Peter's Problem 2022

Problem No. 1

There are 52 pages in a tabloid newspaper.
What other 3 pages are on the same sheet as page 10?
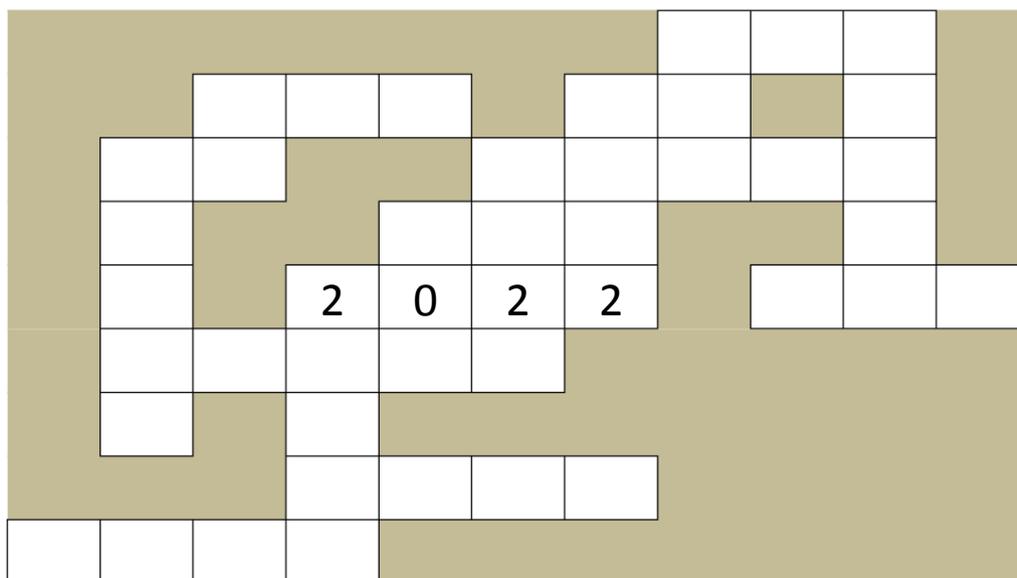
Problem No. 2

The MetroSur underground railway in Madrid runs in a circle loop in both directions – *Sentido Andén 1 (To Platform 1)* or *Sentido Andén 2 (To Platform 2)*. It takes one hour to complete the loop. On certain days of the week the trains in the direction of *Andén 1 (Platform 1)* leave Puerta del Sur station every 10 minutes starting on the hour while the trains in the direction of *Andén 2 (Platform 2)* leave Puerta del Sur station every 10 minutes starting 5 minutes after the hour. On occasion, the Metro has run on a 24-hour basis.

On one of these occasions if I take a complete round trip from Puerta del Sur station in one direction, how many trains will I pass which are going in the opposite direction?
Show all calculations on the Long Answers sheet.

Problem No. 3

There are 22 numbers in the list below. 19 of the numbers may be inserted in the grid.
Write down the sum of the 3 numbers from the list which cannot be included on the grid

18		106		2022		21573
48		137		5143		41488
94		164		5623		51746
98		547		7267		52486
		548		9142		81693
		639		9442		84163

Problem No. 4

What is the next number in the sequence 3, 3, 4, 6, 9, 13, 18, 24, 31, …

Problem No. 5

In the summer of 2021 Laura got a job in the local supermarket, working every third day. John also got a job there, but working Saturdays only. The shop is open 7 days a week. If both started work on June 5th, what was the next date on which both of them were working on the same day? Give the answer in the format DD/MM/YY

Problem No. 6

The sides of a regular decagon are labelled consecutively from A to J. How many diagonals, each longer than |AC|, can be drawn in the decagon?

Problem No. 7

How many three-digit multiples of 9 only contain odd digits?
Note: the sum of the digits of all numbers divisible by 9 is always a multiple of 9.

Problem No. 8

In a downtown café each table has 3 legs and each chair has 4 legs. There are 6 members of staff. There are 2 chairs at half of the tables and 4 chairs at the other half. At a certain time two thirds of the chairs are occupied by customers. Each person in the café has 2 legs. There are 582 legs altogether in the café. How many chairs does the café have?

Problem No. 9

On a digital read-out on a calculator the digits 0 – 9 appear as follows using LED lights.

'Zero' (0) is shown using 6 LED lights; 'One' (1) is shown using 2 LED lights; 'Two' (2) is shown using 5 LED lights; etc, as illustrated.

A fault occurs when a 3-digit number is keyed in. Any two of the LED lights malfunction and light up in the wrong place, occasionally causing a different 3-digit number to appear.

How many possible legitimate 3-digit numbers could now be displayed when 403 is keyed in?

Illustration: could appear but it is not a legitimate number.

Problem No. 10

I must score 501 to win a darts game. I am allowed 3 throws of a dart at each visit to the oche. On the first visit I scored (treble 20, treble 19, double 18); on my second visit I scored (treble 20, treble 20, treble 5); on my third visit I scored (treble 15, 1, treble 20).

If I have to finish on a double with my final dart-throw give one example of the scores I can make on my next visit to the oche which will give me victory?

Problem No. 11

Each letter stands for a different digit. Find the number represented by CARE in the following addition problem

$$
\begin{array}{cccc}
 & E & R & R \\
+ & E & R & R \\
\hline
C & A & R & E \\
\end{array}
$$

Problem No. 12

Agfrud and Breol were hired at the same time by a technology company. They both started with a salary of €10 000 per year but with different special contracts. Every six months Agfrud's pay rose by €500 compared with that for the previous 6-month period. Every year, Breol's pay rose by €1 600 compared with that for the previous 12-month period.

Three years later, who had earned more and by how much?

Note: Contracts are made at the start of a year or period but only fully paid by the end of that year or period.
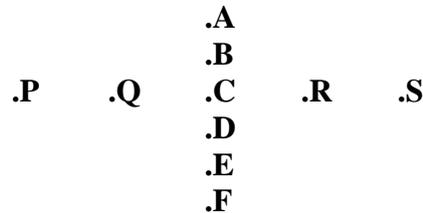
Problem No. 13

A householder is hanging a large painting using picture wire which does not stretch. The hooks on the frame of the painting are 1m apart and are inserted 20cm below the top of the frame. The householder adds 5.5% to the length of the wire between the hooks to allow it to hang from the middle onto the bottom of a wall-hook. The wall-hook is 3cm in height. How far, correct to the nearest mm, will the top of the wall-hook be below the top of the frame?

Problem No. 14

A rectangular garden is one metre longer than it is wide. A gardener has to cover its surface completely with weed barrier material which comes in rolls which are 1m wide. The gardener uses 110m from the roll. How wide is the garden?

Problem No. 15

The points A, B, C, D, E, F are collinear and the points P, Q, C, R, S are collinear, as shown. How many different triangles may be formed by joining the points as vertices?

                     .A
                     .B
.P   .Q   .C   .R   .S
                     .D
                     .E
                     .F

Problem No. 16

All of the students in a school are to be lined up in rows for the St. Patrick's Day parade.
If they line up in rows of 3 there is one left over.
If they line up in rows of 4, two students are left over.
If they line up in rows of 5, three students are left over.
If they line up in rows of 6, four students are left over.
If they line up in rows of 7, no one is left over.
What is the smallest number of students which could be in the school?

Problem No. 17

A 600m long tightrope is suspended over an Irish city street. It is fixed at both ends at equal heights. The weight of the tightrope walker causes the rope to sag by 3° from the horizontal as measured in a direct line from the bottom of the walker's feet to a fixture point at either end when the walker is at the middle of the walk. A minimum of 3m clearance is required for buses or trucks which pass underneath. What is the minimum height for the placement of the fixtures at the ends? Give the answer in metres correct to the nearest cm. Regulations for vehicle heights may be found on the website of the Department of Transport, Tourism and Sport.

Problem No. 18

A 4-digit number is a perfect square. When I add 1 to each of the digits, another 4-digit perfect square is formed.
Which is the smaller of the perfect squares?

Problem No. 19

Insert each of the digits 2-9 in each of the empty boxes below so that the three rows across and the three columns down form correct arithmetic sentences. ALL OPERATIONS ARE FROM TOP TO BOTTOM AND LEFT TO RIGHT.

What is the value of K + L, when both K and L are whole numbers?

|	X		÷		=15
+		÷		X	
(	-	1)	X		=24
-		+		÷	
	-		+		=K
=2		=15		=L	

Problem No. 20

Sixty €1 coins are placed side by side in a straight row. Every second coin is then replaced by a 50 cent coin. Every third coin is then replaced by a 20 cent coin. Every fourth coin is then replaced by a 10 cent coin.

What is the value of all the coins in the row now?

Problem No. 21

Two squares touch at the centre of a circle (as shown). If the larger square has area 64cm^2 what is the area of the smaller square?
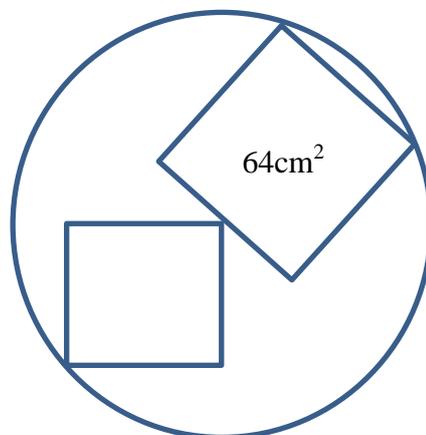
64cm^2

Problem No. 22

A cheetah runs at a speed of 81 km. per hour and a snail moves at 25 hours per km. How long, in hours minutes and seconds, would it take the snail to cover the same distance as the cheetah covers in 18 seconds.

Show, in detail on the Long Answers sheet, how you arrived at your answer.

Problem No. 23

Thirty-one teams apply to enter a competition. The organisers agree to split the teams into two divisions where each team plays each other team in their division once only and no team in the other division. There are 45 more games played in the larger division than in the smaller one. How many teams are in the smaller division?

Problem No. 24

Visit the STEPS Engineers Ireland website (Schools section)
https://www.engineersireland.ie/Schools/Explore-Engineering/What-do-engineers-do/Great-feats-of-engineering
and in the article concerning Great Feats of Engineering find the answer to the following question:

What did the National Academy of Engineering once call 'the greatest engineering achievement of the 20th century'