

MATHSWELL 2017 Y7/8 PROBLEM SOLVING

Question 1

A robot, which is initially facing North, is programmed to travel 5 m then turn through 10° , 5 m then turn through 20° , 5 m then turn through 30° , and so on. Each move consists of moving 5 m in a straight line and then turning clockwise through an angle which increases by 10° at each move. How far has it travelled by the time it is first facing due East at the end of a move?

Question 2

What is the smallest four-digit positive integer which has four different digits?

Question 3

Jack and Jill played a game for two people. In each game, the winner was awarded two points and the loser one point. No games were drawn. Jack won exactly four games and Jill had a final score of ten points. How many games did they play?

Question 4

Four of these jigsaw pieces fit together to form a rectangle. Which one is not used?



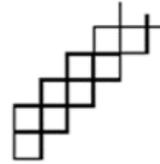
Question 5

The positive integers from 1 to 150 inclusive are placed in a 10 by 15 grid so that each cell contains exactly one integer. Then the multiples of three are given a red mark, the multiples of five are given a blue mark, and the multiples of seven are given a green mark. How many cells have more than one mark?

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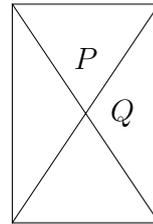
Question 6

A shape consisting of 2004 small squares is made by continuing the pattern shown in the diagram. The small squares have sides of length 1 cm. What is the length, in cm, of the perimeter of the whole shape?



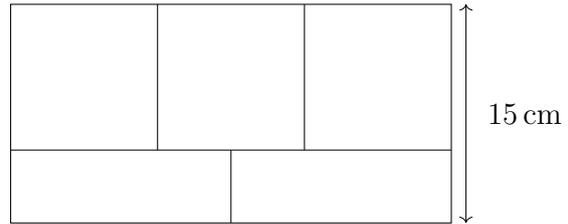
Question 7

A rectangle is split into triangles by drawing in its diagonals. What is the ratio of the area of triangle *P* to the area of triangle *Q*?



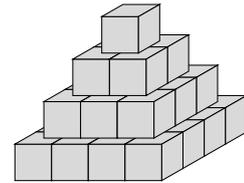
Question 8

Five identical rectangles fit together as shown (not to scale). What, in cm^2 , is the total area which they cover?



Question 9

The diagram shows a pyramid made up of thirty cubes, each measuring $1\text{ m} \times 1\text{ m} \times 1\text{ m}$. What is the total surface area of the whole pyramid, including its base?



Question 10

In a magic square, the numbers in each row, each column, and the two main diagonals have the same total. This magic square uses the integers 2 to 10. Fill in the missing cells.

	10	5
8		4
7	2	

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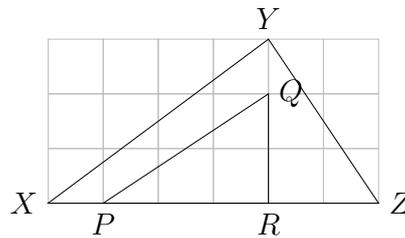
Question 14

The diagram shows a square divided into strips of equal width. Three strips are black and two are grey. What fraction of the perimeter of the square is grey?



Question 15

Triangles XYZ and PQR are drawn on a square grid. What fraction of the area of triangle XYZ is the area of triangle PQR ?



Question 16

Usain runs twice as fast as his mum. His mum runs five times as fast as his pet tortoise, Turbo. They all set off together for a run down the same straight path. When Usain has run 100 m, how far apart are his mum and Turbo the tortoise?

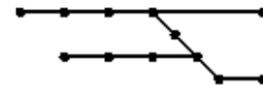
Question 17

In the subtraction below, P , Q , R , S , and T represent single digits. What is the value of $P + Q + R + S + T$?

$$\begin{array}{r}
 7 \quad Q \quad 2 \quad S \quad T \\
 - \quad P \quad 3 \quad R \quad 9 \quad 6 \\
 \hline
 2 \quad 2 \quad 2 \quad 2 \quad 2
 \end{array}$$

Question 18

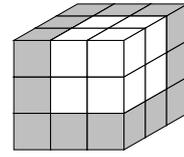
The diagram is a map of Jo's local rail network, where the dots represent stations and the lines are routes. Jo wants to visit all the stations, travelling only by train, starting at any station and ending at any station, with no restrictions on which routes are taken. What is the smallest number of stations that Jo must go to more than once?



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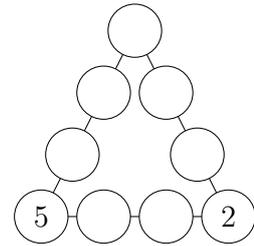
Question 19

Pablo's teacher has given him 27 identical white cubes. She asks him to paint some of the faces of these cubes grey and then stack the cubes so that they appear as shown. What is the largest possible number of the individual white cubes which Pablo can leave with no faces painted grey?



Question 20

Sam wants to complete the diagram so that each of the nine circles contains one of the digits from 1 to 9 inclusive, and each contains a different digit. Also, the digits in each of the three lines of four circles must have the same total. What is this total?

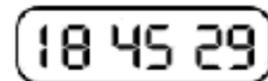


Question 21

Granny swears that she is getting younger. She has calculated that she is four times as old as I am now, but remembers that five years ago she was five times as old as I was at the time. What is the sum of our ages now?

Question 22

On a digital clock displaying hours, minutes and seconds, how many times in each 24-hour period do all six digits change simultaneously?



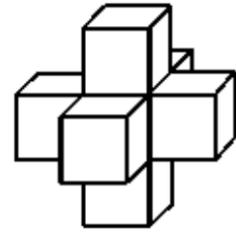
Question 23

Peri the winkle leaves on Monday to go and visit Granny, 90 m away. Except for rest days, Peri travels 1 m each day (24-hour period) at a constant rate and without pause. However, Peri stops for a 24-hour rest every tenth day, that is, after nine days' travelling. on which day of the week does Peri arrive at Granny's?

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Question 24

One cube has each of its faces covered by one face of an identical cube, making a solid as shown. The volume of the solid is 875 cm^3 . What, in cm^2 , is the surface area of the solid?



Question 25

Two adults and two children wish to cross a river. They make a raft but it will carry only the weight of one adult or two children. What is the minimum number of times the raft must cross the river to get all four people to the other side? (N.B. The raft may not cross the river without at least one person on board.)

Question 26

In the diagram shown, all the angles are right angles and all the sides are of length 1 unit, 2 units or 3 units. What, in square units, is the area of the shaded region?

