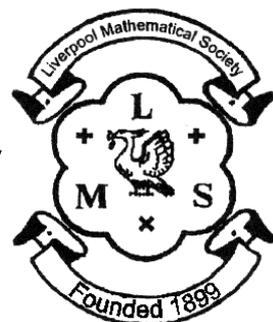


# MATHEMATICAL EDUCATION ON MERSEYSIDE

Sponsored by



# Challenge '18

## For Year 8 or below

Illustrations by Will Ashworth and Theo Chaddock

### Rules

- 1) Challenge '18 should be attempted at home during February half term.
- 2) Your entry must be your own work, though of course you may ask for help on how to get started or for the meanings of unfamiliar words.
- 3) Entries without any working out at all or written on this sheet **will not be marked**.
- 4) It is possible to win a prize even if you have not completed all of the questions, so hand in your entry even if it is not quite finished.
- 5) You must write **your name and school neatly on every page**.

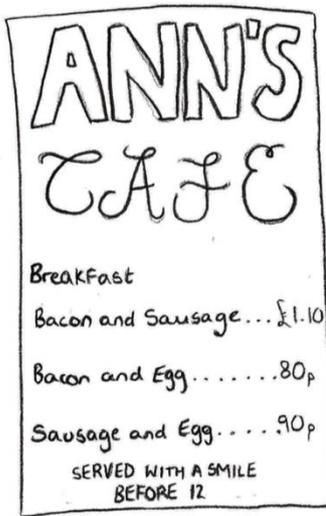
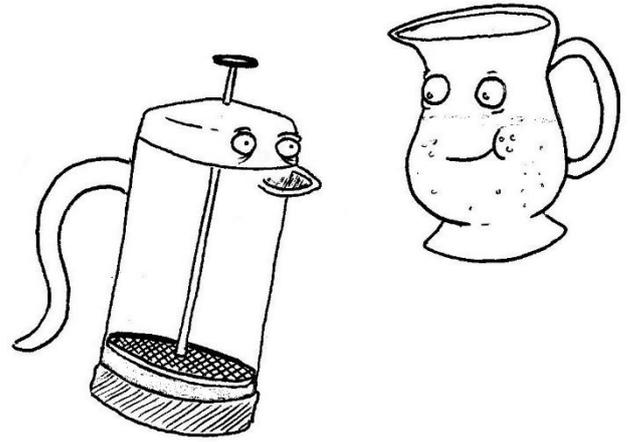
Either you or your maths teacher needs to return your entry by 9<sup>th</sup> March to this address:

Challenge '18 Entries,  
Chris Marchant,  
Department of Mathematical Sciences,  
University of Liverpool,  
Peach Street,  
Liverpool,  
L69 7ZL

A Prize-Giving Evening will be held at the University of Liverpool on 9<sup>th</sup> May.  
We hope that you enjoy the questions.

### 1. Just Jugs

The coffee jug holds 4 times as much as the milk jug. Everyone has the same size cup, but each person likes different amounts of milk in their coffee. Jane likes half milk and half coffee; Jean, June and Joan each like one quarter milk; and Ian drinks black coffee. They fill up their five cups the way they each like and just empty one of the jugs. How much liquid is left in the other?



### 2. Big Breakfast

Ann's café offers a choice of hot breakfast items at these prices:

- Bacon with Sausage – £1.10
- Bacon with Egg – 80p
- Sausage with Egg – 90p

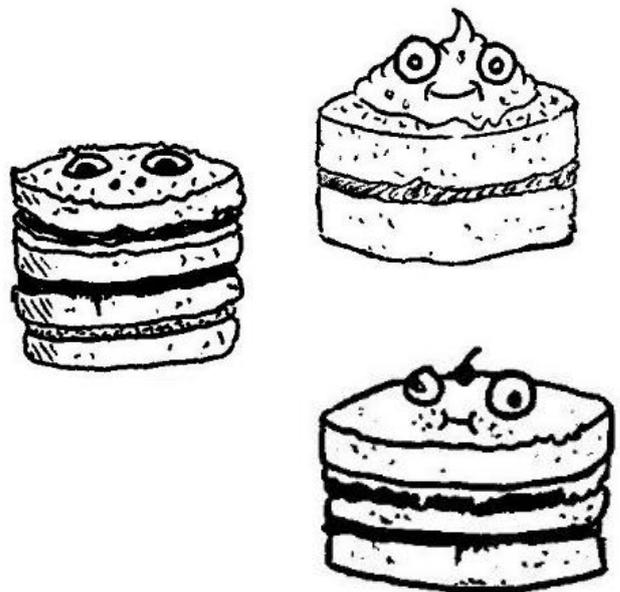
James is a fan of all three, so he requests bacon, sausage and egg with his order! To maintain consistency with the quoted menu prices, how much should Ann charge James?

### 3. The Fussy Baker

Sue has baked 3 different types of circular cake, all measuring 8 inches across. There are equal numbers of coffee cakes and lemon cakes, but just one carrot cake. She wants to arrange them on a rectangular table with area 576 square inches.

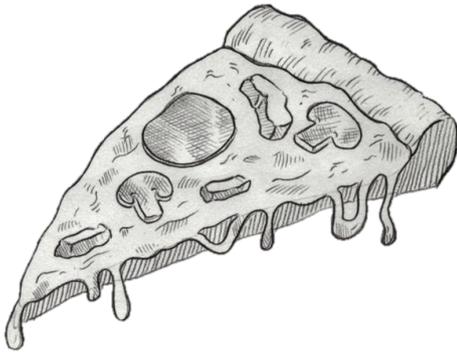
Find the dimensions of the table. How many cakes has Sue baked?

Sue would like to arrange her cakes to make an attractive display. She is a stickler for detail, so she won't place lemon cakes directly next to the carrot cake; nor may cakes of the same flavour be next to each other. Show how she can achieve this.



#### 4. A Sale of Three Score Scones

Rachel has 60 scones. She sells them to Robbie, Cameron, Louis, Tom and Charlie in that order. Each customer buys more scones than the last and the increase is the same number in each case. Robbie and Cameron's combined total number of scones is three sevenths of the total of Louis, Tom and Charlie. How many scones does each boy buy?

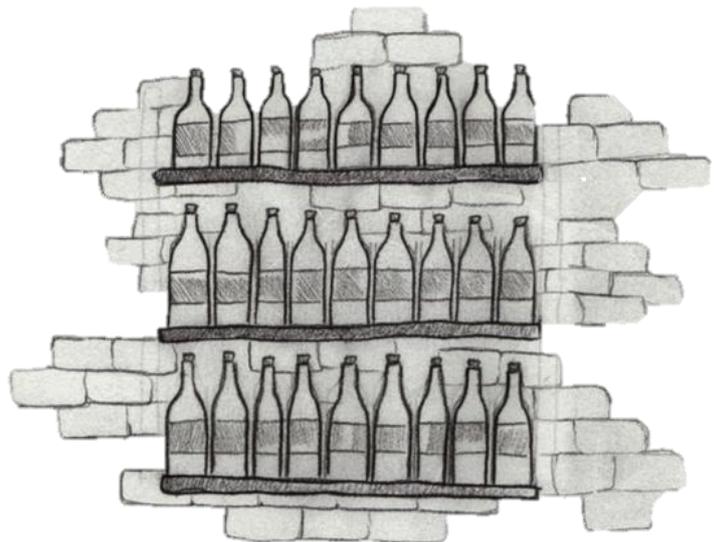


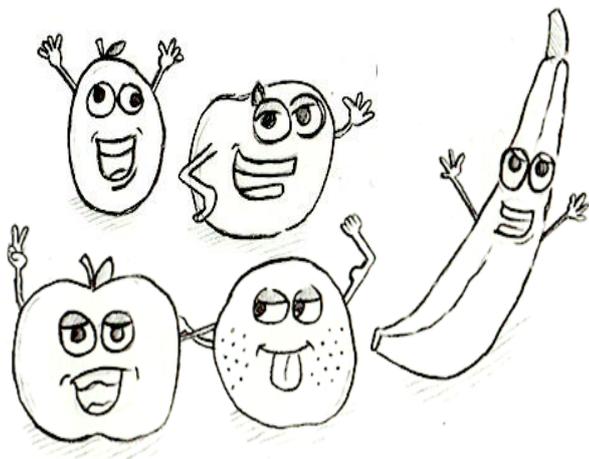
#### 5. A Pizza the Action

Chris visited the local Pizza Shack to purchase one pizza for each member of his Scout Troop. On arrival, he realised that he had mislaid the list he had made of the pizzas that had been requested. He knew that there were 32 people altogether and that all 3 vegetarians in the Troop wanted mushrooms only. He also remembered that the same number of people wanted just the chicken topping as wanted a plain pizza. Alex, a Young Leader, was able to help by recalling that: 12 people requested toppings that included chicken, 10 requested toppings that included pepperoni, 9 requested toppings that included mushroom, 1 person wanted all 3 toppings, 2 wanted chicken and pepperoni only, 2 wanted pepperoni and mushroom only. What was the final order that Chris placed at Pizza Shack?

#### 6. Got a Lot of Bottles

Davina has a large cellar for her wine bottles and also a small fridge dedicated to wine storage in her kitchen. Davina drinks one bottle per day. Being very fussy, she does not like any bottle of her wine to be exposed to the light more than 12 times, including the time she first transfers it to her cellar, each time the cellar door is opened, each time the fridge door is opened and, finally, on the day when she drinks it. To avoid wasting any wine, what is the largest number of bottles she should order each time she needs more wine?





## 8. Coffee Chaos

Lonnie is doing the office coffee run one morning. There are two coffee machines in the building: one from STACO and one from TRUCKBASS.

They dispense two types of coffee: black (no milk) and white (with milk).

The machines are both rather temperamental. Every fourth coffee dispensed from STACO is black and the rest are white.

The coffees dispensed from TRUCKBASS are alternately black and white.

Lonnie visited one of the machines and bought some coffees, of which three turned out to be white. He went back to the same machine for the afternoon run and bought the same number of coffees again. What are the possible numbers of white coffees that Lonnie could have received this time?

## 7. Five a Day

Glenys, Karen, Nicola, Philippa and Shirley enjoy healthy snacks on their daily tea break. There are 5 different pieces of fruit left in the Common Room fruit bowl:

an apple, a banana, a nectarine, an orange and a plum.

They agree to have one piece each. Glenys likes only apples and bananas; Philippa likes only apples and plums; Nicola and Shirley both like nectarines, oranges and plums; and Karen likes only bananas and oranges.

List all the possible ways that they can each have one piece of fruit that they like.

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The competition is promoted by

Mathematical Education on Merseyside (MEM)  
Registered Charity No 517028,  
Department of Mathematical Sciences,  
University of Liverpool,  
Peach Street,  
Liverpool,  
L69 7ZL

MEM is proud to acknowledge generous financial support from the following during the past year:

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