

Mathematical Literacy

Do we really need it?

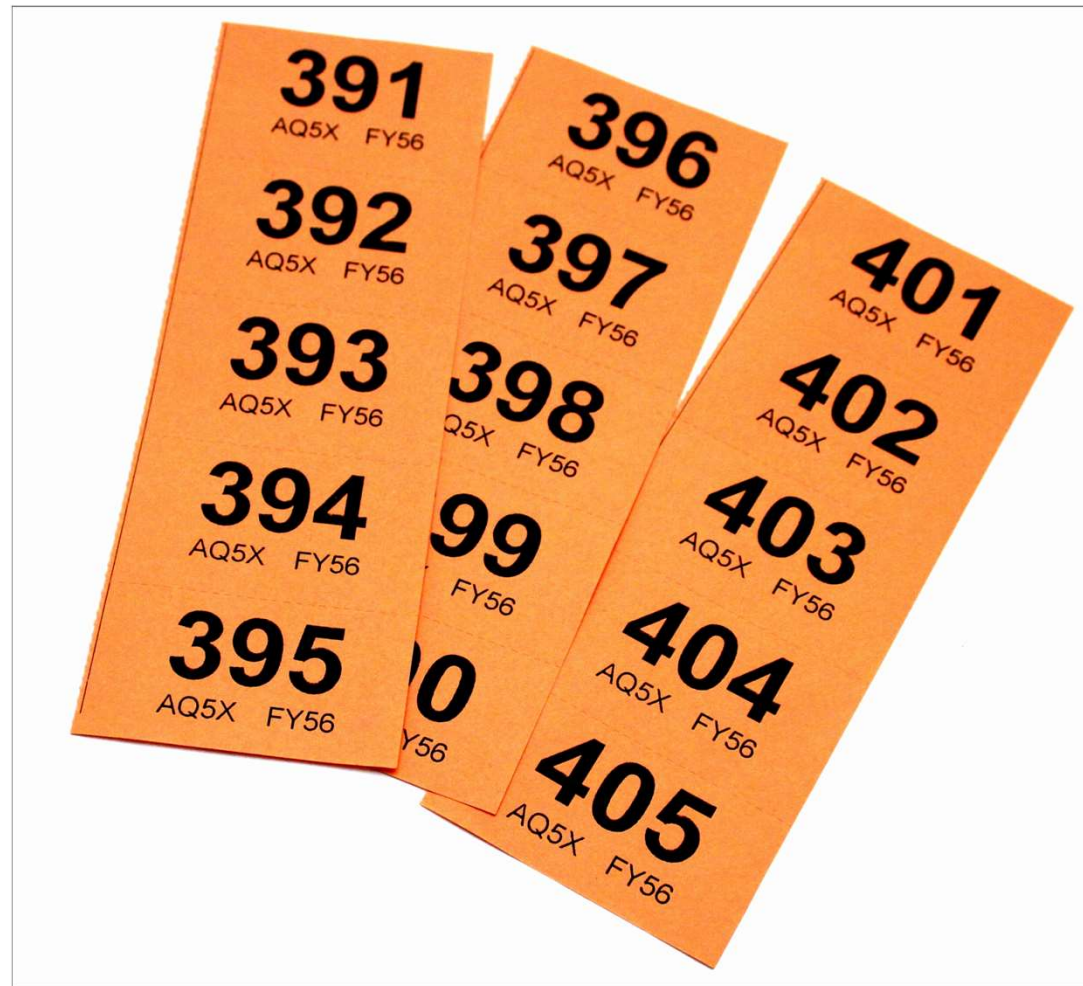
Dr Alison Borthwick

Miami, June 2018

My job today is ...

- to explore what mathematical literacy is (and is not);
- to decide if we need it;
- to show how it affects our daily lives;
- to share my mathematical journey with you.

No tests or worksheets but ...



Pause for thought

What do *you* think
mathematical literacy is?

Literacy experiences

Put your hand up if ...

- you can read;
- you use literacy every day;
- you believe literacy is essential for your job;
- you are not afraid to admit you are good at literacy.

Mathematical experiences

Put your hand up if ...

- you love maths;
- you love maths but don't want to admit it in public;
- you think you don't really use maths a lot in every day life;
- you couldn't wait to finish high school so you would never have to do maths EVER again.

OECD definition:

*Mathematical literacy is an individual's capacity to identify and understand the role that **mathematics plays in the world**, to make well-founded judgements and to **use and engage with mathematics** in ways that meet the needs of that individual's life as a **constructive, concerned and reflective citizen**.*

Yvette Solomon (2009)

Mathematical literacy is about **meaning-making** through language, a necessary part of participating in the practice of mathematics.

For many people this **meaning-making** appears to be out of reach to so many people for a number of reasons.

What do teachers think?

Mathematical literacy is:

- being able to talk, reason and communicate about mathematics;
- about using mathematical vocabulary accurately;
- applying the mathematics we engage with at school in everyday life;
- liking/loving mathematics (an appreciation of it).

Mathematical literacy is not ..

- advanced mathematics;
- calculus;
- algebraic manipulations;
- pages and pages of '*sums*'.

Mathematical literacy is

- about how we talk about and use mathematics;
- being able to understand those activities which require some level of mathematical thinking;
- having positive dispositions towards mathematics;
- a necessary skill for the 21st + century.

Mathematical literacy is all around us,
we use it without even noticing,
and we are all amazing at it!

But

I did not always have this view!

Primary school



Digital Spy Forums

Old stuff they used to have at school you remember? - Page 22 ...

Just mentioned these in another thread: SMP (School Mathematics Project) laminated cards ...

Secondary school

Name : _____ Score : _____
Teacher : _____ Date : _____

$$\begin{array}{r} 64 \\ - 13 \\ \hline \end{array} \quad \begin{array}{r} 86 \\ - 75 \\ \hline \end{array} \quad \begin{array}{r} 85 \\ - 44 \\ \hline \end{array} \quad \begin{array}{r} 74 \\ - 31 \\ \hline \end{array} \quad \begin{array}{r} 55 \\ - 11 \\ \hline \end{array} \quad \begin{array}{r} 65 \\ - 62 \\ \hline \end{array}$$

$$\begin{array}{r} 95 \\ - 32 \\ \hline \end{array} \quad \begin{array}{r} 67 \\ - 13 \\ \hline \end{array} \quad \begin{array}{r} 98 \\ - 85 \\ \hline \end{array} \quad \begin{array}{r} 77 \\ - 65 \\ \hline \end{array} \quad \begin{array}{r} 56 \\ - 33 \\ \hline \end{array} \quad \begin{array}{r} 99 \\ - 54 \\ \hline \end{array}$$

$$\begin{array}{r} 68 \\ - 54 \\ \hline \end{array} \quad \begin{array}{r} 78 \\ - 25 \\ \hline \end{array} \quad \begin{array}{r} 96 \\ - 23 \\ \hline \end{array} \quad \begin{array}{r} 58 \\ - 22 \\ \hline \end{array} \quad \begin{array}{r} 88 \\ - 13 \\ \hline \end{array} \quad \begin{array}{r} 79 \\ - 46 \\ \hline \end{array}$$

$$\begin{array}{r} 66 \\ - 53 \\ \hline \end{array} \quad \begin{array}{r} 59 \\ - 57 \\ \hline \end{array} \quad \begin{array}{r} 84 \\ - 34 \\ \hline \end{array} \quad \begin{array}{r} 64 \\ - 53 \\ \hline \end{array} \quad \begin{array}{r} 69 \\ - 18 \\ \hline \end{array} \quad \begin{array}{r} 76 \\ - 23 \\ \hline \end{array}$$



Teacher



Mathematics adviser!

Why? How?

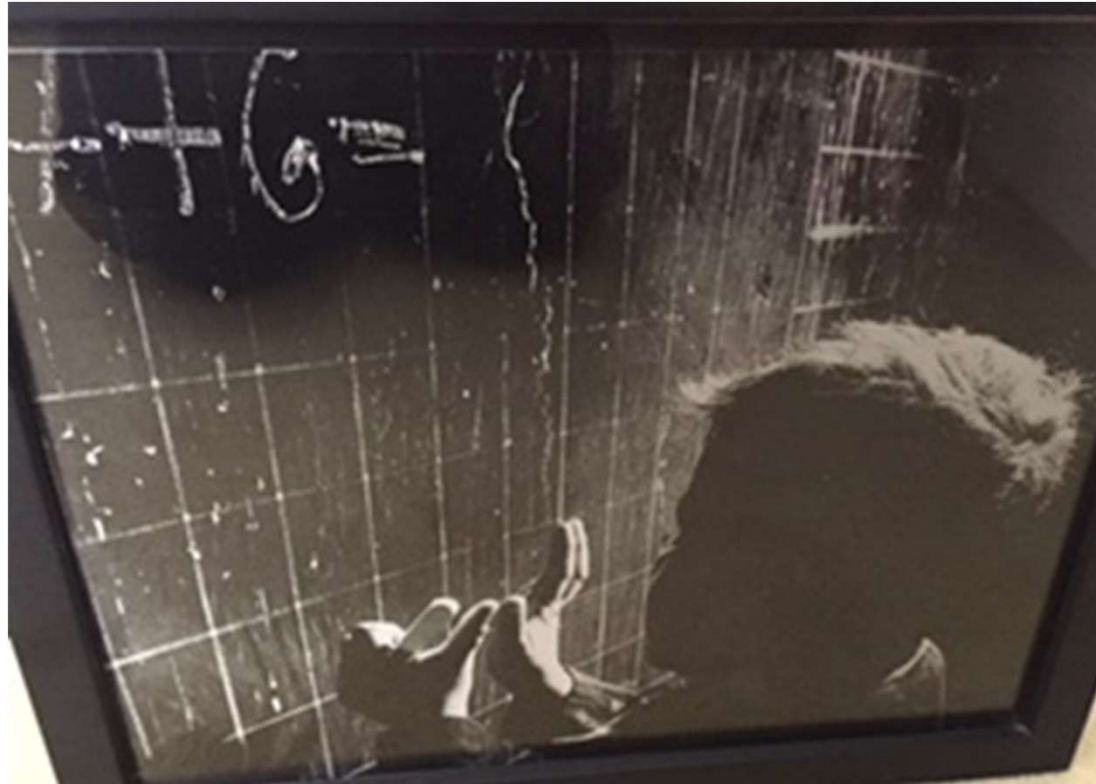
- NRICH

- Professional development course

wow

Masters

Captured or missed moments?



...but then I began to notice

- apathy;
- dislike;
- unhappiness;
- anger;
- fear.

“I would rather die than do maths”

PhD

Children's attitudes of, and
perceptions towards, mathematics
lessons

Do these children have mathematical
literacy?

1 2 3 4 5 6 7 8 9 10 11 12 13 14



Stutharet

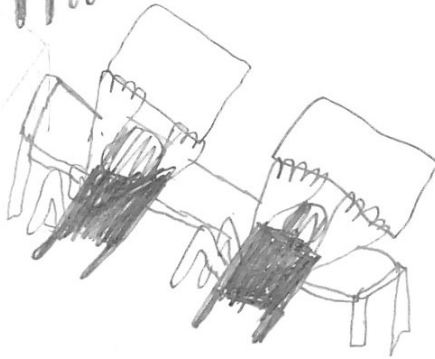
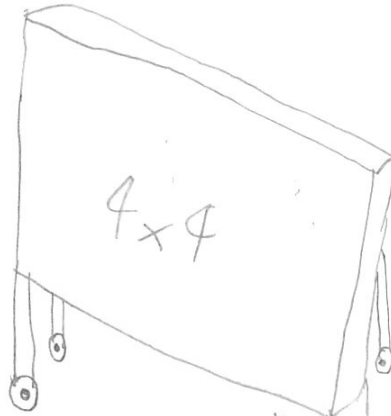
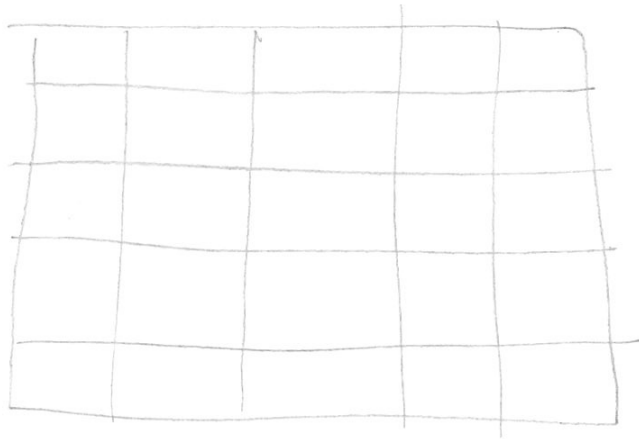


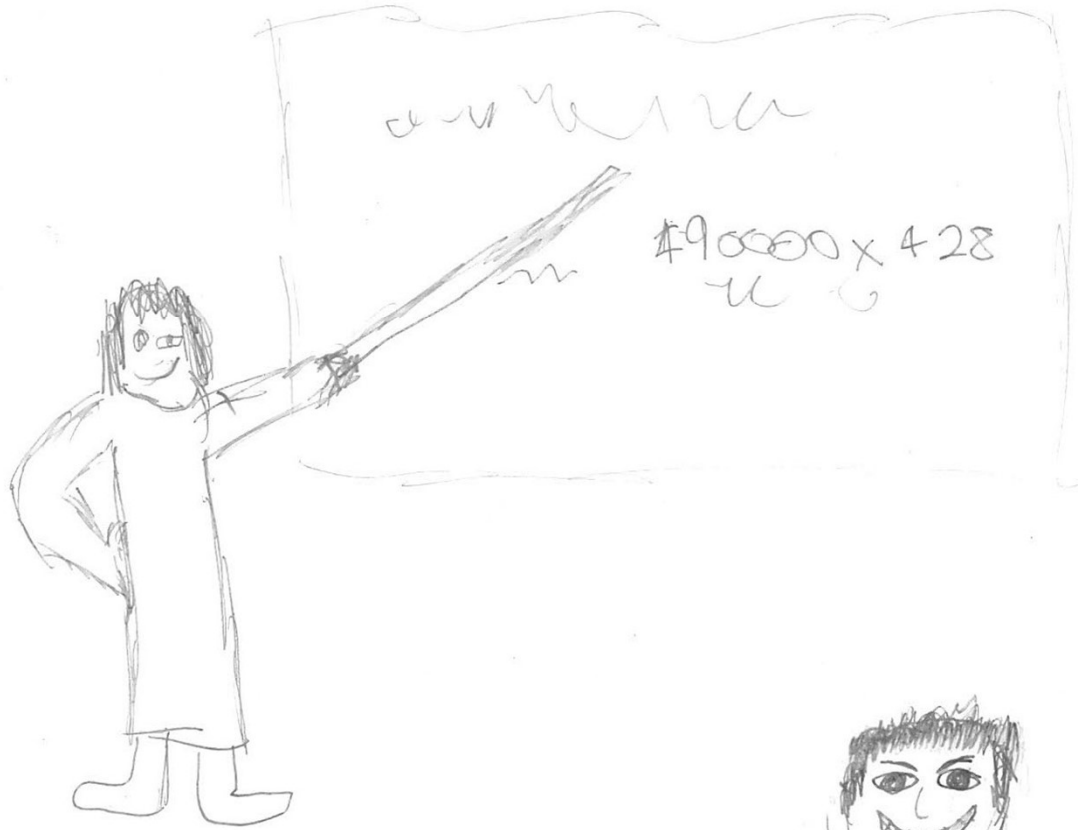
doing maths

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

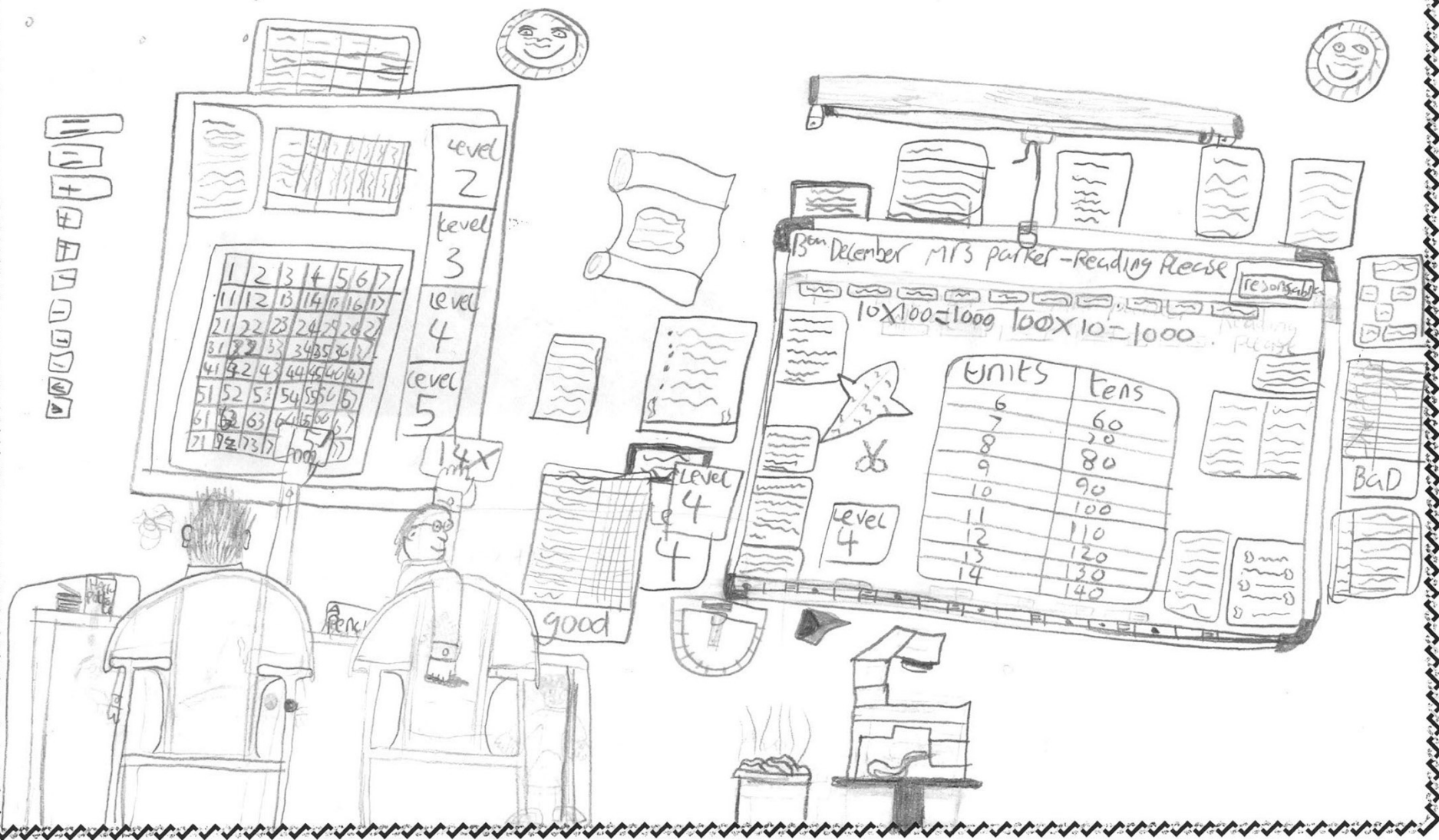
889







OUR MATHS LESSON



[Grid]							level 2
[Grid]							level 3
1	2	3	4	5	6	7	level 4
11	12	13	14	15	16	17	level 5
21	22	23	24	25	26	27	
31	32	33	34	35	36	37	
41	42	43	44	45	46	47	
51	52	53	54	55	56	57	
61	62	63	64	65	66	67	
71	72	73	74	75	76	77	

14x

level 4
4

good

15th December MIS Parker - Reading Recs

$10 \times 100 = 1000$ $100 \times 10 = 1000$

units	tens
6	60
7	70
8	80
9	90
10	100
11	110
12	120
13	130
14	140

Level 4

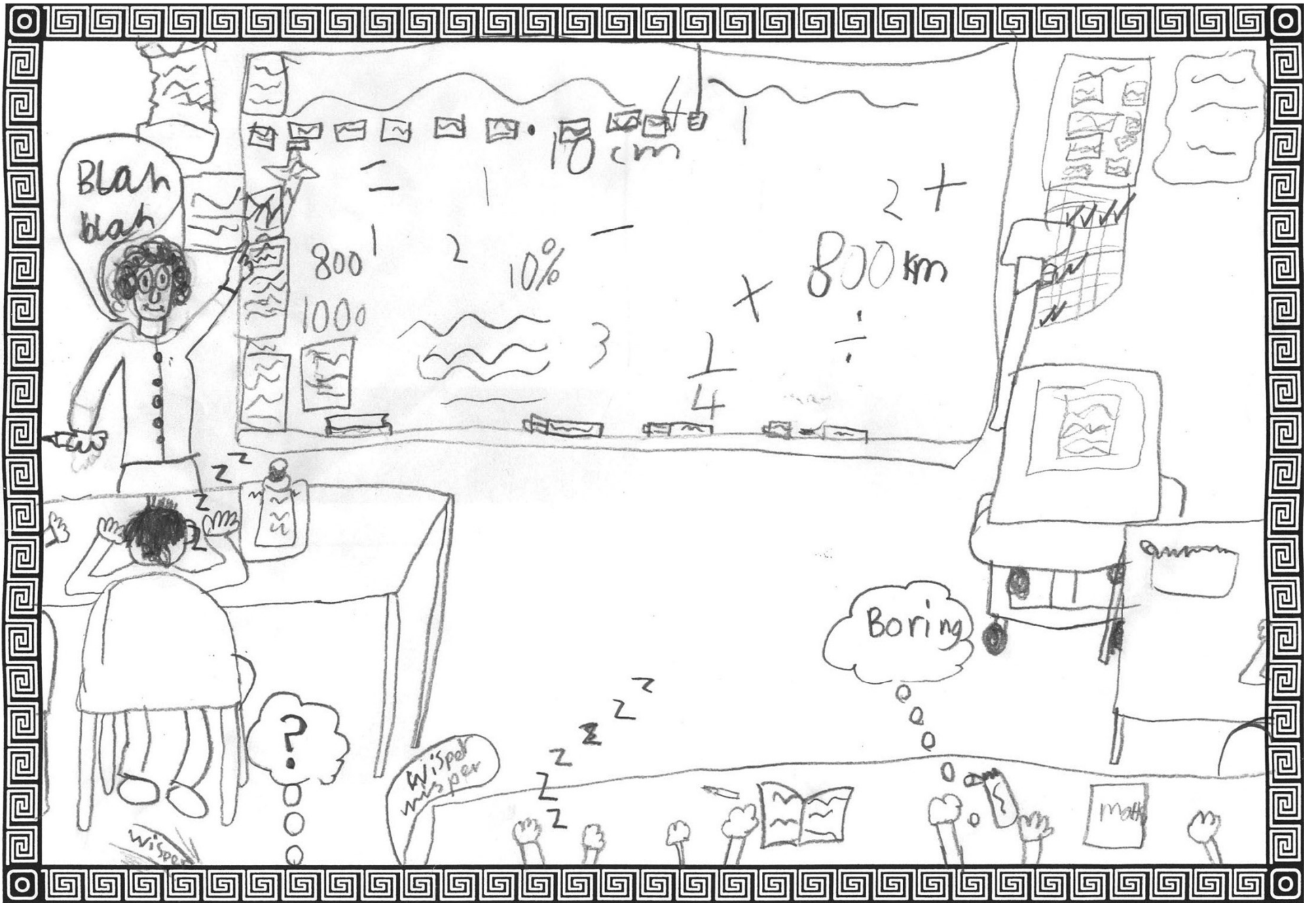
BAD

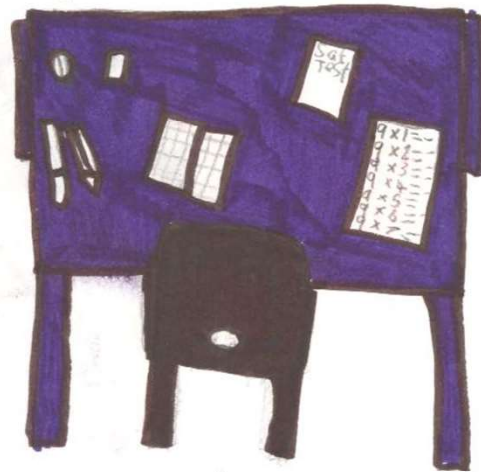
long division 21-8-01

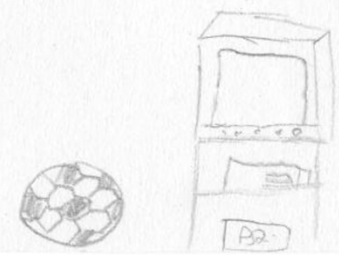
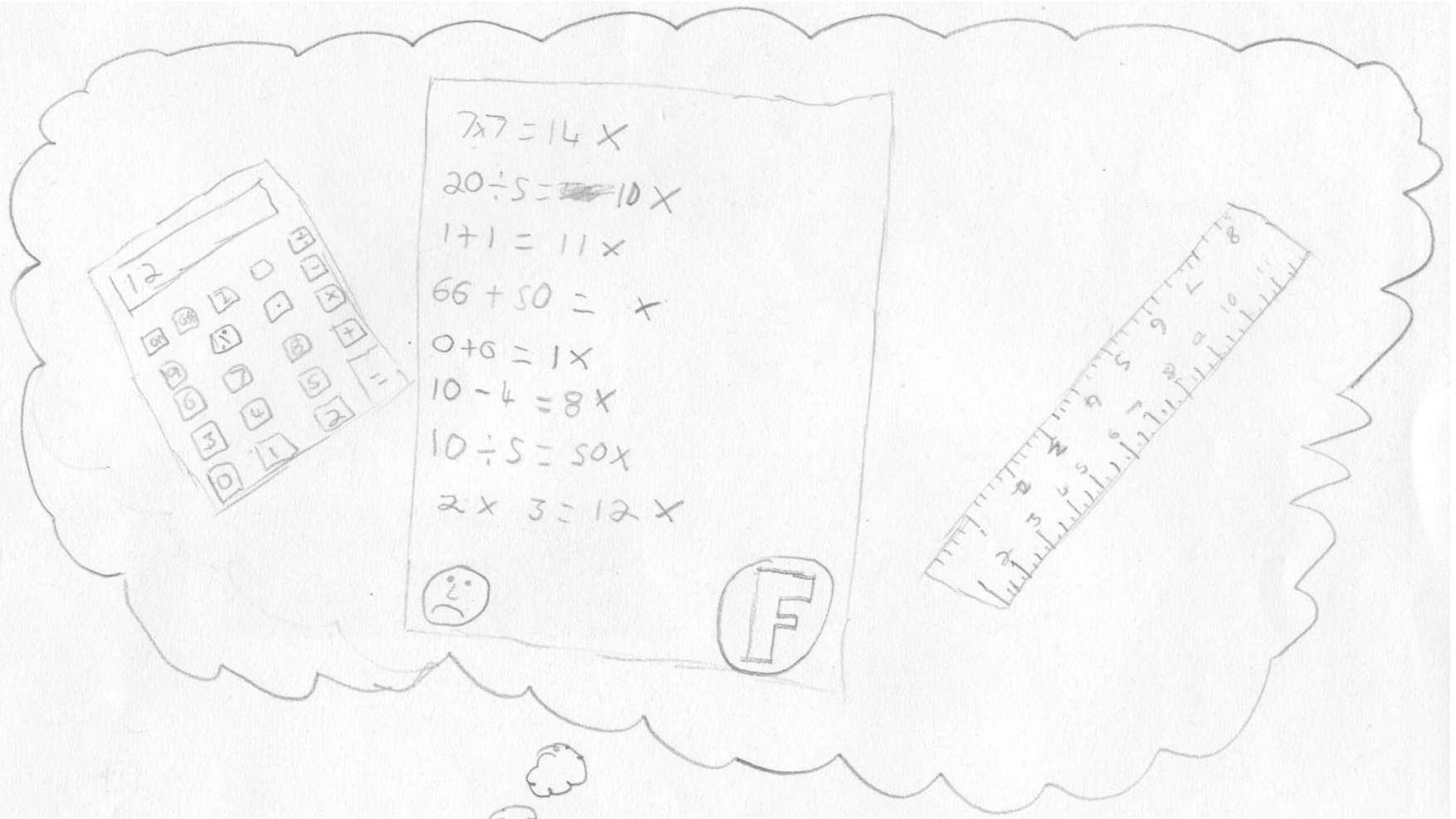
$$\begin{array}{r} 1. \quad 115 \\ + 812 \\ \hline \hline \end{array} \quad \begin{array}{r} 2. 598 \\ - 489 \\ \hline \hline \end{array}$$











PhD conclusions

- Too many students did not think they were any good at mathematics.
- Too many students had negative attitudes towards mathematics.
- I decided to become an ambassador for mathematics!

Foundations for Ambassador Role

- Positive dispositions.
- A belief that I can, not I can't.
- Mathematics is a life skill.
- *Everyone* is good at mathematics.

We need **mathematical literacy** for ...

- developing human capital;
- cultural identity;
- social change;
- environmental awareness;
- evaluating mathematics;
- future proofing.

What can mathematical literacy do for us?

In 2010, mathematician Peter Backus was fed up.

In his paper “Why I don’t have a girlfriend” Backus calculated there were more intelligent alien civilizations in the galaxy than potential girlfriends for him to date!

The Backus formula

Backus adapted a formula used by scientists,

*(to work out why Earth hasn't yet been visited by
aliens)*

to work out how many women would meet his
criteria for a girlfriend.

His criteria

- How many women are there who **live near** me? (In London: 4 million women)
- How many are likely to be of the **right age**? (20% - 800,000 women)
- How many are likely to be **single**? (50% - 400,000 women)

His criteria

- How many are likely to have a **university degree**? (26% - 104, 000 women)
- How many are likely to be **attractive**? (5% - 5,200 women)
- How many are likely to find **me attractive**? (5% - 260)
- How many am I likely to **get along with**? (10% - 26 women)

Did he win?

- Yep!
- Married in 2015!

So, back to the **cloakroom ticket** ...

Look at your number on the ticket.

What is it?

What do you know about this number?

When did you last use this number?

When might you use this number?

Everyone stand up!

- Sit down if your number is **even**
- Sit down if your number is **greater than 250**
- Sit down if your number is a **multiple of 5**
- Sit down if your number **ends in the digit 3**
- Sit down if your number can be **divisible by 1**
- Sit down if

How did you do?

- You were all **successful**.
- You all knew the complex **mathematical language** I was using.
- Everyone was **included ... and appeared to enjoy the task!**
- You all used your **mathematical literacy** to think, problem solve and follow the instructions.

Questions to consider

- What does it mean to have mathematical literacy?
- Do you have mathematical literacy?
- How do you acquire mathematical literacy?
- Can you improve your mathematical literacy?

But do we *really* need it?

- We live in a technological age where computers have all the answers.
- We carry calculators in our pockets.
- We don't use the school mathematics in the 'real' world - *do we?*

We use mathematics more than we think!

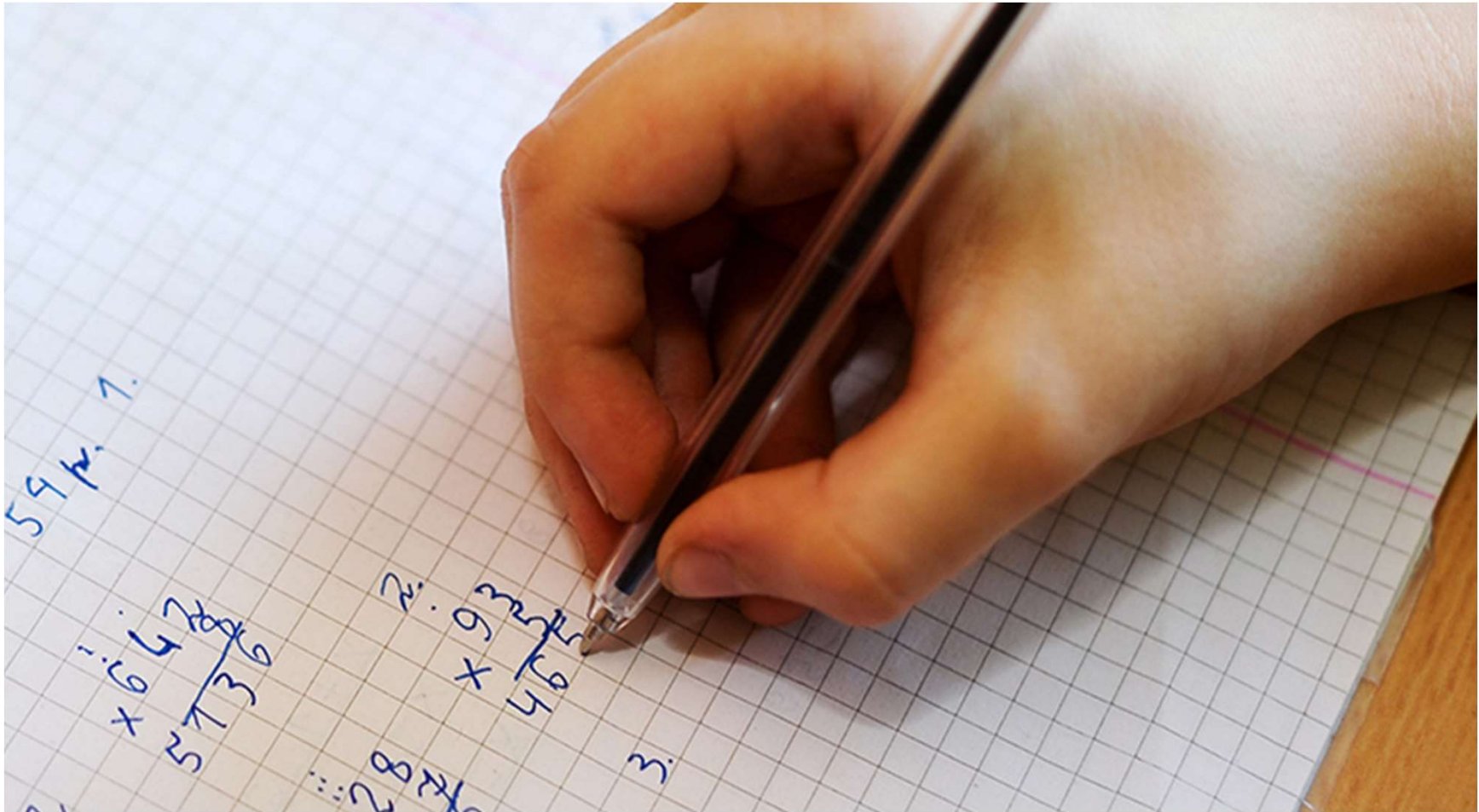
Tell the person sitting beside you:

- how old you are;
- where you live;
- which route/road/train/bus you took to get to the conference today;
- without using any mathematical language!

Pause for thought

Has your definition,
understanding and
awareness of mathematical
literacy changed?

Is it this?



Or this?



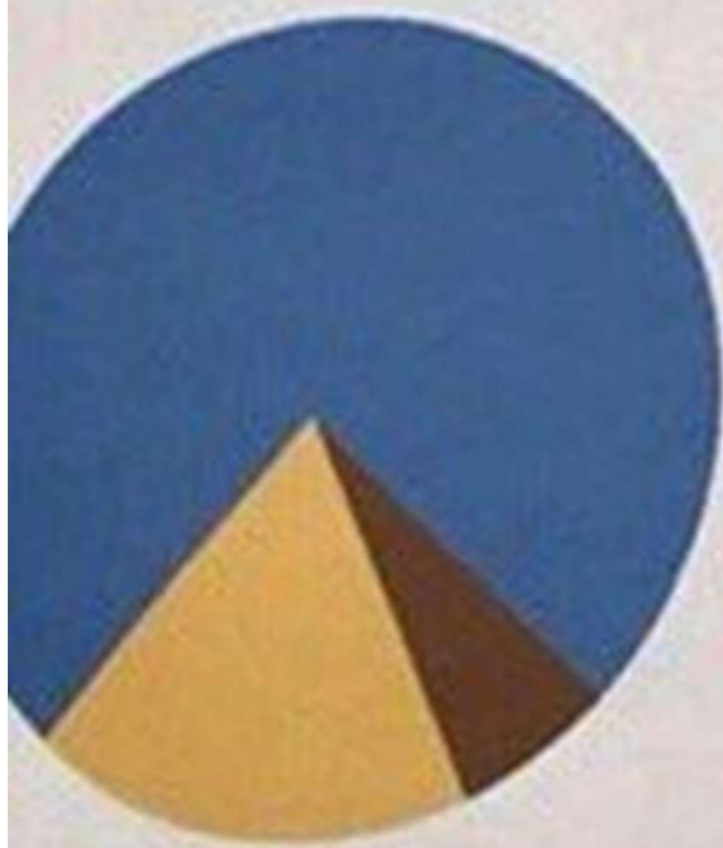
Cognitive Fizz!



Mathematical literacy helps us to ...

- Describe patterns in nature;
- Predict the weather;
- Keep the score at a soccer/baseball game;
- *Get through every day*





Sky



Sunny side of pyramid



Shady side of pyramid



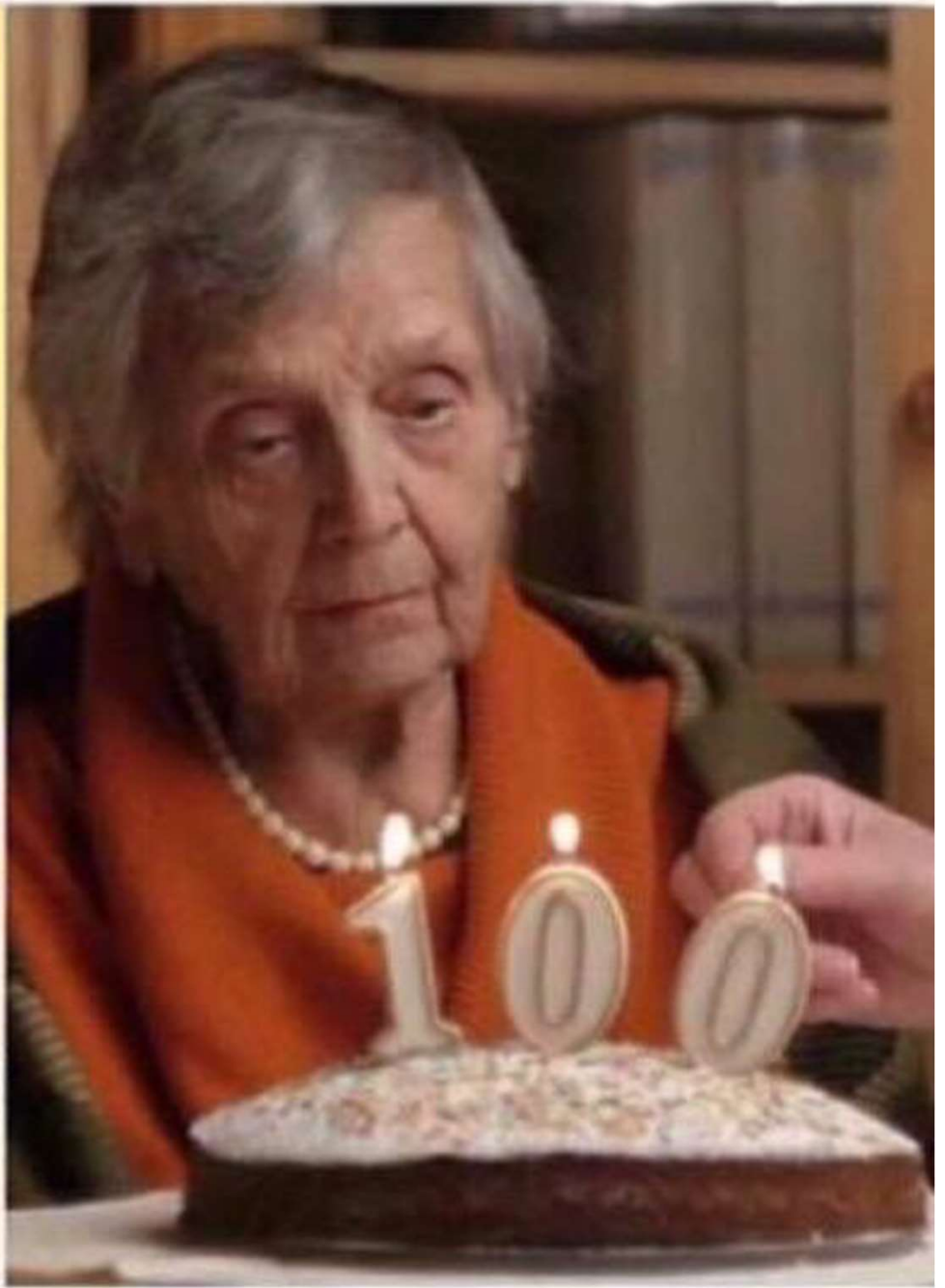
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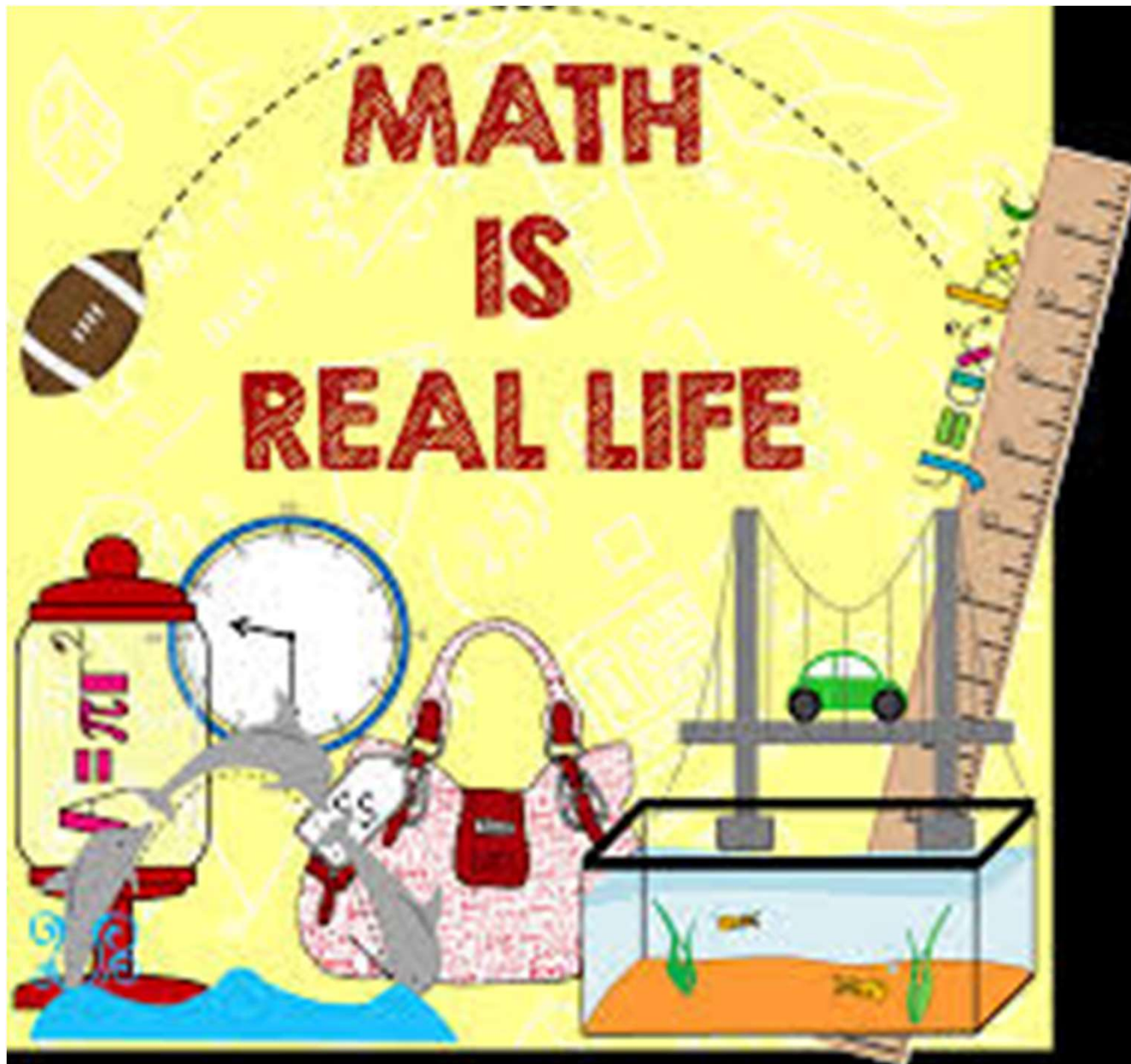
for the 1st Offense
50 - \$100 for
Subsequent Offenses

Department of Mental
Health and Addiction Services
www.dhs.gov/ohio/1949

PLEASE REFRAIN
from Discussing
MATHEMATICS
while waiting in LINE



MATH IS REAL LIFE



Back to me!

- Mathematics adviser (support 420 in Norfolk, but 9 intensively).
- Just finished working at NRICH, University of Cambridge.
- Chair of the National ATM and MA professional group.
- Adviser to the UK Government - for mathematics.

If I can ... anyone can!

We have ...

- explored what mathematical literacy is (and is not);
- decided if we need it;
- considered how it affects our daily lives;
- looked at my mathematical journey.

Now, it's over to you!

References

Brown, M., Brown, P and Bibby, T. (2008) 'I would rather die': reasons given by 16-year-olds for not continuing their study of mathematics. *Research in Mathematics Education*, 10:1, 3-18.

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Teachers – Evolution Academy Trust, UK

Thank you