

UKMT Logic Questions
(Answers follow after all the questions)

2005...

15. The four statements in the box on the right refer to a mother and her four daughters. One statement is true, three statements are false. Who is the mother?

Alice is the mother.
Carol and Ella are both daughters.
Beth is the mother.
One of Alice, Diane or Ella is the mother.

- A Alice B Beth C Carol D Diane E Ella

2006...

18. What is the greatest number of the following five statements about numbers a, b which can be true at the same time?

$$\frac{1}{a} < \frac{1}{b}$$

$$a^2 > b^2$$

$$a < b$$

$$a < 0$$

$$b < 0$$

A 1

B 2

C 3

D 4

E 5

2011...

21. Each of the Four Musketeers made a statement about the four of them, as follows.

d'Artagnan: "Exactly one is lying."

Athos: "Exactly two of us are lying."

Porthos: "An odd number of us is lying."

Aramis: "An even number of us is lying."

How many of them were lying (with the others telling the truth)?

A one

B one or two

C two or three

D three

E four

2012...

9. Pierre said, "Just one of us is telling the truth". Qadr said, "What Pierre says is not true". Ratna said, "What Qadr says is not true". Sven said, "What Ratna says is not true". Tanya said, "What Sven says is not true". How many of them were telling the truth?

A 0

B 1

C 2

D 3

E 4

2015...

13. The Knave of Hearts tells only the truth on Mondays, Tuesdays, Wednesdays and Thursdays. He tells only lies on all the other days. The Knave of Diamonds tells only the truth on Fridays, Saturdays, Sundays and Mondays. He tells only lies on all the other days. On one day last week, they both said, "Yesterday I told lies."

On which day of the week was that?

- A Sunday B Monday C Tuesday D Thursday E Friday

2016...

22. Three friends make the following statements.

Ben says, "Exactly one of Dan and Cam is telling the truth."

Dan says, "Exactly one of Ben and Cam is telling the truth."

Cam says, "Neither Ben nor Dan is telling the truth."

Which of the three friends is lying?

- A Just Ben B Just Dan C Just Cam D Each of Ben and Cam
E Each of Ben, Cam and Dan

UKMT Logic Answers

2005...

15. E Number the four statements in order from the top. If Alice is the mother, then statements 1 and 4 are both true. If Beth is the mother, then statements 2 and 3 are both true. If Carol is the mother, then all four statements are false. If Diane is the mother, then statements 2 and 4 are both true. However, if Ella is the mother then statements 1, 2 and 3 are false and statement 4 is true, as required.

2006...

18. D It is not possible for all five statements to be true at the same time since if $a < b$, $a < 0$, $b < 0$ are all true then $\frac{1}{a} < \frac{1}{b}$ is not true since $\frac{1}{b} - \frac{1}{a} = \frac{a-b}{ab}$ which is negative. However, when these three statements are true, $a^2 > b^2$ is also true, so it is possible for four of the statements to be true at the same time.

2011...

21. C At least one of d'Artagnan and Athos is lying. One of Porthos or Aramis is telling the truth and the other is lying. So the number of liars is either two (d'Artagnan and Porthos) or three (all except Porthos).

2012...

9. C If Pierre is telling the truth then Qadr is not telling the truth. However, this means that Ratna is telling the truth, so this leads to a contradiction as Pierre stated that just one person is telling the truth. So Pierre is not telling the truth, which means that Qadr is telling the truth, but Ratna is not telling the truth. This in turn means that Sven is telling the truth, but Tanya is not. So only Qadr and Sven are telling the truth.

2015...

13. E	Knave of	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
	Hearts	T	T	T	T	L	L	L	T
	Diamonds	T	L	L	L	T	T	T	T

When a knave says "Yesterday I told lies" it could be that today he is telling the truth and he did indeed tell lies yesterday. In the table, this is a T preceded by an L.

It could also be that today he is lying, in which case he was in fact telling the truth yesterday. In the table, this is an L preceded by a T. The only day when one or the other of these options applies to each knave is Friday.

2016...

22. C Suppose first that Cam is telling the truth, so Ben and Dan are both lying. Then Ben's statement is actually correct, as is Dan's. There is a clear contradiction. So we know that Cam is in fact lying. Therefore at least one of Ben and Dan is telling the truth. If Ben is telling the truth, then we learn that Dan is telling the truth. If Dan is telling the truth then we learn that Ben is telling the truth. So both Ben and Dan are telling the truth. This means that only Cam is lying.