

1. Find all solutions to the sum opposite:
 [Different letters stand for different digits. There may be one or more solutions, but you must show that you have found them all.]
- $$\begin{array}{r} \text{TE} \\ + \text{TE} \\ + \underline{\text{TE}} \\ = \underline{\text{AT}} \end{array}$$

2. Find the number of positive divisors (factors) of 10^{2013} which are not divisors of 10^{2012} .

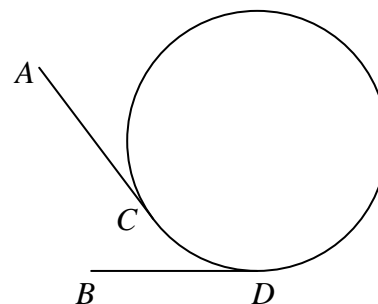
3. Solve the system of equations
- $$\begin{aligned} x^2 + xy + y^2 &= 21 \\ x^2 - xy + y^2 &= 13 \end{aligned}$$

4. Four positive integers a, b, c and d have a product of $8!$ and satisfy the equations

$$\begin{aligned} ab + a + b &= 524 \\ bc + b + c &= 146 \\ cd + c + d &= 104. \end{aligned} \quad \text{Find } a, b, c \text{ and } d.$$

5. $A, B,$ and C stand in a triangle and are each given a card to hold out in front of themselves. Each card has a single, positive, non-zero digit on it which the holder can not see but is visible to the other two. They are told that the values of the cards are such that $A < B < C$ and that the product of the three digits is a multiple of 12. Starting with $A,$ they are asked in turn whether they can state with certainty the value of their own card. If not they must pass. A, B and then C all pass and then A states the value of his card and then in turn, B and C do the same. What digit does each person hold?

6. From any two points C and D on the circumference of a circle, two tangents of equal length are drawn with orientations as shown. Prove that the line DC extended bisects AB .



7. If the digits “15” are inserted in the middle of the square 16, the number 1156 is formed, which is also a perfect square. If this process is repeated, we obtain the numbers 111556, 11115556, 1111155556 and so on. Prove that each number in this sequence is a square.
8. Ten girls, numbered from 1 to 10, sit at a round table, in a random order. Each girl then receives a new number, namely the sum of her own number and those of her two neighbours. Prove that some girl receives a new number greater than 17.