

Logic (Senior UKMT)

These questions must be attempted without a calculator

Topics covered in the questions below may not necessarily be from the topic of the title.

1. An examination paper is made by taking 5 large sheets of paper, folding the pile in half and stapling it. The pages are then numbered in order from 1 to 20.

What is the sum of the three page numbers that are on the same sheet of paper as page number 5?

A 13 B 21 C 33 D 37 E 41

2. The first six volumes of the *Encyclopedia of Mathematicians* are arranged in order on my shelf from left to right. The six volumes contain names beginning A-Ba, Be-Ca, Ce-Ei, Ek-Fe, Fee-Fi, Fo-Fum. If one ignores the covers, which of the following encyclopedia entries could be on a page "next to" the page with the entry for Einstein?

A Abel B Bernoulli C Cantor D Euler E Fibonacci

3. Which of the following numbers n gives a counter-example for the statement:

'If n is a prime number then $n^2 + 2$ is also a prime number'?

A 3 B 5 C 6 D 9 E none of them

4. The four statements in the box refer to a mother and her four daughters. One statement is true, three statements are false.

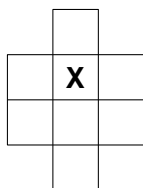
Alice is the mother.
Carol and Ella are both daughters.
Beth is the mother.
One of Alice, Diane or Ella is the mother.

Who is the mother?

A Alice B Beth C Carol D Diane E Ella

5. The digits 1 to 8 are to be inserted in the grid below so that any two digits which are adjacent to each other in the sequence 1 to 8 are not adjacent to each other in the grid horizontally, vertically or diagonally.

Which one of the following digits could be placed in the box labelled X?



A 4 B 5 C 6 D 7 E 8

6. The Queen of Hearts had some tarts, but they were eaten. Precisely one of the following statements about the tarts and the Knaves of Clubs, Diamonds and Spades is true.

Which one?

- A None of the three Knaves ate any tarts.
- B The Knave of Clubs ate some tarts.
- C Only one of the three Knaves ate any tarts.
- D At least one of the Knave of Diamonds and the Knave of Spades ate no tarts.
- E More than one of the three Knaves ate some tarts.

7. The factorial of n , written $n!$, is defined by $n! = 1 \times 2 \times 3 \times \dots \times (n - 2) \times (n - 1) \times n$.

Which of the following values of n provides a counterexample to the statement: "If n is a prime number, then $n! + 1$ is also a prime number"?

- A 1
- B 2
- C 3
- D 4
- E 5

8. If $x^2 - 3x + 1 = 0$, what is the value of $x^2 + (1/x)^2$?

- A 7
- B $(7 - 3\sqrt{5})/2$
- C 9
- D $(7 + 3\sqrt{5})/2$
- E 10

9. Given that $y = \frac{x}{x + \frac{x}{x+y}}$, for which of the following values of x is y not a real number?

- A -6
- B -3
- C 1
- D 3
- E 6

10. The letters S , M and C represent whole numbers. If $S \times M \times C = 240$, $S \times C + M = 46$ and $S + M \times C = 64$, what is the value of $S + M + C$?

- A 19
- B 20
- C 21
- D 24
- E 36