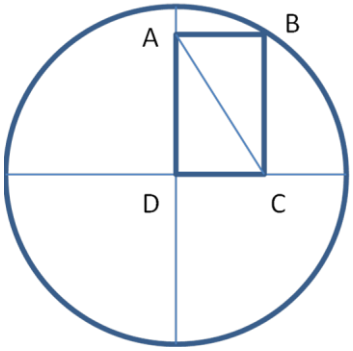
Peter's Problem 2023

Problem No. 1
How many degrees, if any, in the angle between the hour hand and the minute hand of a clock when the time is 3:15pm.

Problem No. 2
A circle of radius 10cm has a rectangle ABCD inscribed in the first quadrant. Find |AC|



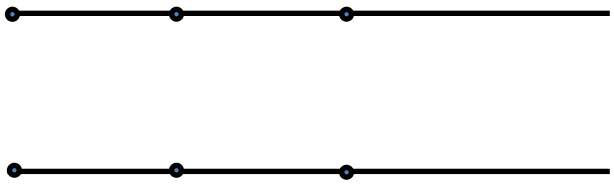
Problem No. 3
Working in a science laboratory Albert isolated a newly-identified bacterium. The bacteria triple in size every 30 minutes. If Albert placed one bacterium in a test tube at 8am then the test tube was full of bacteria at 4pm.
If he had placed 3 bacteria in the test tube at 8am, at what time would the test tube be full?

Problem No. 4
300 is divided into 4 parts such that the first integer number is twice the second, three times the third and four times the fourth. What is the value of the largest of these numbers?

Problem No. 5
A 55-seater bus was 40% full of its capacity on leaving the depot. At the first stop only my friend and I boarded the bus. At the second stop one third of the passengers alighted and 9 passengers boarded. At the third stop I, together with 10 other passengers, got off the bus and 5 boarded.
How many passengers were on the bus as it pulled away from the stop?

Problem No. 6
Tamsin is saving up for a smartwatch and puts all of her 50 cent and 20 cent coins in a jar each night. She thinks that she has saved enough and empties the 620 coins to count the money. 286 of the coins are 50 cent.
If the cost of the smart watch is €230, how much more must she save to allow her buy the watch?

Problem No. 7
Three equidistant dots on each of two parallel lines (see sketch for illustration purposes only) are joined in all possible ways. How many triangles can be formed?



Problem No. 8
A rectangular schoolroom floor can be covered by 2400 square tiles. If the tiles are 5cm longer and 5cm wider, 1350 tiles are needed.
If none of the tiles are cut, what is the area of the floor in m^2?

Problem No. 9
Each of the letters in the multiplication sum below represents a digit:

$$\begin{array}{rr} & 7A \\ \text{times} & B5 \\ \hline & C90 \\ & DE20 \\ \hline = & F5GH \end{array}$$

What is the value of A+B+C+DE+F+G+H?

Problem No. 10
Tammy's Taxis has rented an office in town and needs to get a landline for the premises. The area code is 07893 followed by five other digits, ie. 07893xxxxx where each 'x' stands for a digit. Tammy requires that the final six digits contain only two different digits. How many different telephone numbers are possible?

Problem No. 11
Without repetition and using only addition show a selection of the ten numbers
25, 27, 3, 12, 6, 15, 9, 30, 21, 19
which makes a total of 50.

Problem No. 12
In the 2022 Eurovision Song Contest, the entry from Ukraine was adjudged the winner with 631 points made up of the points awarded by the jury and the popular vote (televote) from the participating countries.

Considering the number of countries that actually awarded Ukraine top points in the televote what is the minimum number of other countries which **could** have awarded Ukraine their next highest number of points in the televote in order to obtain the same winning total?

Problem No. 13
There are 21 women and 14 men in a choir. How many women should join the choir so that the number of women represents 72% of the membership of the choir, assuming that the number of men in the choir stays the same?

Problem No. 14
I choose 10 consecutive numbers. If I exclude one of the numbers the remaining 9 sum to 2023. Which number did I exclude?

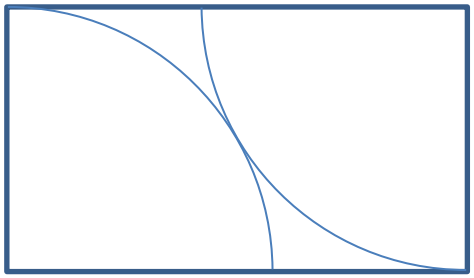
Problem No. 15
A square field has an area of 1 hectare. The farmer decides to set aside 10% of the field as a uniform border all around the field to be managed for rewilding. What is the width of the border in metres correct to 2 decimal places?

Problem No. 16
I write the numbers from 1 to 10 inclusive on a whiteboard. I erase two of the numbers at random and add 1 to their sum and jot this number into a notepad. I repeat the exercise, erasing two numbers in turn until all 10 numbers are erased. I then add up the numbers in the notepad and always get the same total. What is this total and why is it so? (Give your explanation on the separate sheet)]

Problem No. 17
A number of teenagers are playing with their calculators. One of them multiplies their ages (in whole numbers) together and finds that the product is eighteen million seven hundred and twenty seven thousand two hundred.
How many teenagers are in the group and how did you reach that answer? (Give your explanation on a separate sheet)

Problem No. 18
At a scout jamboree, dinner is served from tinned food. Each tin of soup is shared between 2 scouts. Each tin of frankfurters is shared between 3 scouts and each tin of fruit is shared between 4 scouts. If 117 tins are opened to feed all the scouts, how many scouts attended the jamboree?

Problem No. 19
Two quarter circles each of radius 5cm fit inside a rectangle. The centres of the circles are at opposite vertices of the rectangle. What is the area of the rectangle in the form $a^2\sqrt{b}$?



Problem No. 20
In a 10 digit number, the first digit is the number of zeros in the number. The second digit is the number of ones in the number. The third digit is the number of twos in the number and so on with the tenth digit showing the number of nines in the number. What is the number?

Problem No. 21
Shown below is a magic square where all the rows and columns and both diagonals add to the same sum. Calculate the value of N

18			
9	16		
	17	12	18
	N	21	5

Problem No. 22
How many different pairs of prime numbers add to 90?

Problem No. 23
If Sam drives to work at an average speed of 60km/hr, she arrives in work two minutes early. If she travels at 45km/hr she arrives three minutes late,
How far, in km, does she live from work?

Problem No. 24
There are 20 students in a TY class. As a fundraiser, they decided that, between them, they would sit on every seat which could be allocated for a rugby match in the Aviva stadium and raise sponsorship in doing so. They estimated that it would take each student an average of 2.4 seconds to sit on each seat, If they began their challenge at 10.30am, at what time, to the nearest minute will they expect to finish the challenge?

Problem No. 25
As given on the STEPS Engineers Ireland website (Engineers Week, Secondary School section) how many free engineering activities are available to download by teachers for classroom use?