Problem No. 1
There is a set of numbers which have the property that the number is unchanged under a rotation of 180^o. A student was given a problem to find the next numbers in the following sequence (which shows all the possible 1-digit and 2-digit numbers)

0, 1, 8, 11, 69, 88, 96, …

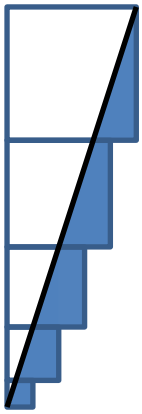
How many 3-digit numbers are there which have this property?

Problem No. 2
If you were to write down in ascending order all of the numbers that are not factors of 480, what is the 10^{th} number on the list?

Problem No. 3
The difference between an interior angle of a regular polygon and an exterior angle of the same polygon is 100^o.
How many sides does the polygon have?

Problem No. 4
There are 10 boys in a mixed TY class of boys and girls. Two students are picked at random for the Student Council. If the probability that two boys are chosen is 0.15, how many girls are in the class?
Show all your work on a separate sheet.

Problem No. 5
The shape shown consists of squares with sides of lengths 5, 4, 3, 2, 1 given in cm. Find the area of the shaded portion. Give your answer in cm^2.

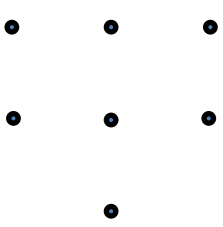


Problem No. 6
A seamstress charges a bride €2180 including 23% VAT for supplying her wedding dress. The seamstress purchased the materials including VAT at 23%. She then charged twice this amount for her labour. How much did she pay for the materials before tax?
Give the answer correct to the nearest euro.

Problem No. 7
A train from Cork to Dublin travelling at an average speed of 100 km per hour takes three hours to complete the journey. A malfunction on the train caused a delay on the journey, reducing the average speed to 90 km per hour.
How long was the delay in minutes?

Problem No. 8
Three friends, Hans, Jake and Karl, train for a marathon by running on a dedicated circuit which has a fixed starting point. Hans takes 5 minutes to complete the circuit while Jake takes 7 minutes and Karl takes 11 minutes. Hans and Jake start together but Karl starts 1 minute later.
What is the number of minutes it takes so that the three runners cross the starting point together for the first time?

Problem No. 9
A diagram contains 7 points in two rows of 3 points and a centre column of 3 points. The points are equally spaced in both the rows and columns (as illustrated). The vertical spacing is the same as the horizontal spacing.
How many parallelograms may be formed by joining the points and using only these points as vertices of the parallelograms?



Problem No. 10

Two isosceles triangles have apex angles of 50^o and 40^o respectively. Their bases are 40 cm and 50 cm respectively.

Which triangle (the first or the second) has the larger area and by how much? Give your answer in cm^2 correct to 1 place of decimals.

Problem No. 11

The addition of four numbers is shown where each of the letters represents a digit. Find the **lowest** value of A + B + C + D.

$$\begin{array}{r} ABCD \\ BCD \\ CD \\ +\quad D \\ \hline 6666 \end{array}$$

Problem No. 12

In a sequence of increasing natural numbers, the 3rd and subsequent terms are made up of the sum of the previous two terms. The eighth term is 207.

What is the value of the ninth term?

Problem No. 13

A clock was programmed to have 80 minutes in a 'new' hour and 20 'new' hours in a 'new' day. If the clock was started at midnight on Tuesday what time would the clock show when an ordinary clock showed 12:00 on the following Thursday?

Problem No. 14

A tide-clock does not display numbers. At the time of High Tide the hand of a tide-clock may be set at the 12 o'clock position which is marked as 'High Tide'. The 6 o'clock position is marked as 'Low Tide' which may also be set. The hand of the clock rotates once every 12h 25min 14sec. On a given day at 05:32 the pointer is set at the Low Tide position.

At what time will the pointer be at the High Tide position for the first time on the following day if it is not reset?

Give the answer on the 24-hour clock correct to the nearest minute.

Problem No. 15

A right circular cone has radius 6cm and height 8cm. A frustum is obtained by slicing the cone perpendicular to its axis, forming a shape with two circles and a curved side.

If the area of the curved surface of the frustum is equal to the area of the two circles formed, what is the height of the frustum in cm given that it is an integer?

Show all your work on a separate sheet.

Problem No. 16

If it takes 4 gardeners 4 hours to dig 4 circular flower beds each of diameter 4 meters, how long will it take 6 gardeners to dig 6 circular beds each of diameter 6 metres, working at the same rate?

Problem No. 17

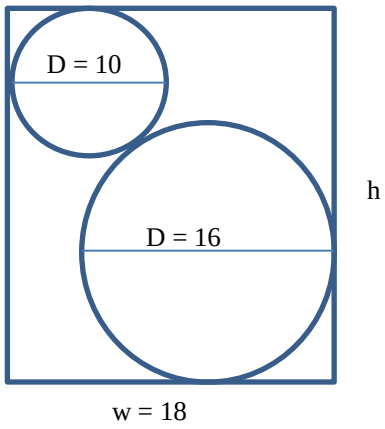
Using all the digits 1 to 9 (only once for each) complete the table so that the totals given are correct. The calculations are done across from left to right and down from top to bottom. The symbols for calculation are used as they occur.

What three numbers fill the diagonal going from Top Left to Bottom Right?

	+		-		= 4
×		+		×	
	×		+		= 27
÷		-		-	
	÷		×		= 3
= 45		= 5		= 50	

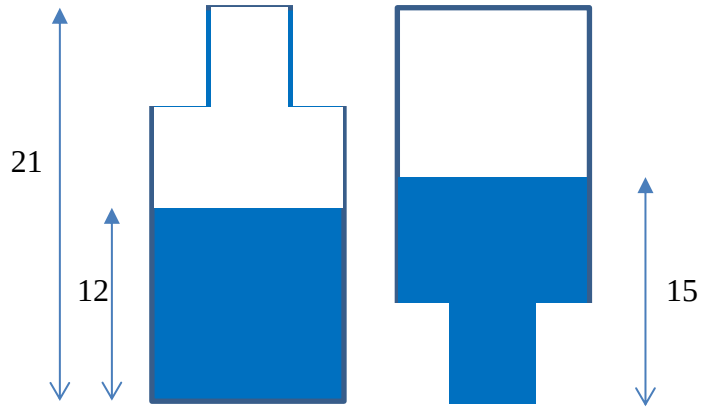
Problem No. 18

Find the height, h, of the rectangle. D is the Diameter of the circle in each case and 'w' is the width of the rectangle. (Note: the given diagram is not to scale).



Problem No. 19

A container of water as shown is partially filled. What fraction of the container is filled?
The measurements are given in cm.



Problem No. 20

In a high-rise car park the ramp angle may be up to 15^o. A small transition ramp with an angle of 6^o to its foundation is required at the beginning of the ramp in order that cars gradually reach this angle.

The length of the foundation of the transition ramp is given by the maximum wheelbase of a car (distance between the axels) which it can accommodate.

The wheelbase of a car may be related to its length by the following approximation formula:

$L = \frac{3}{4}(W + 2.3)$ where W = wheelbase length in m, L = Length of car in m.

An SUV has a Length of 4.8m. What is the minimum surface length of the transition ramp built on that foundation required to accommodate the SUV?

Give your answer in cm correct to the nearest cm.