



# Answers

1

Answer: **SPECIAL**

This is the only seven-letter word on the Christmas Card with the properties described, and it can be found here in the text of Puzzle 1!

2

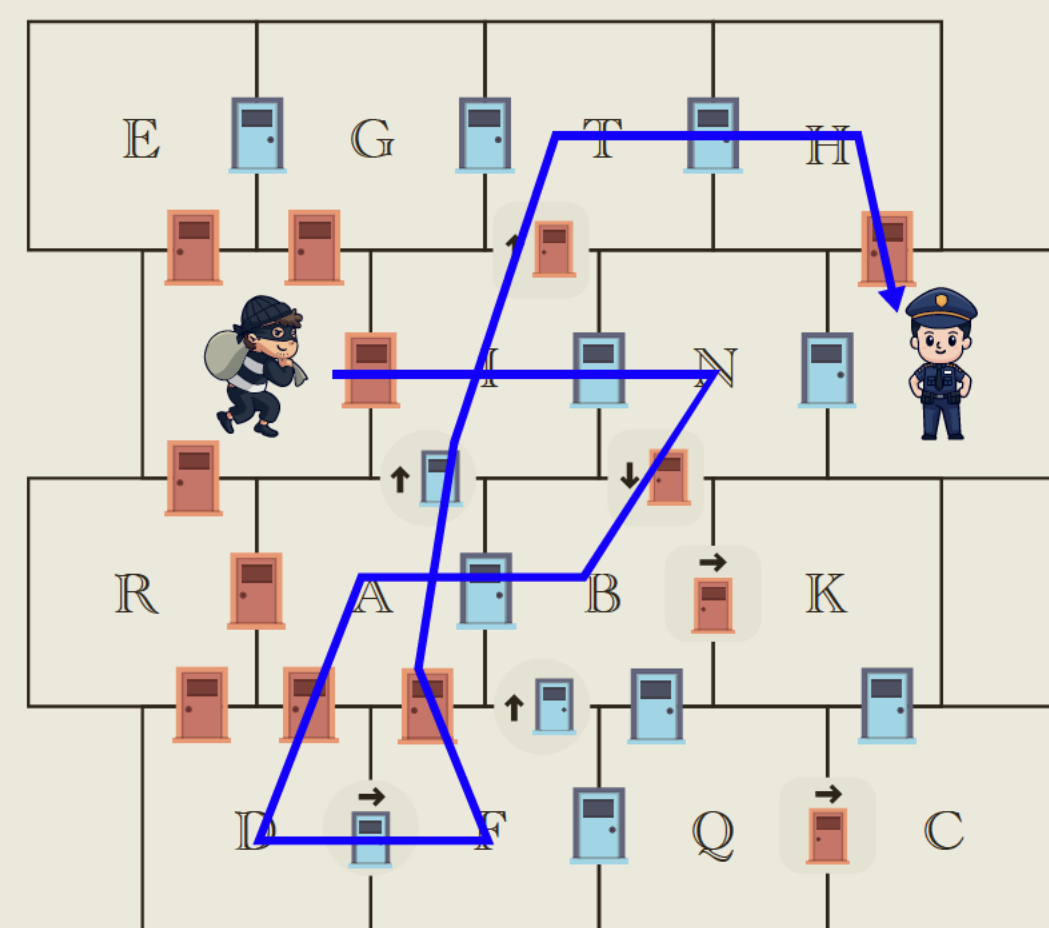
Answer: **THAMES**

The stream is made up of six sections each with a scrambled river name and an extra letter. The river names, in order left to right, are Amazon, Nile, Ganges, Seine, Rhine, and Danube. The extra letters when reversed spell THAMES. We also shaped the puzzle to look like the famous bend in the River Thames – well done if you spotted this hidden extra.

3

Answer: **IN BAD FAITH**

There is only one route through the house that takes the robber from their starting position to the police officer at the end obeying the rules given. Reading the letters in each room that the robber visits in order gives the answer.



4

Answer: **SOCKS**

In each of the five rows, we have written the names of two related gifts. These names use one letter from each of the boxes in its row, in order. However, one of each pair of gifts is missing a letter. The pairs of gifts and missing letters in each row are:

1. **S**LIPPERS and SWEATER
2. **C**OMPUTER and CONSOLE
3. NE**C**KLACE and PENDANT
4. COO**K**BOOK and JOURNAL
5. HAND**S**OAP and SHAMPOO

The missing letters are the missing gift – Socks – a common Christmas gift that comes in pairs!





5

Answer: **VARIOUS**

By studying the equations given, the values of each letter can be deduced. A possible start to this could be the following observations:

$SO + SO = VOW$  tells us that  $V=1$ , as it is not possible for a pair of two-digit numbers to sum to over 200.

Knowing  $V=1$ , the equation  $UV + UV + V = VAR$  tells us that  $R=3$  as three numbers ending in 1 must sum to a number ending in 3.

Knowing  $R=3$ , the equation  $R \times P \times P = AIR$  tells us that  $P$  must be 1 or 9, as the result of  $3 \times P \times P$  only ends in 3 when  $P$  is one of these two digits. Since  $V=1$  and the letters are uniquely matched with digits, it must be that  $P=9$ . This makes the equation  $3 \times 9 \times 9 = 243$ , so  $A=2$  and  $I=4$ .

That means  $VAR$  is 123, and so  $UV + V + V = VAR$  tells us that  $U=6$ . The unknown letters  $[S, O, W, T]$  must now be  $[5, 7, 8, 0]$  in some order.  $SO + SO = VOW$  means  $O + O$  ends in  $W$ , which must mean  $O=5$  and  $W=0$ . The same equation then means  $S=7$ , which leaves  $T=8$ .

The full set of values therefore is:

T	W	O	U	V	P	A	I	R	S
8	0	5	6	1	9	2	4	3	7

With this correspondence, the number 1234567 as letters gives the word **VARIOUS**.

6

Answer: **ROSAMUND**

To solve this code, you need to figure out how each letter has been encoded. The puzzle provides a hint to get started. "Four-letter" is written in red and so is "UITL-FMQQML" in the code, suggesting these may in fact be the same! Using this to get started and making sensible deductions, the full code can be deciphered to yield:





Someone has encoded these eight four-letter girl's names.  
Ruby, Orla, Sara, Abby, Maya, Usha, Noor, Dani.  
She left a clue to her own name but can you work it out?

The first letters of each name spell an additional ninth name  
and the answer to this puzzle: ROSAMUND. Keen  
codebreakers may also spot that the substitution alphabet  
used to encode the text is a keyword cipher with ROSAMUND  
as the key.



Answer: **COUNTRY**

Each of the five flags is the national flag of a seven letter  
European country. In order they are Denmark, Germany,  
Estonia, Hungary, and Croatia. These names can be entered  
into the grid and then the clues solved to find the target word.  
The positions of C, T, R, Y in the target word are quickly  
confirmed with O, U, N requiring correct placement. The O  
can only go in one place, which then restricts N to one option,  
leaving the final position for letter U.

## MAIN PUZZLE

Answer: **ROUND THE COUNTRY, ROUND THE CLOCK**

The seven puzzle answers can be entered into the grid at the  
top of the back page. The text suggests to then use just the  
letters on the front of the card. In other words, you should  
read the answer words but ignore any letters which don't  
appear among the twelve written on the front of the card. This  
yields the final answer that describe GCHQ's work to protect  
the country 24/7.

ROSAMUND	➡	ROUND
THAMES	➡	THE
COUNTRY	➡	COUNTRY
VARIOUS	➡	ROU
IN BAD FAITH	➡	NDTH
SPECIAL	➡	ECL
SOCKS	➡	OCK





## FRONT OF CARD DESIGN CHALLENGES

### KEY STAGE 3

The present in the top left of the design has a maths equation. This can be rearranged to find a hidden seasonal message.

$$y - \frac{\ln\left(\frac{x}{m} - sa\right)}{r^2}$$

Multiply both sides by  $r$  twice.

$$rry = \ln\left(\frac{x}{m} - sa\right)$$

The next step is tricky and requires some good maths knowledge. The natural logarithm  $\ln$  is removed by raising the mathematical constant  $e$  to the power of both sides of the equation.

$$e^{rry} = \frac{x}{m} - sa$$

Finally, multiply both sides by  $m$  and swap the order of  $a$  and  $s$  to get the puzzle answer **MERRY XMAS**.

$$me^{rry} = x - mas$$

### KEY STAGE 4

There are two hidden puzzles in this design.

The numbers at the top are an alphanumeric cipher. But the usual method of  $1 = A$ ,  $2 = B$ , ... doesn't yield a sensible result. The cat's computer screen helpfully provides a clue that  $2 = H$ . So, we instead need to decipher using the key  $1 = G$ ,  $2 = H$ , ...,  $26 = F$ . Doing so yields the message **MERRY CHRISTMAS**.

This same message is also found in the border where it has been encoded using Morse Code, but sneakily the Morse Code is reversed and reads anticlockwise!

## KEY STAGE 5

There's a lot to solve in this design. A good starting point is the letter to Santa from A. T. Bash. This letter is enciphered using the Atbash cipher, which maps the alphabet to the reverse alphabet ( $A \leftrightarrow Z$ ,  $B \leftrightarrow Y$ , etc.). Deciphering yields:

Your password is 16 letters long. The second, tenth and eleventh letters are the fifth letter of the alphabet. Your first letter is S. Hidden around the card are clues to the other letters of the password which unlocks the top-secret laptop. These other clues are:

- Baubles at the top which hide a message using an alphanumeric cipher
- The bunting which uses a rail fence cipher
- The board above the coffee cup, which is a shift cipher with letters stepped by 3
- Morse code on the right-hand side
- Pigpen cipher in the bottom left
- Finally, a message written backwards in the bottom right corner

Deciphering each message yields the remaining letters of the password and gives the final answer: **SEASONS GREETINGS**