



The Scottish Mathematical Council

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MATHEMATICAL CHALLENGE 2024–2025

Primary Division: Problems II

SOLUTIONS

P2.1

Seven identical cakes are to be shared between eight guests at a party. In order to prevent arguments, each guest must be given an equal amount of cake.

What is the smallest number of separate pieces that the cakes can be cut into to achieve this?

How can these cuts be made so that each guest gets their share in at most two pieces?



Solution

One way for each guest to receive $\frac{7}{8}$ of a cake is to cut $\frac{1}{8}$ out of each cake, and give the first seven guests one $\frac{7}{8}$ piece and the remaining guest the seven $\frac{1}{8}$ pieces. Each of the 7 cakes must be cut into 2 pieces, so the smallest number of pieces is 14.

To give each guest their share still with 14 pieces in all:

Start by cutting $\frac{7}{8}$ of a cake for the first guest, leaving $\frac{1}{8}$ for the second.

The second guest needs a further $\frac{6}{8} = \frac{3}{4}$ of a cake, leaving $\frac{1}{4}$ for the third.

The third guest needs a further $\frac{5}{8}$ of a cake, leaving $\frac{3}{8}$ for the 4th.

The 4th guest needs a further $\frac{4}{8} = \frac{1}{2}$ of a cake, leaving $\frac{1}{2}$ for the 5th.

The 5th guest needs a further $\frac{3}{8}$ of a cake, leaving $\frac{5}{8}$ for the 6th.

The 6th guest needs a further $\frac{2}{8} = \frac{1}{4}$ of a cake, leaving $\frac{3}{4}$ for the 7th.

The 7th guest needs a further $\frac{1}{8}$ of a cake, leaving $\frac{7}{8}$ for the 8th.

P2.2

I like Felicity better than Joanne. They are both hockey players – both good hockey players – but Joanne is inclined to brag more than a little.

‘I’ve scored half as many again as Felicity,’ she told me shortly after last season started. A fortnight later she had scored 7 more, while Felicity had increased her total by only two.

‘I’ve got twice as many as Felicity now,’ she said. ‘I need only four more before the end of the month to set up a new club record.’

I couldn’t help being rather pleased when I heard a little later that she hadn’t managed it, and so the old club record for the number of goals scored before the end of May still stands.

What is the club record?

Solution

Let Joanne’s initial score be j and Felicity’s f .

Initially:

$$j = 1.5f$$

Fortnight later:

$$j + 7 = 2(f + 2)$$

So:

$$1.5f + 7 = 2f + 4$$

$$f = 6$$

$$j = 9$$

So, Joanne needed $9 + 7 + 4 = 20$ at least to create a new club record.

The standing club record must be one less than this. i.e. 19.

P2.3

Three identical balls numbered 1, 2 and 3 are placed in a bag. Without looking, a ball is drawn from the bag and the number noted. The ball is then replaced in the bag. After this has been repeated three times, find the probability that the total of the three numbers is greater than 4.

Solution

There are $3 \times 3 \times 3 = 27$ possible draws.

The only draws with totals less than or equal to 4 are

111 211 121 112

So the other 23 draws have total greater than 4.

Hence the probability that the total of the three numbers is greater than 4 is $\frac{23}{27}$.

END OF PROBLEM SET II

CLOSING DATE FOR RECEIPT OF SOLUTIONS :

22 November 2024
