



# Puzzle Corner

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Welcome to the Australian Mathematical Society *Gazette*'s Puzzle Corner number 46. Each Puzzle Corner will contain one or more puzzles aimed to intrigue and/or entertain our readers. We shall provide a solution in a subsequent issue of the *Gazette*.

In April 2015 a logic puzzle from the Singapore and Asian School Mathematics Olympiad was posted on Facebook by the Singapore TV presenter Kenneth Kong. *Cheryl's Birthday* went viral, becoming an instant source of amusement and consternation around the globe, with angry parents claiming that their children had been subjected to what was plainly an impossible problem. Of course it was not impossible, but it was, by anyone's standards, very tricky although its nature was not entirely new.

The novel aspect to the puzzle is that people can make inferences from knowing that other people absolutely cannot make other deductions. This type of trick has been around for a long time. I first remember seeing a problem of this kind in the classic books of Martin Gardner in the 1960s. The peculiar feature of the puzzle is that a key piece of information is that one of the listeners states 'I cannot find the answer'. The critical point that you, the puzzle solver must take on board is to interpret this literally. The speaker is not merely saying that he is not clever enough to work out the answer but rather that given the information that he has to hand, the solution is not unique. You then exploit the fact that from the viewpoint of this listener there are multiple solutions to help you find the one true answer.

How can this be possible? Perhaps the simplest example of knowing because you know others don't know is the joke about three logicians that walk into a bar. The barman asks them, 'Do you all want a drink?' The first says, 'I don't know', as does the second, whereupon the third logician answers 'Yes'. The third logician deduces that each of the first two must want a drink because, if either of them did not, they would have known that the answer to the barman's question was 'No' and would have said so. Since they did not, they must both want a drink and, since the third logician evidently also wants one, he knows that answer to the question. (As he equally would if he did not want one.)

Having been forewarned therefore let's move to an example that is reminiscent of *Cheryl*.

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Alex and Barbara are trying to guess Caroline's birthday, which she tells them is one of the following ten dates:

March 29, 30, 31

July 8, 11

August 27, 30

December 8, 27, 29.

She then teasingly whispers to Alex the correct month, and to Barbara the correct day for her birthday and tells them that she has done that.

Alex then says, 'I don't know Caroline's birthday, but I *do* know that Barbara doesn't know.'

To which Barbara responds, 'I didn't know Caroline's birthday, but now I do!'

Finally, Alex then concludes, 'In that case, I now know it too!'

When is Caroline's birthday?



Peter Higgins is a Professor of Mathematics at the University of Essex. He is the inventor of Circular Sudoku, a puzzle type that has featured in many newspapers, magazines, books, and computer games all over the world. He has written extensively on the subject of mathematics and won the 2013 Premio Peano Prize in Turin for the best book published about mathematics in Italian in 2012. Originally from Australia, Peter has lived in Colchester, England with his wife and four children since 1990.