

# Junior Challenge '25

## *Year 8 or below*

Illustrations by Kira Wadeson

### Rules

- 1) The challenge should be attempted in your own time. Your entry must be **your own work**, though you may ask for help for the meanings of unfamiliar words. It is possible to win a prize or certificate even if you have not completed all the questions.
- 2) Present your worked solutions **separately on A4 size papers**. Lined papers are recommended, but blank or graph paper are accepted – as long as they are neatly presented. Do not write on this question sheet directly.
- 3) **Write your name and school on every page neatly.**
- 4) When you have completed, please scan your pages and save as a **single PDF file**. Make sure the scan is clear and legible.

### Submission instructions

All submissions are done online. If you are planning to submit an entry, please ask your teacher<sup>1</sup> to fill in this form to register:

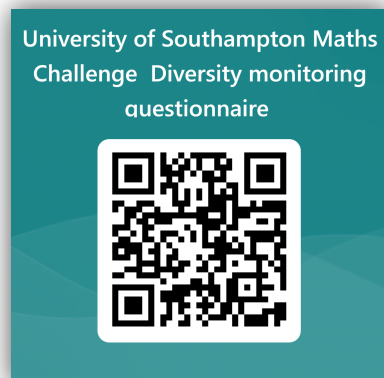
<https://forms.office.com/e/0wCqJwWcHj>

Only one registration per teacher is needed. Teachers will receive a link to upload as many entries as they need. All entries should be uploaded by **Friday 21 March 2025**. A Prize-Giving Evening will be held at the University of Southampton in June 2025.

*We hope that you enjoy the questions!*

### ***Optional diversity monitoring questionnaire***

Completing this questionnaire is **optional** and is **not a requirement** for participating in the Challenge. The questionnaire is meant to be completed by a parent or guardian of the participating student. This data is being collected for the purpose of assessing the diversity of participants in the Maths Challenge. The data will be stored and used in accordance with the University of Southampton's published Data Privacy Notice and Data Protection Policy.

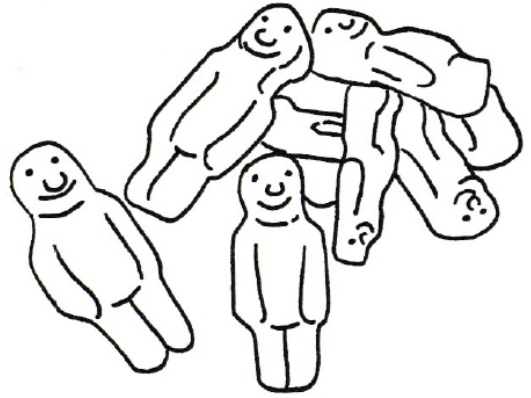


<https://forms.office.com/e/PgKjUA9sfc>

<sup>1</sup> If you are not affiliated with a school, you may also ask your parents to fill in the form and submit for you.

## 1. Jelly Babies

Susha is trying to divide a packet of jelly babies between her 4 children. Firstly, she gives some to the eldest; the second gets  $\frac{1}{3}$  of what is left; from what is then left, the third gets  $\frac{5}{8}$  part; and after that the youngest receives the rest of the packet, which is  $\frac{2}{5}$  of their eldest sibling's share. Each child receives fewer than 20 jelly babies.



How many are in the packet and what number does each child get?

## 2. Clean Break

Ellie's bar of chocolate has four rows of six squares. She wants to divide it into individual squares using clean straight breaks, where each break makes two pieces out of one.

(a) What is the minimum number of breaks she needs to do?

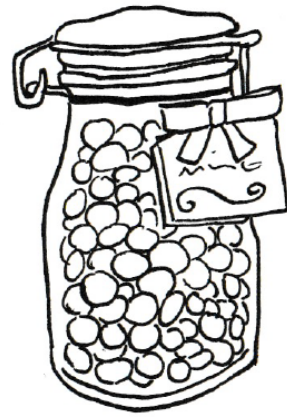
Her husband, Charlie, has a larger bar, with 8 rows of 6 squares. The top-left and top-right squares both contain a nut. Neither Charlie nor Ellie likes nuts and each of them wants to avoid getting one. They play the following game. Starting with Charlie, they take it in turns to snap the bar into 2 pieces along a line between 2 rows or 2 columns, eating 1 of the 2 pieces produced. If a player eats a nut they lose and the game finishes.

(b) Who can guarantee not to eat a nut? Is this true for any size of bar?

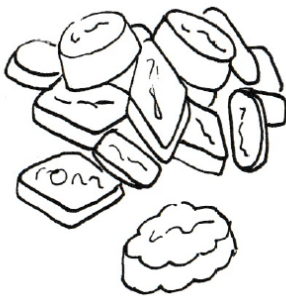
### 3. Imperial Volunteers

Pat, Sharon and Helen are litter picking along the canal with 7 volunteers. They have 35 mint imperials. Pat eats 1, Sharon eats 2 and Helen eats 3. They leave the rest for the volunteers. All of them are eaten.

Show that at least one volunteer ate at least 5 mint imperials.



### 4. Wonky Wine Gums



Something has gone wrong at the factory. The five wine gum colours and flavours are mismatched so that **ALL** are wrong.

Sarah eats a red and thinks it could be orange, lemon or lime-flavoured.

Sue eats a yellow and is sure it is also one of the three citrus flavours.

Martin tries a green and says it's either strawberry or blackcurrant.

Michael tries an orange-coloured one and a purple one at the same time and can taste both blackcurrant and something else that's not lemon or lime.

Identify which colour is which flavour.

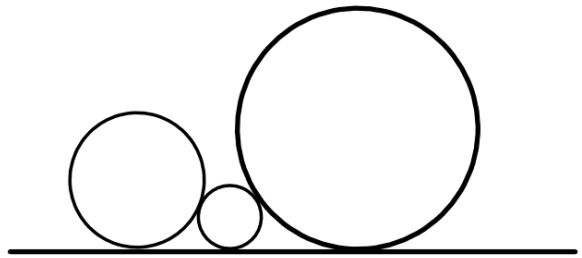
### 5. Hard Toffee

Barry takes a box of toffees to the Maths staff room to share with the other teachers during breaks. He eats one himself on the first day and hands out 10% of what is left; he eats 2 on the second day, giving away 10% of the remainder; 3 on the third day, giving away 10% of the remainder; and continues in this way until no toffees are left.

How many toffees were in the box and how many days did they last? (We assume that no partial toffee was eaten.)

## 6. Coin Conundrum

Grace stands three chocolate coins from her Christmas stocking on a horizontal table, as shown. The radius,  $r$ , of the smallest coin is the quarter of the one on its left and is the ninth of the one on its right. How far apart are the leftmost and rightmost coins' points of contact with the table in terms of  $r$ ?



## 7. Prize Purchasers

Robert and Miriam need sweets as prizes for a quiz. They decide to buy four bags of Fruit Drops, five Liquorice Allsorts packs and five Smarties tubes. However, they don't coordinate their shopping!

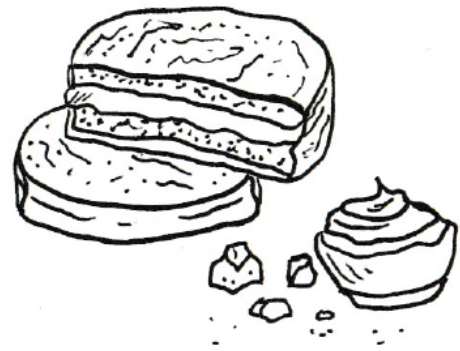
Robert buys three bags of Fruit Drops, two Liquorice Allsorts packs and four Smarties tubes for £5.85.

Miriam separately purchases two bags of Fruit Drops, four Liquorice Allsorts packs and three Smarties tubes for £5.60.

They return the excess goodies to the shop, receiving £2.60 back. How much does each item cost?

## 8. Alfajor Arrangements

Alejo's Alfajor Emporium sells expensive imported alfajores (a traditional Hispanic confection) in boxes of 6, with a choice from 8 different recipes. To manage his range well, he insists that each box contains at least 4 different types of alfajor and no more than 2 of the same type. How many different boxes are possible?



## 9. Dorothy's Journey

Dorothy boarded a train to Emerald City to attend a long-awaited science fair. Knowing the journey would take exactly 115 minutes, her mom handed her a bag of 40 mini mint balls to snack on during the ride. Dorothy, being both a budding scientist and a mint enthusiast, noticed an interesting pattern: for every 60-minute stretch of the journey, she has eaten at least 10 and no more than 11 mint balls. Moreover, for every 1-minute stretch she has eaten at most 1 mint ball. Now, here's the puzzle:

- (a) What is the smallest number of mint balls she could have eaten by the time the train reached Emerald City?
- (b) What is the largest number of mint balls she could have eaten?
- (c) Can you figure out how her snacking pattern might have looked during the trip to achieve the minimum possible number of eaten mint balls?

— End of Challenge —