

Challenge '25 Solutions

1. Jelly Babies																																					
39 jelly babies in total. Each child receives, respectively, 15, 8, 10 and 6.	5 marks: (1 mark for total 2 for all the children's amounts 2 for reasoning)																																				
2. Clean Break																																					
Since you aren't allowed to break two or more pieces at the same time, it will take 23 breaks, since each break increases the number of pieces by one. Charlie wins by snapping off the row containing both nuts and eating the rest. Then Ellie must eat a nut, because, wherever she snaps the remaining row, she will have a nut in each part. He will win for any bar where both dimensions are greater than 1. For a 1 by n bar, Ellie wins, because Charlie has to eat a nut in the same way as above. NB the minimum bar size is 1 by 2	5 marks: (1 for 23 1 for 'break one off each time' 1 for 'Charlie wins' 1 for 'always Charlie', 1 for 'Ellie if 1 x n')																																				
3. Imperial Volunteers																																					
After Pat, Sharon and Helen have eaten their mints, there are 29 left. Any attempt to share them fairly means four being allocated to each of the seven volunteers, with one remaining mint, so one volunteer would have had a fifth. Sharing <i>unfairly</i> means that one or more volunteer has 5 or more.	3 marks: (1 for working out that 29 cupcakes are to be shared, 2 for reasoned argument)																																				
4. Wonky Wine Gums																																					
Red – lemon flavour Green – strawberry flavour Yellow – lime flavour Orange – blackcurrant flavour Purple – orange flavour <table><tr><td></td><td>R</td><td>Y</td><td>G</td><td>P</td><td>O</td></tr><tr><td>O</td><td>X</td><td>X</td><td>X</td><td>/</td><td>X</td></tr><tr><td>LE</td><td>/</td><td>X</td><td>X</td><td>X</td><td>X</td></tr><tr><td>LI</td><td>X</td><td>/</td><td>X</td><td>X</td><td>X</td></tr><tr><td>S</td><td>X</td><td>X</td><td>/</td><td>X</td><td>X</td></tr><tr><td>B</td><td>X</td><td>X</td><td>X</td><td>X</td><td>/</td></tr></table>		R	Y	G	P	O	O	X	X	X	/	X	LE	/	X	X	X	X	LI	X	/	X	X	X	S	X	X	/	X	X	B	X	X	X	X	/	7 marks: (1 for each correct colour and flavour, 2 for reasoning)
	R	Y	G	P	O																																
O	X	X	X	/	X																																
LE	/	X	X	X	X																																
LI	X	/	X	X	X																																
S	X	X	/	X	X																																
B	X	X	X	X	/																																

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5. Hard Toffee

The minimum number of toffees he can give away is 1. This is 10% of 10, which means that he will have 9 to eat on the final day.

This means the box of toffees will last for 9 days.

Working backwards then:

Day	No at start	Eat	Leaving	Give Away	End of Day
9	9	9	0	0	0
8	18	8	10	1	9
7	27	7	20	2	18
6	36	6	30	3	27
5	45	5	40	4	36
4	54	4	50	5	45
3	63	3	60	6	54
2	72	2	70	7	63
1	81	1	80	8	72

So 81 toffees were in the box to start with.

4 marks:

1 mark for realising last give away must be 1.

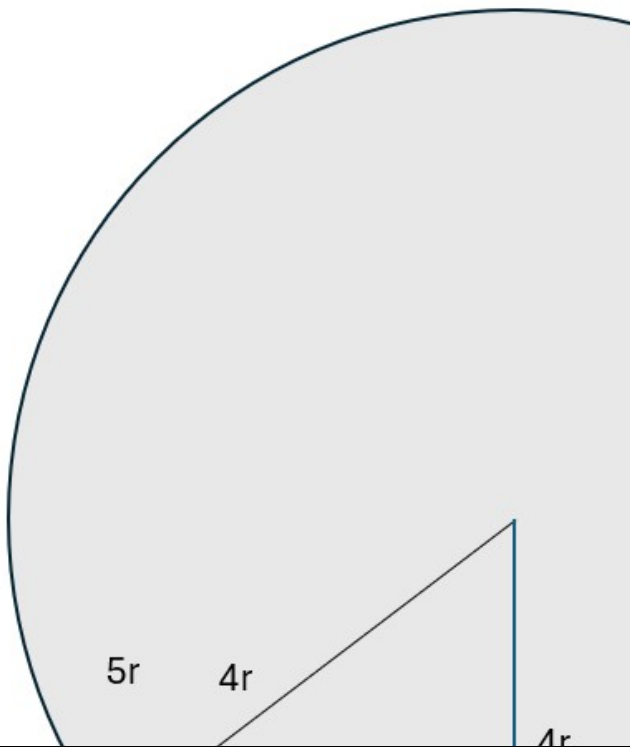
1 mark for 'last for 9 days'.

1 mark for 81 toffees to start with.

1 mark for systematic approach.

6. Coin Conundrum

The centres are $4r$ apart (note that the centre of the small coin is directly under the edge of the large coin)



6 marks:

(2 marks for $4r$,

2 marks for correct diagram,

2 marks for some reasoning)

Special case:

Max of 4 for 'they are R apart', where R is the radius of the larger coin

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7. Prize Purchasers	
This is best considered as three simultaneous equations: F is the cost of Fruit Drops, L of Liquorice Allsorts packs and S of Smarties tubes $3F + 2L + 4S = 585$ [1] $2F + 4L + 3S = 560$ [2] $F + L + 2S = 260$ [3] $[1] - [3] \times 2 \rightarrow \underline{F = 65}$ Sub into [3] $\rightarrow L + 2S = 195$ [4]; sub into [2] $\rightarrow 4L + 3S = 430$ [5] $[4] \times 4 - [5] \rightarrow 5S = 350$, so $\underline{S = 70}$ Sub $F = 65$ and $S = 70$ into [3] $\rightarrow \underline{L = 55}$	5 marks: (1 for each price, 1 for extrapolating equations, 1 for systematic method)
8. Alfajor Arrangements	
3 possible scenarios: 6 unique alfajores, 1 pair and 4 different types, 2 pairs and 2 different types. 6 unique = $8!/(6! \cdot 2!) = 8 \cdot 7/2 = 28$ 1 pair and 4 different = 8 possible pairs, then picking 4 from 7 so $8 \cdot 7!/(4! \cdot 3!) = 8 \cdot 7 \cdot 6 \cdot 5/6 = 8 \cdot 7 \cdot 5 = 280$ 2 pairs and 2 different = 8 possible first pairs, 7 second pairs, but these could interchange, so divide by 2, then pick 2 from 6 so $8 \cdot 7/2 \cdot 6!/(2! \cdot 4!) = 28 \cdot 6 \cdot 5/2 = 28 \cdot 15 = 420$ So $28 + 280 + 420 = 728$	5 marks: 1 mark for identifying scenarios 1 mark for 28 1 mark for 280 1 mark for 420 1 mark for 728 (Maximum of 3 marks if no method shown)