Maths Challengers
Loughborough University
Maths Masterclasses

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Problem 1.
Cockroach Ben claimed that he can run at a speed of 50 metres per minute. Nobody believed him and rightly so because in fact he has confused everything: he thought that a metre is 60 cm long and that a minute contains 100 seconds!
What is the actual speed of Ben in metres per minute? [6]

Problem 2.
A fox and two bears are sharing 100 sweets. The fox is splitting the sweets into three piles; the piles are then distributed randomly to each of them. The fox knows that if the bears get a different amount of sweets to each other, they will ask her to level their pile, allowing her to take the excess for herself.
How should the fox split the sweets so that she has exactly 80 sweets?
Can she split the piles so that she has exactly 65 sweets? [6]

Problem 3.
Two woodcutters John and Bob are sawing a log. They make 10 cuts.

a) How many pieces do they get?
b) How many logs do they have to saw in order to get 16 pieces out of 10 cuts? [6]

Problem 4.
If you multiply all the numbers between 1 and 100:
$1\times2\times3\times\ldots\ldots\times99\times100$,
how many trailing zeroes does the result contain? [6]

Problem 5.
Find the smallest whole number that has exactly five factors.
What is the second smallest such number?
(Example: number 6 has 4 factors: 1, 2, 3 and 6.) [6]

Problem 6.
A shop is selling pens: 1 pen for 50p or 3 pens for £1.
What is the wholesale price of the pen if the shop has the same profit from each buyer? [6]

Problem 7.
A man and his wife can drink a barrel of beer in 10 days; the man alone can drink it in 14 days. How many days does it take the wife alone to drink the barrel? [6]

Problem 8.
A clock shows 9:20.
What is the angle between the 2 hands? [6]

Problem 9.
A carpenter agreed to work on the condition that he is paid £2 for every day that he works, while he loses £3 every day that he does not work. At the end of thirty days, he found that he has paid out exactly as much as he received. How many days did he work? [6]

Problem 10.
The Locker problem. A school has 1000 students and a 1000 student lockers in a row.

1. The first student goes along the row and *opens every* locker.
2. The second student then goes along *and shuts every other locker* beginning with **number 2** (i.e. he shuts number 2, number 4 and so on…)
3. The third student *changes the state of every third locker* beginning with **number 3** (if the locker is open the student shuts it, and if the locker is closed the student opens it.)
4. The fourth student *changes the state of every fourth locker* beginning with **number 4**.

This continues until the thousand students have followed the pattern with the thousand lockers. At the end, which lockers will be open and which ones will be closed? Why? [6]