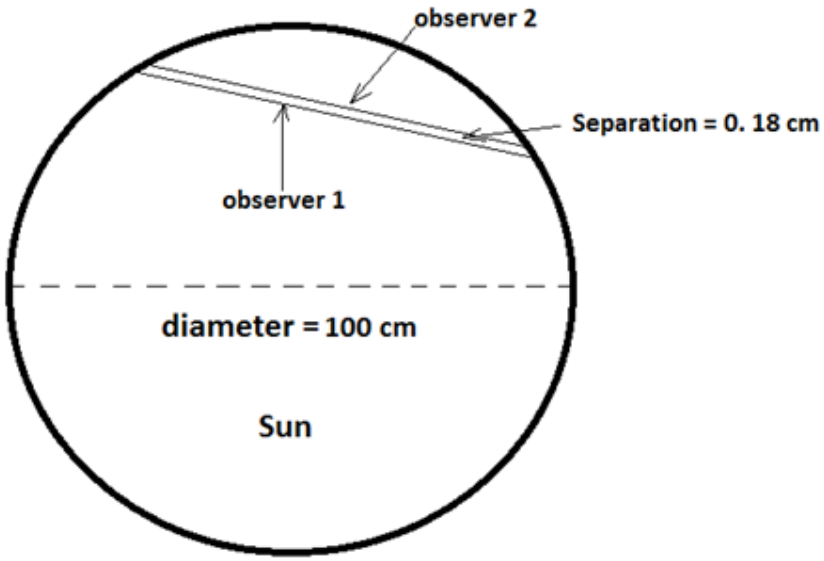


Fig 7

Using ratios gives:

$$\frac{Circle\ diameter}{separation\ of\ transit\ paths} = \frac{Sun's\ diameter}{transit\ separation\ (S_t)}$$

$$\frac{100\ cm}{0.18} = \frac{Sun's\ diameter}{2\ 571.43}$$

$$\text{Sun's diameter} = \frac{100 \times 2\ 571.43}{0.18}$$

$$= 1\ 428\ 570 \text{ kilometres}$$

Now the radius = 0.00466 AU. So 1 AU = $\frac{1\ 428\ 570}{2 \times 0.00466}$ = 153 280 000 km which rounds to 150 000 000 km.
Therefore, one Astronomical unit ≈ 150 million kilometres.

Activity: Measuring the diameter of the Sun with a Solar projector (pinhole camera)

******NEVER LOOK DIRECTLY AT THE SUN*****

A pinhole camera is a safe way of projecting an image of the Sun.

Objectives

- To make a solar projector
- To use similar triangles to determine the diameter of the Sun
- A Solar projector can also be used to view the transit of Venus

Materials

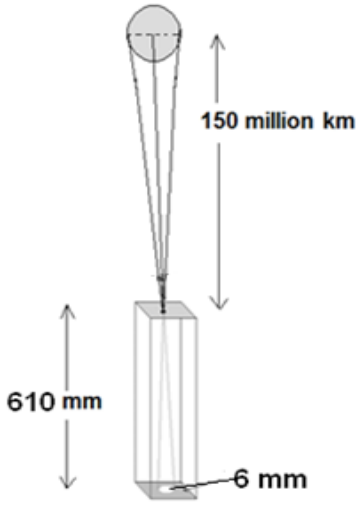
Cardboard box, pencil, aluminium foil, sheet of A4 paper, sticky tape

[Note: The longer the box is the bigger the image is; however, the brightness of the image decreases as the box length increases]

With a solar projector, we can obtain an image of the Sun and accurately measure the diameter of the solar image. Once we have calculated the diameter of the image and the distance from the image to the pinhole, we can determine the diameter by using similar triangles.

$$\frac{diameter\ of\ Sun}{distance\ to\ the\ Sun} = \frac{diameter\ of\ image}{height\ of\ projector}$$

$$diametr\ of\ Sun\ = \frac{diameter\ of\ image\ (mm)\ \times\ 150\ million\ km}{height\ of\ projector\ (mm)}$$



Procedure

1. Use a pencil to poke a hole in the top end of the cardboard box.
2. Tape some aluminium foil over the hole.
3. Use a pin to poke a small hole in the middle of the aluminium foil.
4. Secure a sheet of A4 paper on the bottom of the cardboard box with some sticky tape or blu-tack.
5. Point the box in the direction of the Sun. Measure the diameter of the solar image in millimetres.

   Diameter = $\frac{6 \times 150\ million}{610}$ = 1.48 million km

[Footnote: Spare a thought for the French Aristocrat and Astronomer Guillaume le Gentil who journeyed for 11 years attempting to observe a transit of Venus. le Gentil left by sea in March,1760 to observe a transit from the French colony at Pondicherry in India. The transit was due to occur on June 6th 1761 and another on June 4th 1769. Enroute, the British who were at war with France seized Pondicherry, so le Gentil stayed on the boat to observe the transit and even though he observed the transit, he obtained no useful information due to the movement of the boat. He decided to stay and wait 8 years for the next transit in 1769. Unfortunately it clouded over on the day and he missed the entire event. Adding to his despair, he contracted dysentery. After several attempts to sail back home which were aborted due to storms and hurricanes, he arrived home to find his wife remarried and his estate had been ransacked by his relatives. His journey had lasted 11 years 6 months and 13 days for a 6 hour event.]

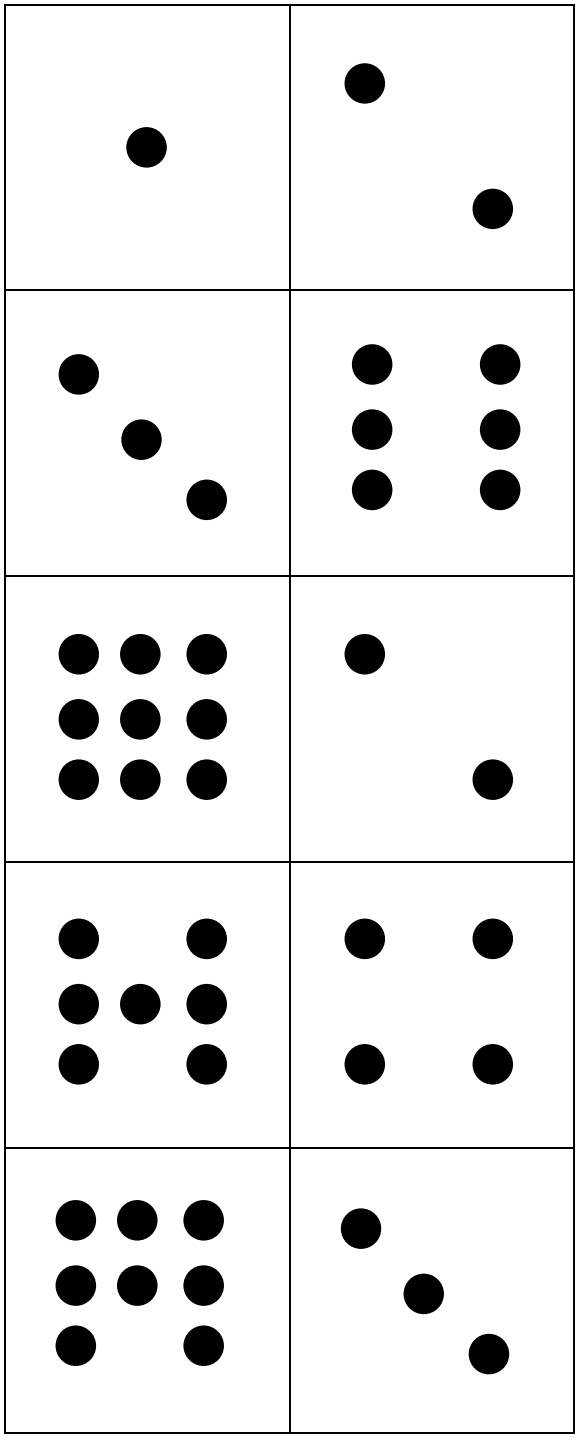
References

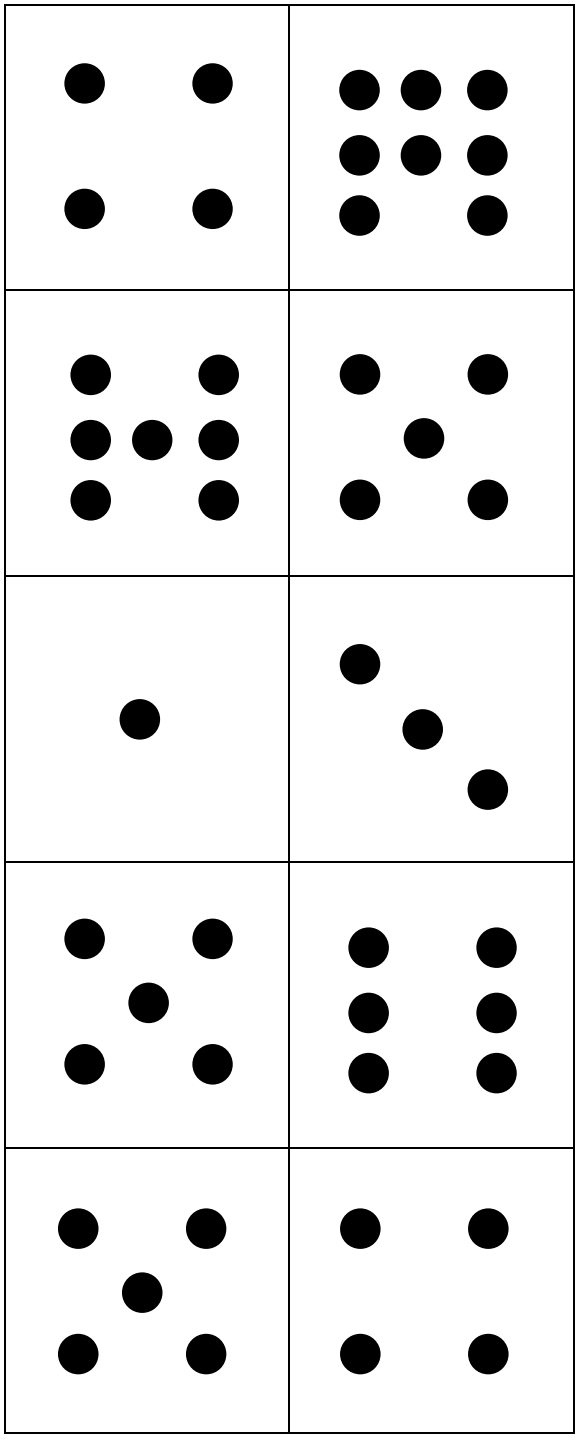
The General History of Astronomy Vol 2 (1989) Taton R, Wilson C
www.oneminuteastronomer.com/2199/le-gentil/

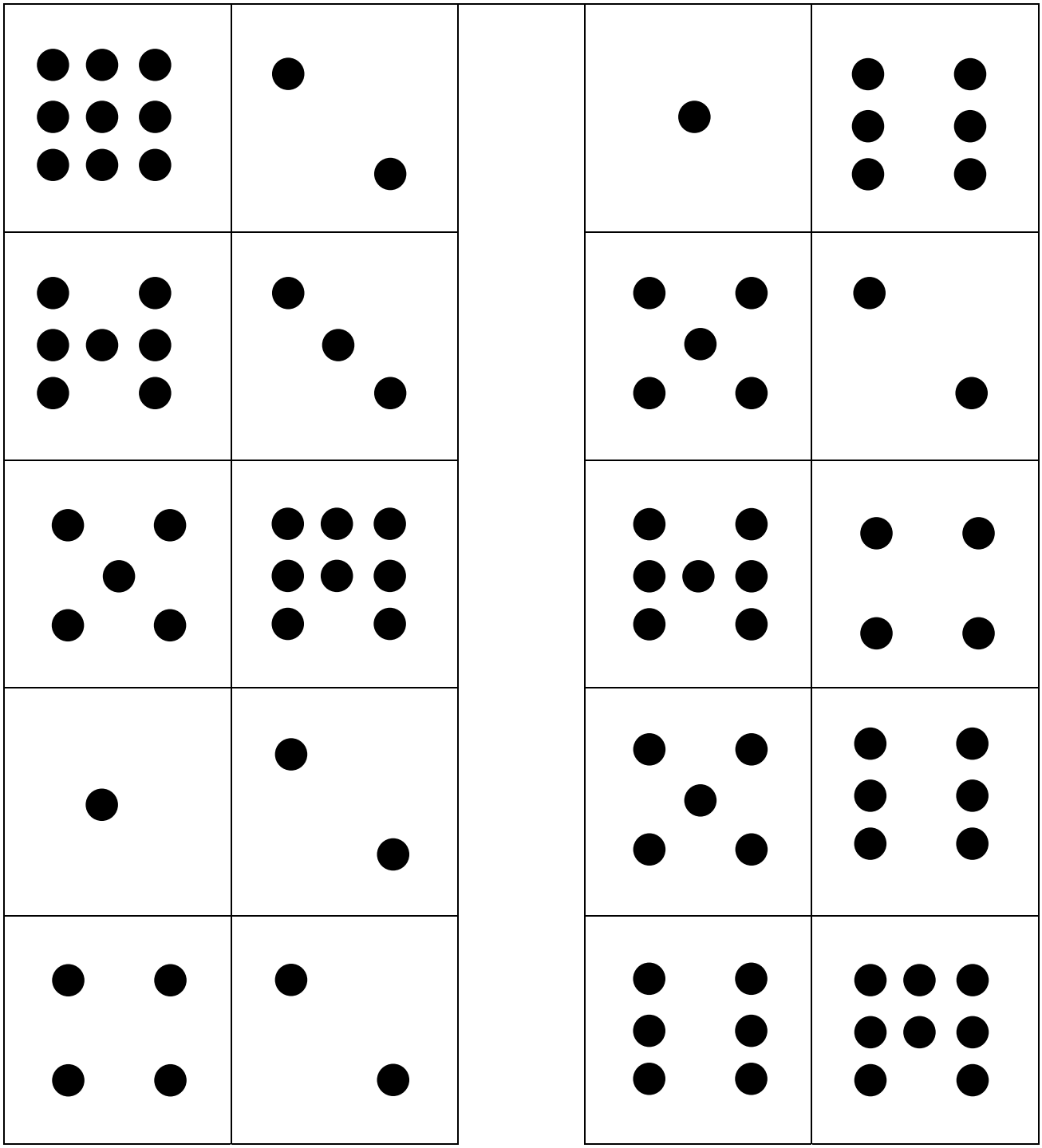
Make 10 Dominoes

Tierney Kennedy
Back to Front Maths

Photocopy and cut out the dominoes below. Each child gets 5 dominoes, place the rest in a pile. Child places a domino down and draws a replacement. Second child uses one end of the placed domino, and one end of their own domino to "make ten" (e.g. if one end of a domino on the ground has a 4, the child can place a 6), then draws a replacement from the pile. Continue adding dominoes, one child at a time, until all are used. Play in teams of 2 or 3. The winning team is the one that can use up the most dominoes.







Target

Andy Edwards
QSA

Equipment: A protractor, paper (scrap paper is fine but it has to have enough blank space on it to draw angle big enough to measure with the protractor), ruler.

Skill required: Recognise angles as greater than or less than 90 degrees. Ability to measure to one degree accuracy.

Skill developed: Improve estimation of acute, obtuse (and reflex) angles.

Play in pairs. I draw an angle on the paper. The arms need to be at least 5 cm long. You mark your estimate of the size in the hoop.

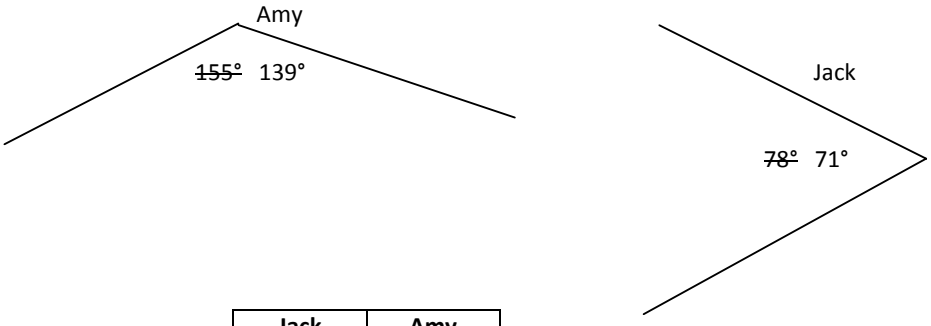
Then, under your close supervision, I measure the angle and declare, with your agreement, its exact size. You score one point for each degree out your estimate is. If you are 25 degrees or more out, you score 25 (under the mercy rule!)

Then we swap roles and you draw an angle for me. We keep a running total of points and play to a target. 50 or 100 or 150 are all reasonable targets depending on how much time is available and the skill of the players.).

When one of us passes the target, if we have had the same number of turns, the one who hasn't reached the target wins. If one of us is a turn behind, he/she catches up and the lower score wins. If time runs out and the target hasn't been reached, the lower score wins (provided the number of turns is equal.)

At first, only acute and obtuse angles are drawn for estimation. If reflex angles are known, they may be drawn for estimation but not more than once every two turns.

The improvement in students' skills in estimation and understanding of angle measurement is remarkable and swift.



Jack	Amy
7	16

Volume 36, Number 4

1. If $\frac{a}{b} = \frac{3}{4}$ $\quad \frac{a+b}{b} = \frac{a}{b} + \frac{b}{b}$
$= 1 + \frac{3}{4}$
$= 1\frac{3}{4}$

2. 8 revolutions per minute $= \frac{8\ revolutions}{60\ seconds}$
$= \frac{8 \times 360^{\circ}}{60\ s}$
$= 48^{\circ}\ per\ second$

3. 

Perimeter = 30 = 2x + x + 2x + x
x = 5

$Area = 10 \times 5 = 50\ cm^2$

Perimeter = 30 = 4 × x
x = 7.5

$Area = 7.5^2 = 56.25\ cm^2$

$Area\ of\ Square : Area\ of\ Rectangle = \frac{56.25}{50}$
$= \frac{9}{8}$

4. $x = t + \frac{1}{t}$ and $y = t - \frac{1}{t}$

$x^2 - y^2 = \left(t + \frac{1}{t}\right)^2 - \left(t - \frac{1}{t}\right)^2$
$= t^2 + 2 \times t \times \frac{1}{t} + \frac{1}{t^2} - \left(t^2 - 2 \times t \times \frac{1}{t} + \frac{1}{t^2}\right)$
$= 4$

5. Using $speed = \frac{distance}{time}$, hence $distance = speed \times time$

For the first stage of the journey $d_1 = v \times t$
For the second stage of the journey $d_2 = V \times T$

$$Average\ speed = \frac{vt + VT}{t + T}$$

Entries

Solutions for the student Problems were submitted by Immanuel Lutheran College, Kepnock SHS, Kingaroy SHS, Marist College Ashgrove, Redeemer Lutheran College, St Joseph's College Gregory Terrace, St Mary's College Maryborough, St Peter Claver College, Whitsunday Anglican School,

Winners

Congratulations are extended Praveena Sivanujan of Whitsunday Anglican College and Thomas Wong of St Joseph's College.

They received prizes provided by our generous sponsor, The University of Queensland.

Submitting Solutions

Students are invited to submit solutions to the Student Problems.

Please photocopy the problem page and clearly print your name, your school, and your year level.

Write your solutions (with working) next to each question, or by filling in the appropriate boxes.

Send your solutions to:

"QAMT Student Problems"
C/- Rodney Anderson
Moreton Bay College
PO Box 84
WYNNUM QLD 4178

Closing date is 8 May, 2012

Student Problems

Name: ..... School: ..... Year: .....

Question 1.

Question 2.

Question 3.

Question 4.

Question 5.