



2014

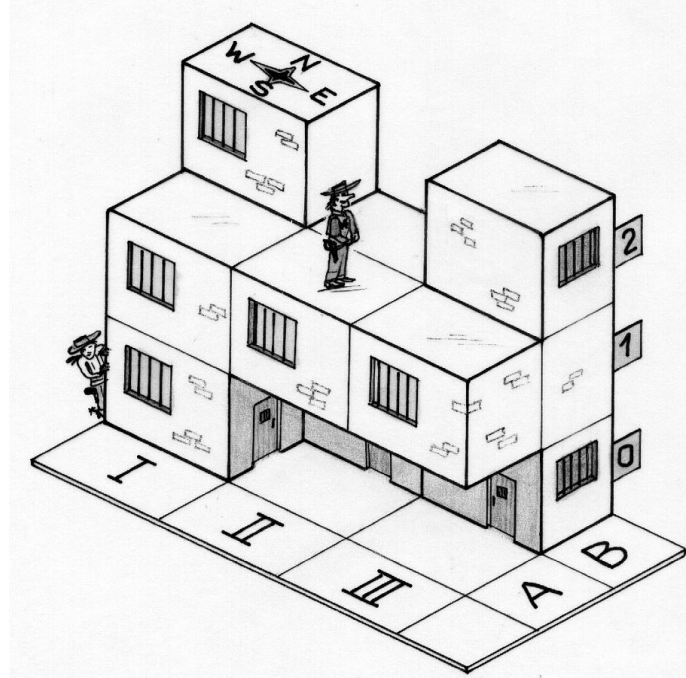
Training test December 2013

You must explain your answers for all the questions except 2, 4 and 6
Every attempt gets some marks
Careful work is taken into account

Q 1 (LV) – 7 marks

Dalton brothers

*Your answer must be in French, German, Spanish or Italian
and must be a minimum of 30 words.*



Les frères Dalton sont quatre redoutables bandits du Far-West.

Trois d'entre eux, Bill, Grat et Emmett sont faits prisonniers. Chacun est enfermé séparément dans l'une des 12 cellules de la prison représentée ci-. Chaque cellule n'a qu'une seule fenêtre. Pour libérer ses frères, le quatrième Dalton, Bob, dispose des indications suivantes :

- *La fenêtre de la cellule de Bill est orientée au sud.*
- *Bill se trouve à l'étage au-dessus de celui de Grat.*
- *La fenêtre de la cellule de Grat est orientée à l'est.*
- *Emmett, enfermé au 2^e étage, se trouve dans une cellule plus à l'ouest que celle de Grat.*
- *Il existe une cellule juste en dessous de celle de Bill.*

Sur le dessin, on voit le gardien de la prison. On note sa position par (2 ; A ; II).

Aider Bob à libérer ses frères en indiquant la position de chacun d'eux. Justifier.

Die Dalton-Brüder sind vier gefürchtete Banditen aus dem Wilden Westen.

Drei von ihnen, Bill, Grat und Emmett, werden gefangen genommen. Jeder wird alleine in eine der 12 abgebildeten Gefängniszellen gesperrt. Jede Zelle hat nur ein einziges Fenster. Der vierte Dalton, Bob, verfügt über folgende Hinweise um seine Brüder zu befreien:

- Das Fenster von Bills Zelle ist nach Süden ausgerichtet.
- Bill befindet sich im Stockwerk oberhalb von Grat.

- Das Fenster von Grats Zelle ist nach Osten ausgerichtet.
- Emmett, der im 2. Stock eingeschlossen ist, befindet sich in einer Zelle, die weiter im Westen liegt als Grats Zelle.
- Eine der Zellen befindet sich direkt unter Bills Zelle.

Auf der Abbildung sieht man den Gefängniswärter. Seine Position wird wie folgt angegeben: (2 ; A ; II).

Helpf Bob seine Brüder zu befreien, indem ihr ihm die Positionen von Bill, Grat und Emmett angebt. Begründet eure Antwort.

Los hermanos Dalton son cuatro temibles bandidos del Oeste.

Tres de ellos, Bill, Grat y Emmett fueron hechos prisioneros. Cada uno está encerrado por separado en una de las 12 celdas de la cárcel representada aquí arriba. Cada celda tiene sólo una ventana.

Para liberar a sus hermanos, el cuarto hermano Dalton, Bob, dispone de las siguientes indicaciones:

- *La ventana de la celda de Bill está orientada hacia el sur.*
- *Bill está en el piso de encima del de Grat.*
- *La ventana de la celda de Grat está orientada al este.*
- *Emmett, encerrado en el segundo piso, se encuentra en una celda más al oeste que la celda de Grat.*
- *Hay una celda justo debajo de la celda de Bill.*

En el dibujo, vemos al guardia de la prisión. Su posición se denota por (2, A, II).

Ayuda a Bob a liberar a sus hermanos indicando la posición de cada uno de ellos. Justifica la respuesta.

I fratelli Dalton sono quattro terribili banditi del Far West.

Tre di essi, Bill, Grat et Emmett sono imprigionati. Ognuno è rinchiuso da solo in una delle 12 celle della prigione rappresentata nel disegno. Ogni cella ha una sola finestra.

Bob, il quarto Dalton, per liberare i suoi fratelli ha a disposizione le seguenti informazioni:

- *la finestra della cella di Bill è esposta a sud,*
- *Bill si trova al piano disopra a Grat,*
- *la finestra della cella di Grat è esposta a est,*
- *Emmett, rinchiuso al secondo piano, si trova in una cella più a ponente di quella di Grat,*
- *c'è una cella proprio sottostante quella di Bill.*

Nel disegno, si vede la guardia della prigione. La sua posizione è indicata come (2; A; II).

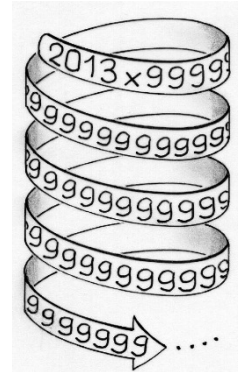
Aiutate Bob a liberare i suoi fratelli indicando la posizione di ognuno. Giustificate la risposta.

Question 2 – 5 marks

Done up top the nines

$$2013 \times 9999\dots 9999$$

where 9999....9999 is a number written with 2013 digits all of which are 9.



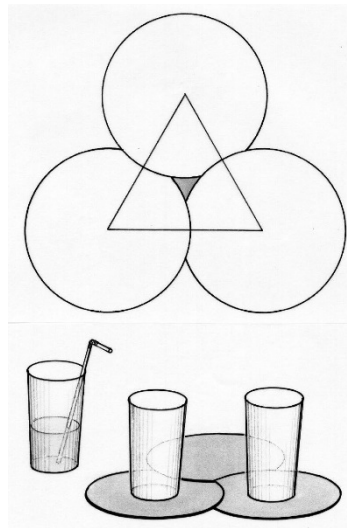
What is the sum of the digits in the result of this multiplication? Explain how you got the answer.

Question 3 – 7 marks

Coast to coast

Three coasters are put down on a restaurant table. They are circles diameter 10 cm.

Playing around with the three coasters I can make sure that the centres of the circles form the vertices of an equilateral triangle. I can move them closer together so that the shaded area in the diagram just disappears. The three centres are still the vertices of an equilateral triangle.



Work out the exact value of the side of this equilateral triangle.

Question 4 – 5 marks

Zooming out

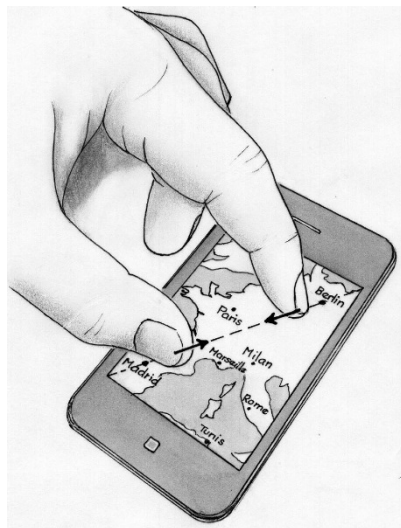
On Jacquot's smartphone there is an app that allows him to bring up satellite images and to change the scale.

Jacquot downloads a view of a street in his own village. His house is at the bottom on the right hand side and the village school is at the top on the left. In reality they are 150 metres apart as the crow flies.

With his fingers he squeezes the diagonal to reduce the image. The screen now shows a satellite image of a larger area; Jacquot can see the whole village. The diagonal now corresponds to 600m.

Jacquot continues to squeeze the screen in the same way so that eventually he can see nearly the whole of Europe. Finally he sees Berlin and Madrid lying along the diagonal. That distance in reality is 1860 km.

How many times did Jacquot squeeze the screen from seeing just his own street to seeing the final map? Justify your answer.

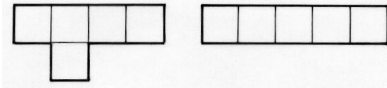


Question 5 – 7 marks

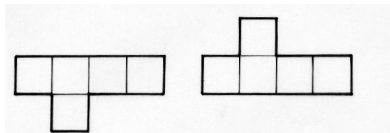
Party time

A pentomino is made by placing 5 identical squares edge to edge so that each square is joined to at least one other.

Here are two examples of pentominoes:

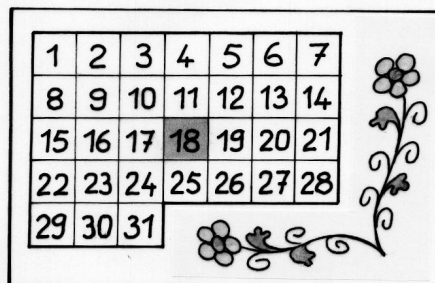


Two arrangements that can be laid on top of each other after turning round or over are considered to be identical. Here are two pentominoes that are actually identical:



There are 12 different pentominoes.

Draw the 12 different pentominoes.



Charlotte has her birthday on the 18 January. She wants to make a party invitation using 6 different pentominoes to cover the dates on the calendar. She wants to leave the 18 uncovered.

Help Charlotte with her design. Make sure you show clearly the pentominoes you have used by using different colours.

Question 6 – 5 marks

De-side-edly odd

My side of my street has the odd numbers. The houses are numbered 1, 3, 5, 7, ... and my house is number 37.

If the houses were numbered from the other end of the street my house would be 65.

How many houses are there on the odd side of my street? Justify your answer.



Question 7 – 7 marks

All square

This instruction was found in an old maths jotter:

Draw a square ABCD.

Find the point A' which is the image of A reflected in B.

Similarly find the points : B' the image of B reflected in C,

C' the image of C reflected in D,

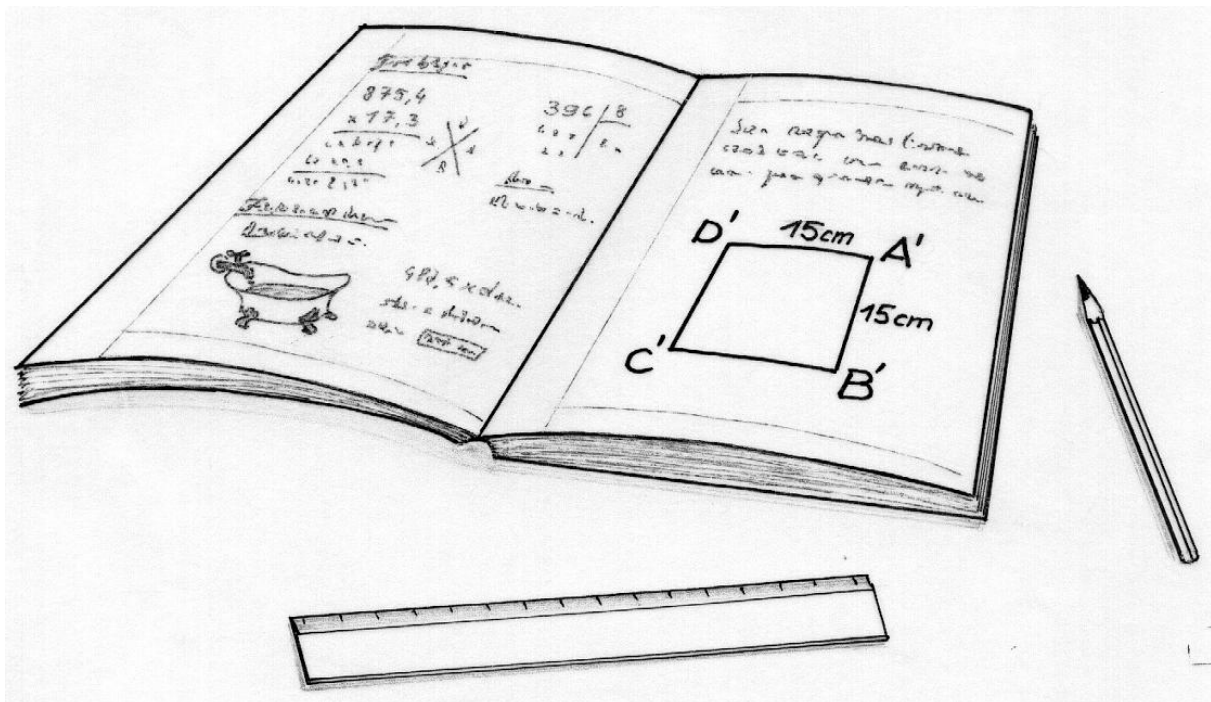
D' the image of D reflected in A.

Unfortunately the only other thing on the jotter page is a square $A'B'C'D'$ of side 15 cm.

Draw a square $A'B'C'D'$ of side 15 cm.

Construct the original square ABCD.

Describe the steps in the construction and justify your answer.

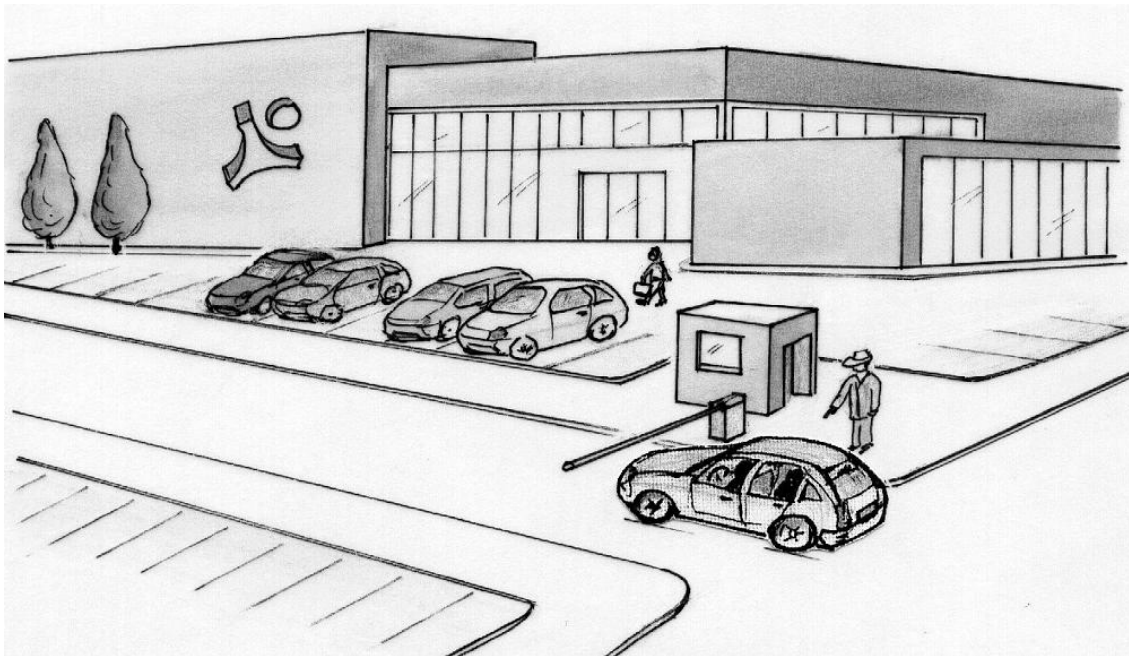


Question 8 – 5 marks

Car sharing

This morning the car park attendant at a large company saw as many cars with 3 occupants as cars with 4 occupants going in; and as many cars with 2 occupants as those with just the driver going in. No car had more than 4 occupants.

Knowing that 100 people arrived by car work out all the combinations of the number of cars and occupants going in to the car park.

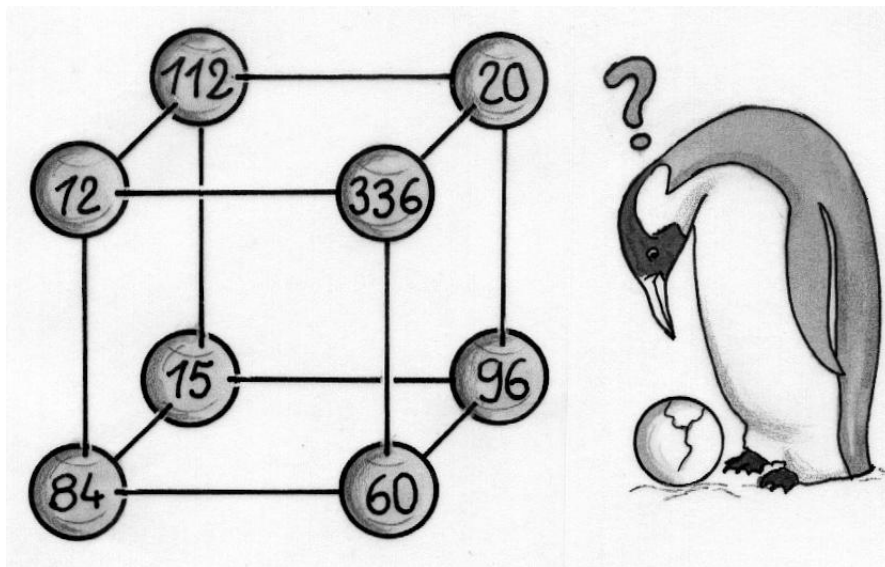


Question 9 – 7 marks

Ballean algebra

Inside 8 balls a clever maths teacher has hidden the whole numbers from 1 to 8. Each ball holds just one number.

The 8 balls are then placed at the vertices of a cube as shown :



Here each ball is linked to 3 other balls. On the surface of each ball the teacher has written the product of the 3 numbers hidden in the 3 balls that are linked to it.

Draw the cube and show clearly the number hidden in each ball.

Question 10 – 10 marks

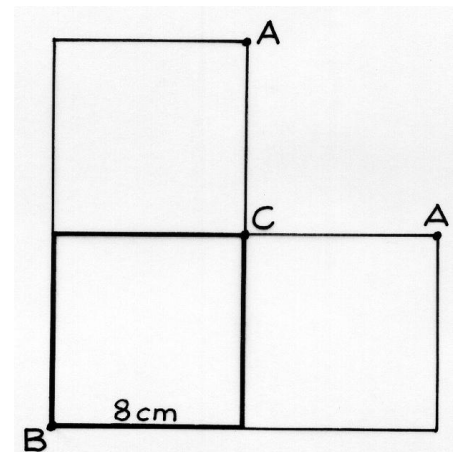
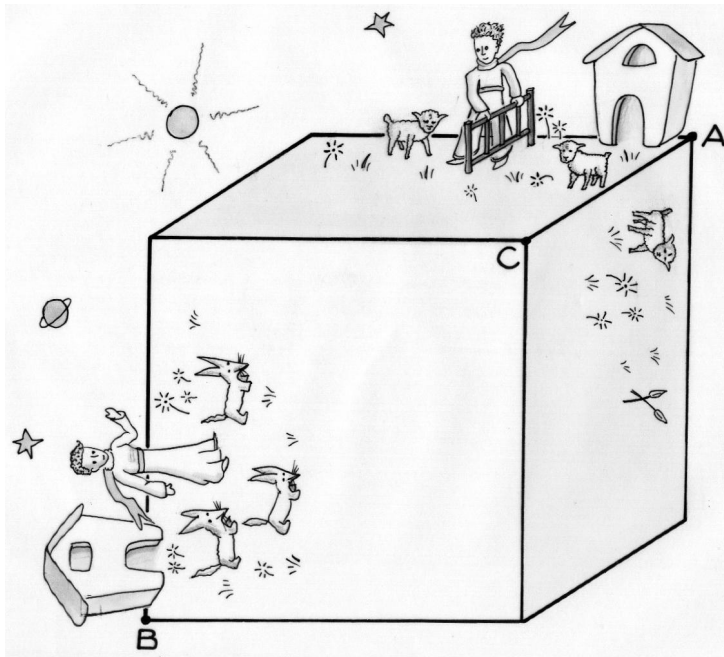
Outfoxed

In a far away galaxy there is a cubic planet divided into two farms : Prince Arikara has his farm at A where he raises sheep ; and Princess Bella has her farm at B where she looks after some wild foxes.

To protect his sheep Arikara wants to erect a fence which will divide the surface of the planet into two areas separated by a border fence which would go right round the planet. The border would need to satisfy this rule :

If a sheep met a fox at any point on the border then they would both, by taking the shortest distance, have the same distance to run to get back to their farm.

Draw the net of the three faces shown here.



On this net mark and name two points on the frontier. Justify your choice.

Draw the border fence on the front face of the cube.

Help the prince put up his fence by drawing the border on the three visible faces of the planet on the perspective drawing of the planet.

Question 11 – 5 marks – Senior classes only

Outfoxed

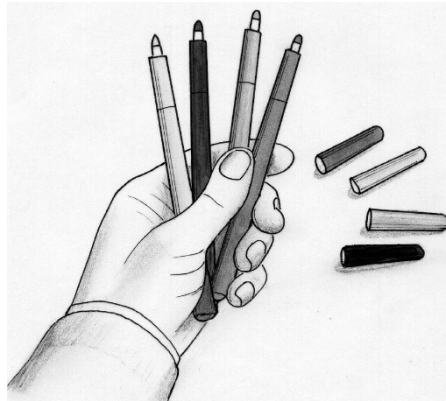
Elia has four different-coloured felt tip pens. She takes off the covering top. Each top is the same colour as the felt tip pen it belongs to.

Without looking Elia puts the tops back on at random.

What is the probability that Elia succeeds in replacing each top correctly?

What is the probability that no top is on the correct pen?

Justify your answers.



Question 12 – 7 marks – Senior classes only

A proper Charlie

During a school cinema festival all the pupils watched 3 famous Charlie Chaplin films: Modern Times, The Great Dictator and City Lights. As they came out of the film all the pupils had to answer, yes or no, to the question – did you enjoy the film?

- 71% enjoyed Modern Times
- 76% enjoyed The Great Dictator
- 63% enjoyed City Lights



What are the maximum and minimum percentages of pupils who enjoyed all three films. Explain your working.

Question 13 – 10 marks – Senior classes only

The game's afoot

Here is how to make a special isosceles triangle: one of the vertices is the mid-point of the line joining the foot of one of the altitudes and the mid-point of a side.

Note: in a triangle ABC the foot of the altitude from A is the point of intersection of that altitude and the side BC.

Draw an isosceles triangle that meets this condition.

If the area of the triangle is 100 cm^2 , work out the lengths of the three sides to the nearest mm.

