Unnatural Maths Problems
- and how to make them better

Animations and copyrighted images have been removed from these slides.
This is an aide memoire only.

@robeastaway

An article based on this workshop will appear in Teaching Times.

(a) The shortest route?
(i.e. a straight line)

(b) The shortest swim?

(c) Another route?

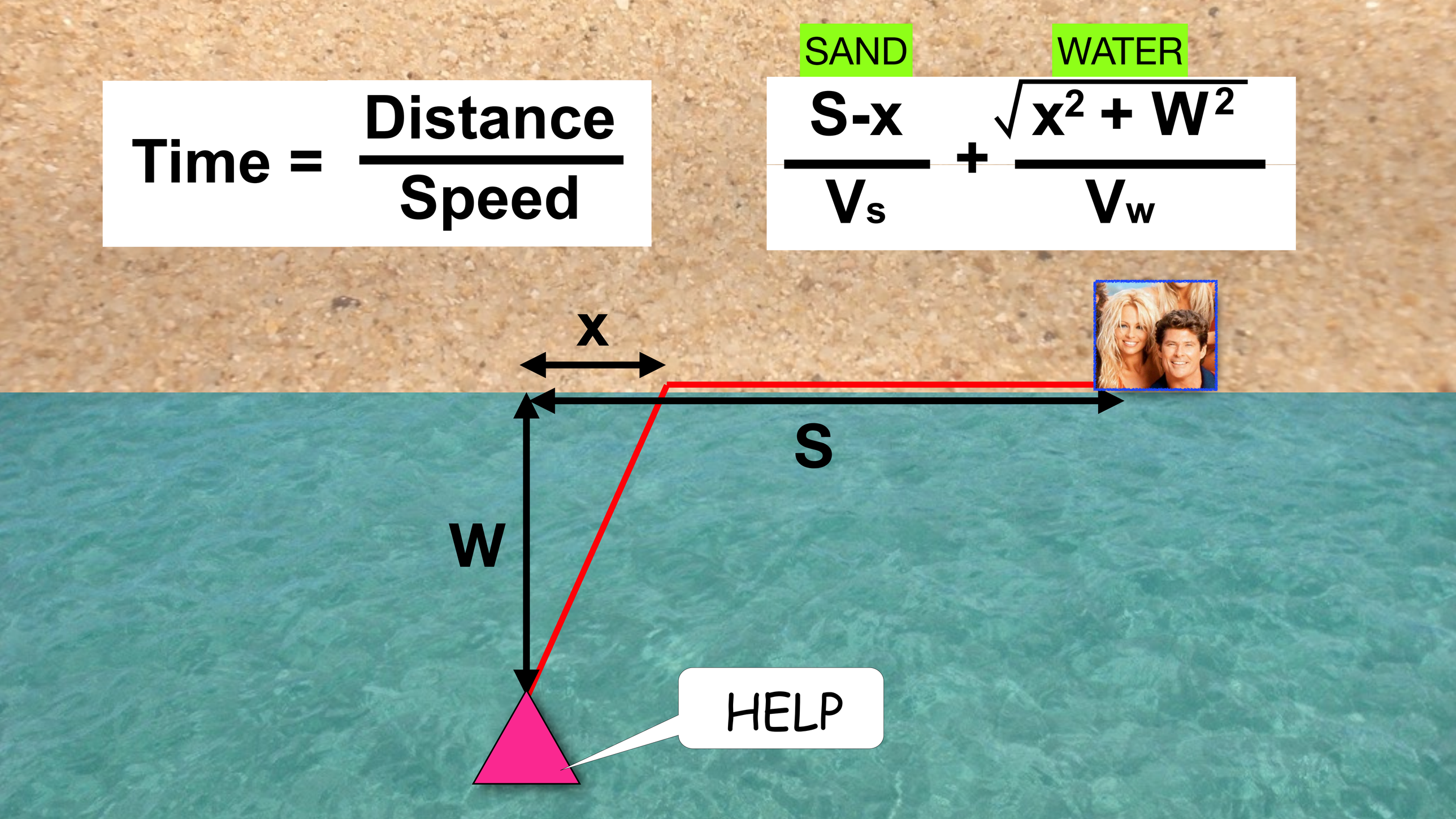
?

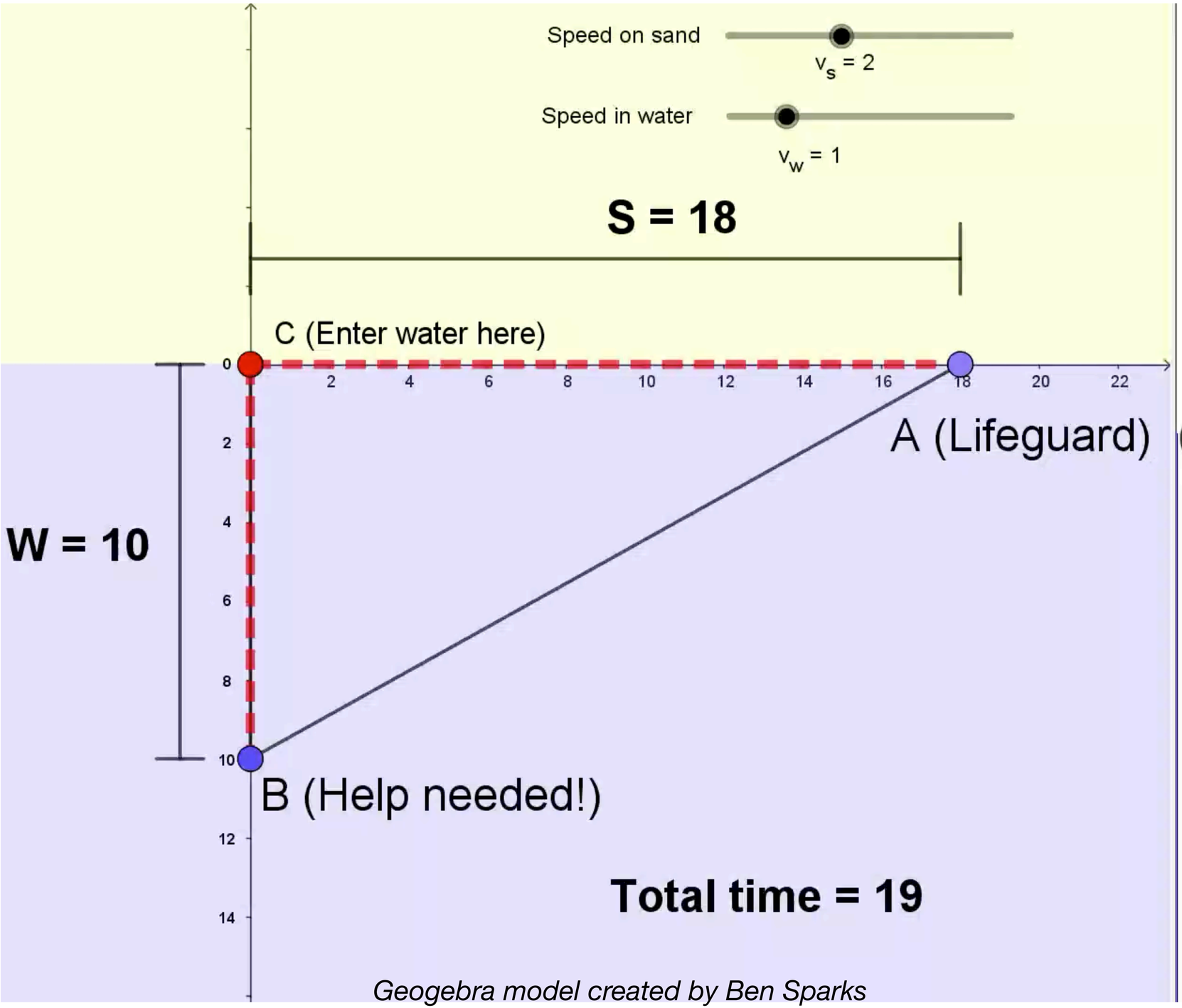
HELP

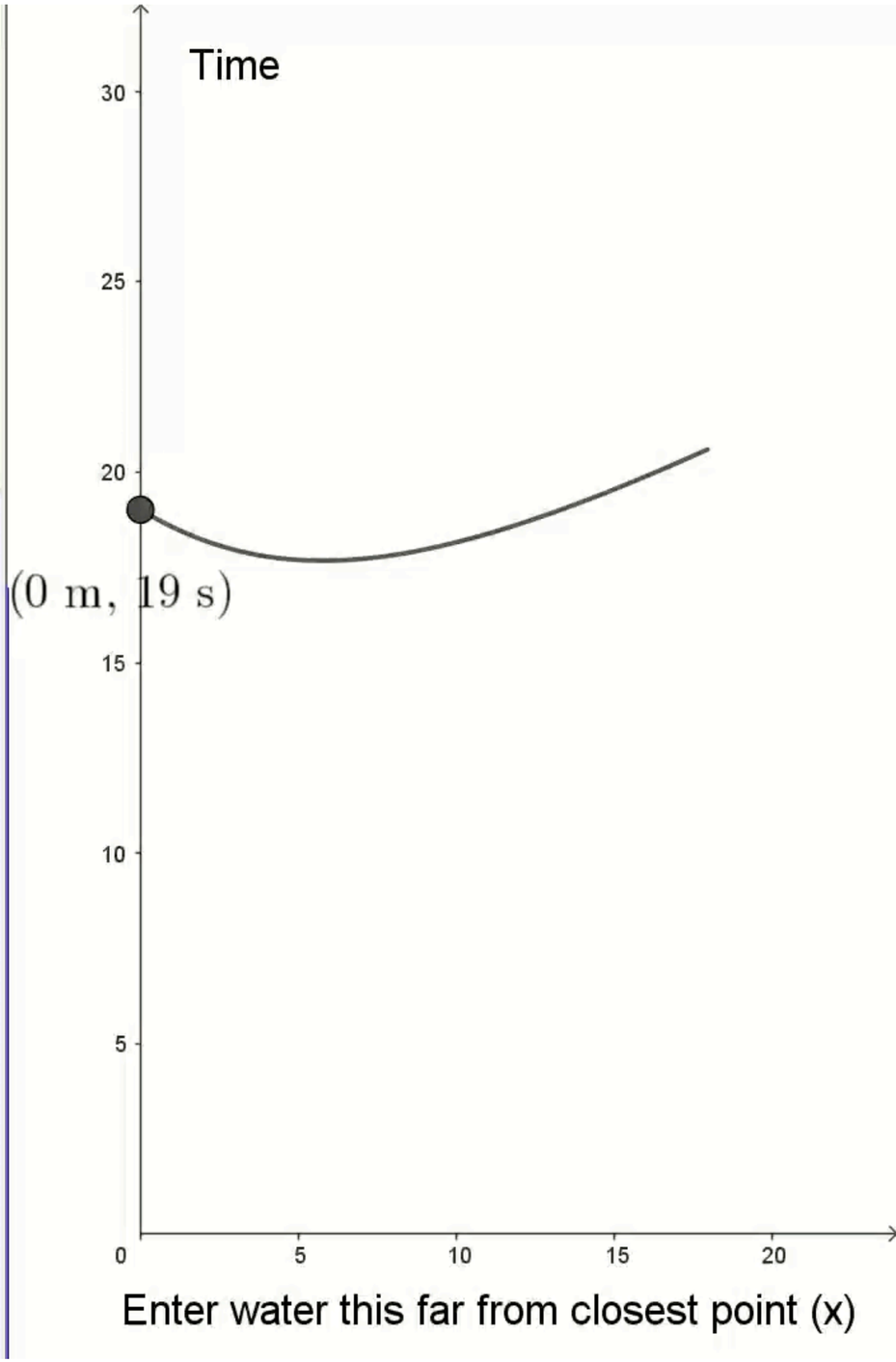
$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

SAND WATER

$$\frac{S-x}{V_s} + \frac{\sqrt{x^2 + W^2}}{V_w}$$



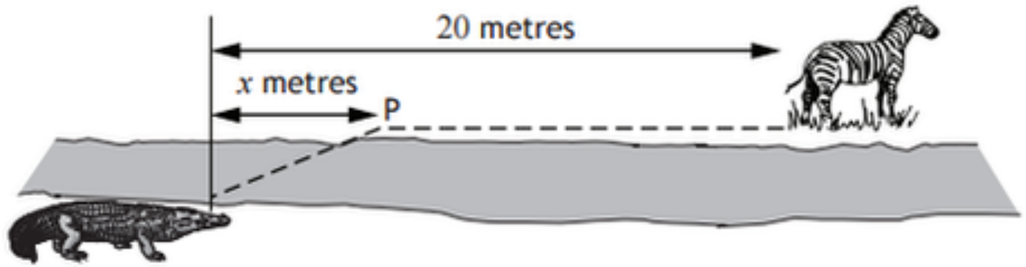

Speed on sand
$v_s = 2$
Speed in water
$v_w = 1$
S = 18
C (Enter water here)
A (Lifeguard)
W = 10
B (Help needed!)
Total time = 19
Geogebra model created by Ben Sparks


Time
(0 m, 19 s)
Enter water this far from closest point (x)

8. A crocodile is stalking prey located 20 metres further upstream on the opposite bank of a river.

Crocodiles travel at different speeds on land and in water.

The time taken for the crocodile to reach its prey can be minimised if it swims to a particular point, P, x metres upstream on the other side of the river as shown in the diagram.



The time taken, T, measured in tenths of a second, is given by

$$T(x) = 5\sqrt{36 + x^2} + 4(20 - x)$$

(a) (i) Calculate the time taken if the crocodile does not travel on land. 1

(ii) Calculate the time taken if the crocodile swims the shortest distance possible. 1

(b) Between these two extremes there is one value of x which minimises the time taken. Find this value of x and hence calculate the minimum possible time. 8

SQA

SQA Highers 2015

UNNATURAL

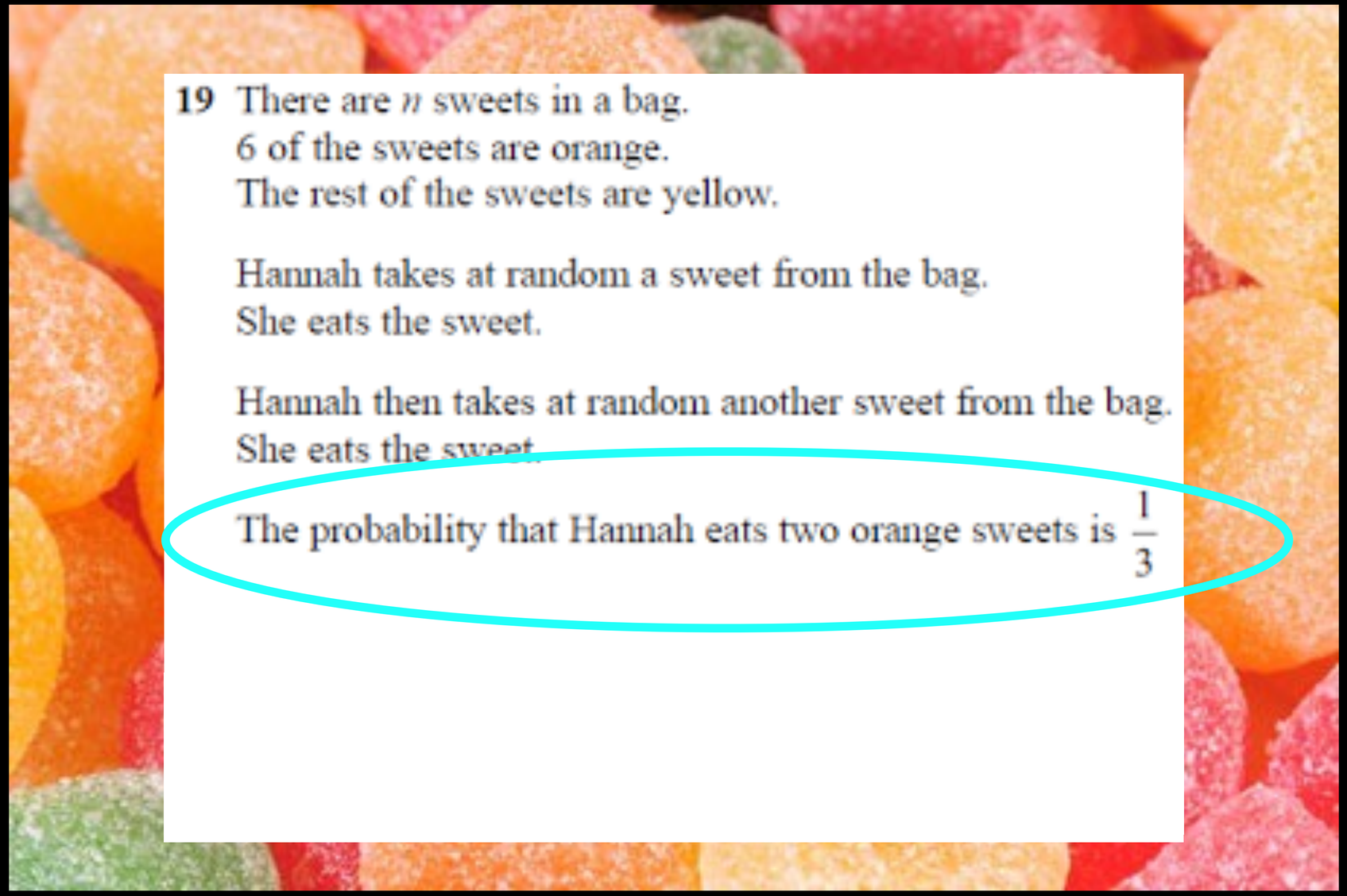
PROBLEM

Edexcel GCSE 2015

19 There are n sweets in a bag.
6 of the sweets are orange.
The rest of the sweets are yellow.

What comes next?

Edexcel GCSE 2015



19 There are n sweets in a bag.
6 of the sweets are orange.
The rest of the sweets are yellow.

Hannah takes at random a sweet from the bag.
She eats the sweet.

Hannah then takes at random another sweet from the bag.
She eats the sweet.

The probability that Hannah eats two orange sweets is $\frac{1}{3}$

What comes next?

2 Kiaria is 7 years older than Jay.
Martha is twice as old as Kiaria.
The sum of their three ages is 77

Find the ratio of Jay's age to Kiaria's age to Martha's age.

Chicken & Steak Pies

A factory makes 450 pies every day. The pies are chicken pies or steak pies. Each day Milo takes a sample of 15 pies to check.

The proportion of the pies in his sample that are chicken is the same as the proportion of the pies made that day are chicken.

On Monday, Milo calculated that he needed exactly 4 chicken pies in his sample. *Work out the total no. of chicken pies made on Monday.*

On Tuesday, the number of steak pies Milo needs in his sample is 6, correct to the nearest whole number.

Milo takes at random a pie from the 450 pies made on Tuesday.

Work out the lower bound of the probability that the pie is a steak pie

'So much repetition of the word pie, this would be criticised in a piece of analytical writing. And I don't understand the fourth sentence. The whole thing feels dystopian.' (English teacher)

NATURAL PROBLEMS

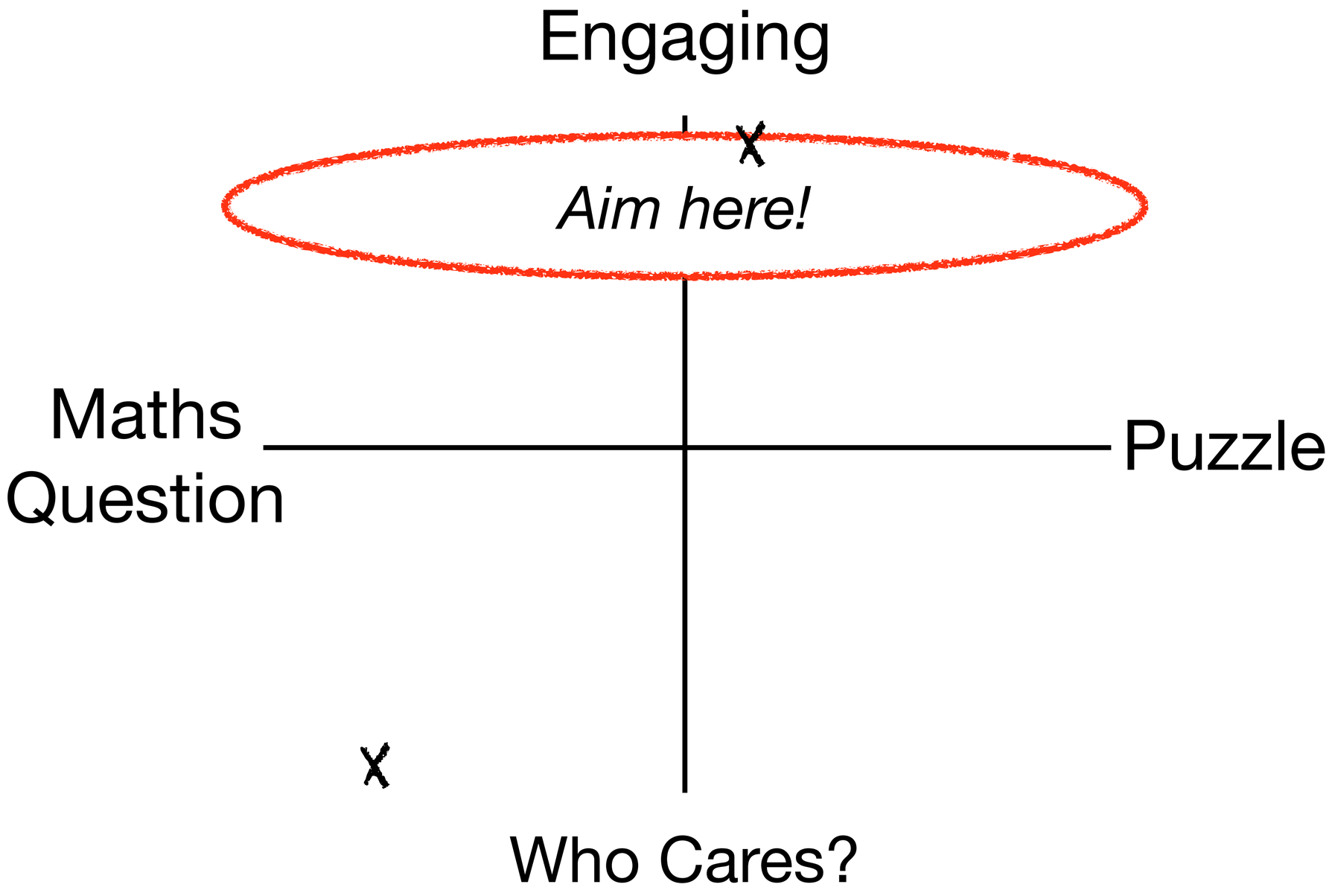

Dan Meyer
What are you wondering?


12:21:05
M62
11
12
16
Manchester


12:23:00
M62
Bradford 8
Halifax 9
Huddersfield 13
Manchester 36


BT
1
2
3
NR26 8LG
Emergency
Telephone
Dial 999
and ask for the
emergency service
you require
This telephone is for
emergency use only
It is located outside the
Lifeguard Hut,
West Prom, Sheringham

Humour
&
Empathy


Engaging
Aim here!
Maths Question
Puzzle
Who Cares?

$$a + b = 78$$

$$b + c = 69$$

$$a + c = 137$$

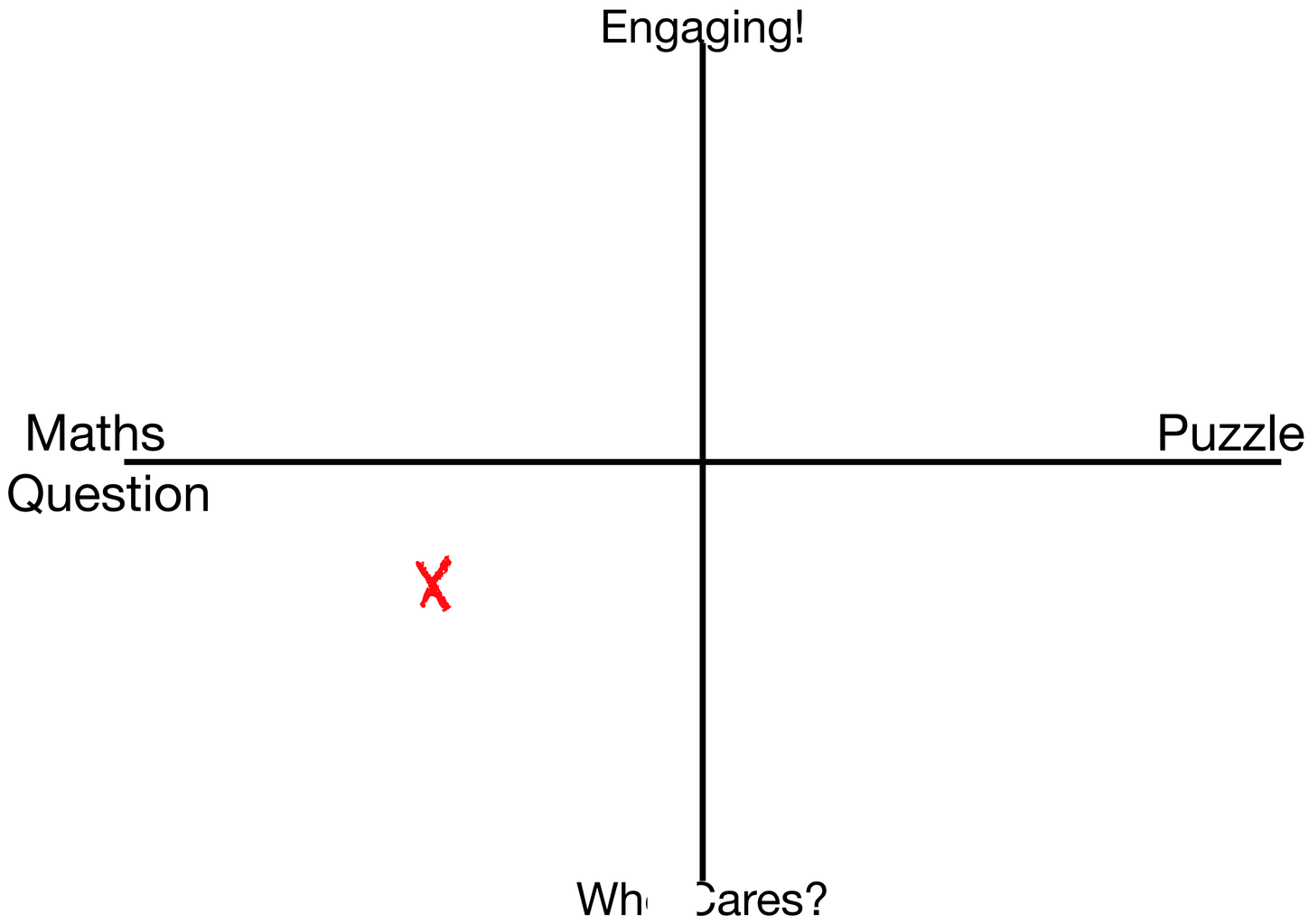
Work out $a + b + c$

Alf and Bert weigh 78 kg

Bert and Charlie weight 69 kg

Alf and Charlie weight137 kg

What is the combined weight
of Alf, Bert and Charlie?


Engaging!
Maths
Question
Puzzle
Who Cares?

UKMT Maths Challenge question:

Weighing the baby at the clinic was a problem.

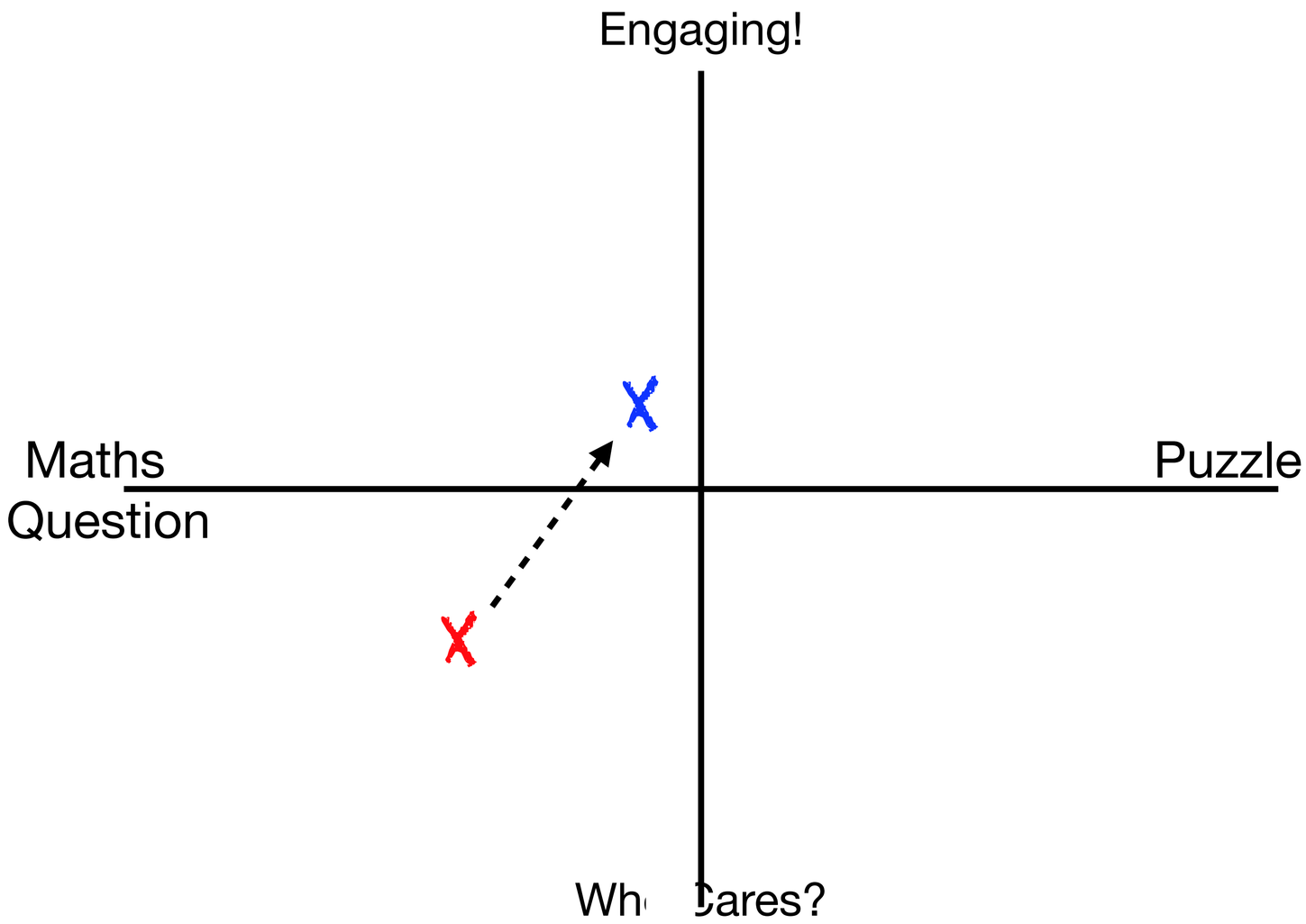
The baby would not keep still and caused the scales to wobble.

So I held the baby and stood on the scales while the nurse read off 78kg.

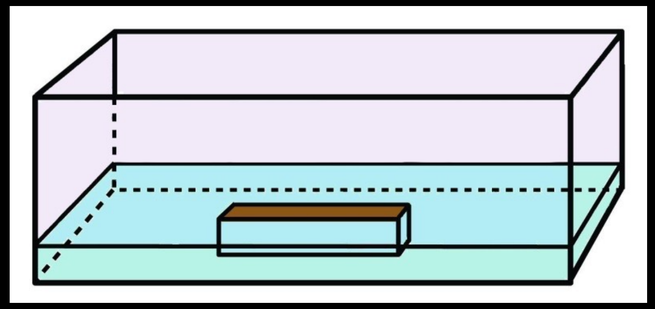
Then the nurse held the baby while I read off 69kg.

Finally I held the nurse while the baby read off 137kg.

What was the combined weight of all three?


Engaging!
Maths
Question
Puzzle
Who Cares?

What makes this an unnatural maths question, not a puzzle?



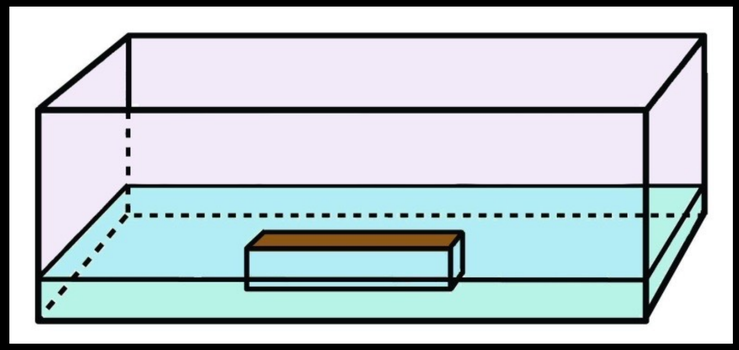
Toddler Tina has accidentally dropped one of her toy bricks in the fish tank.

The cuboid brick has length Lcm, with a width that is one half of its length, and a height that is one third of its length. The cuboid fish tank has negligible thickness, a length that is one-and-a-half times L, and a width that is two-thirds of L.

Fortunately, Goldie the goldfish who normally lives in the tank is away on vacation because the depth of water without the brick is only 2cm. When the brick rests on the bottom of the tank, with its height running vertically, the water just reaches the top of the brick.

What are the dimensions of the brick?

THE STICKLE BRICK



Tina has noticed that the water in Sticky the stickleback's tank is very shallow, so she has the bright idea of dropping one of her toy bricks to raise the water level.

Fortunately the brick misses the fish and the water level rises to exactly the height of the brick which is lying flat.

The interior of the tank is one and a half times as long as the brick…

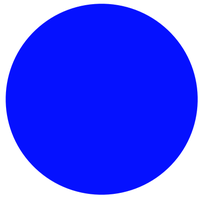
£1 to play: Pick out Two balls

6 Red ping pong balls

…and some **blue** (at least one)

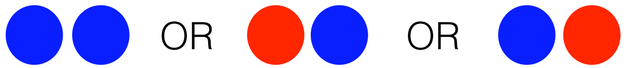
Both **RED** you win £3!

BLUE you lose



How few blues must there be for you to be willing to play?

Treble Your Money!



Raise £1

Give away £2

Break-even if P(**2 reds**) = $\frac{1}{3}$

6 reds

n blues

The game breaks even if

$$P(\text{two reds}) = \frac{1}{3}$$

Chance first and second balls are red

$$\frac{6}{(6+\mathbf{n})} \times \frac{5}{(5+\mathbf{n})} = \frac{1}{3}$$

$$\frac{30}{(\mathbf{n}^2 + 11\mathbf{n} + 30)} = \frac{1}{3}$$

There are n blues

The game breaks even if

$$n^2 + 11n - 60 = 0$$

$$n = 4 \quad \text{or} \quad n = -15$$

Making problems more ‘natural’

1. We are where we are.

2. Use images and topical problems to spark curiosity.

3. Acknowledge that mathematical modelling simplifies the real world. (“All models are wrong, but some are useful”)

4. Use Humour.

5. Talk to humanities teachers.

@robeastaway

p.s. The question that provoked most backlash in the May 2026 Scottish Highers exam was this:

11. (a) (i) Show that $(x+2)$ is a factor of $x^3+7x^2+18x+16$.

(ii) Explain why $(x+2)$ is the only linear factor of $x^3+7x^2+18x+16$.

Give a reason for your answer.