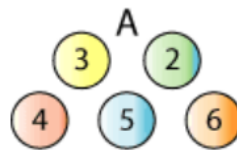**Problem of the Week: Week 4 (Summer 1): Year 8: Probability - Theoretical**

- Generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities

Problem 1:

Odds and Evens

Here is a set of numbered balls used for a game:

To play the game, the balls are mixed up and two balls are randomly picked out together. For example:

The numbers on the balls are added together: $4 + 5 = 9$

If the total is even, you win.
If the total is odd, you lose.
How can you decide whether the game is fair?

https://nrich.maths.org/4308

Solutions:
This assumes that the first all is replaced before the second ball is selected.

| Add	2	3	4	5	6
2	4	5	6	7	8
3	5	6	7	8	9
4	6	7	8	9	10
5	7	8	9	10	11
6	8	9	10	11	12

There are 25 totals, 12 of which are odd numbers and 13 are even.

This means that the game is not fair as the probability of an even total is $\frac{13}{25}$ and an odd total is $\frac{12}{25}$

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Problem 2:

The following spinner is spun and a standard 6 faced die is rolled.
   a.   How many outcomes are there?
   b.   Can you change the spinner to increase the number of outcomes?
   c.   What happens if you change your die to a 4 sided die numbered 1 to 4?
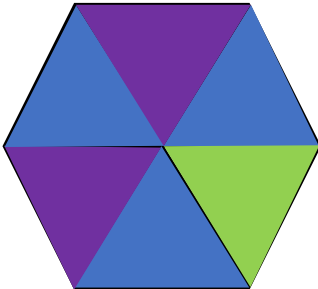
Solutions:
   a.   There are 36 outcomes in total,
   b.   If the spinner has more sides then the number of outcomes will increase. For example, an 8-sided spinner will give 48 outcomes
   c.   If the die changes to a 4-sided die, then the number of outcomes will change to 24.

	1	2	3	4	5	6
purple	p,1	p,2	p,3	p,4	p,5	p,6
blue	b,1	b,2	b,3	b,4	b,5	b,6
green	g,1	g,2	g,3	g,4	g,5	g,6
blue	b,1	b,2	b,3	b,4	b,5	b,6
purple	p,1	p,2	p,3	p,4	p,5	p,6
blue	b,1	b,2	b,3	b,4	b,5	b,6

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