ACADÉMIE DE STRASBOURG
Liberté
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Fraternité

Interclass competition for Years 4 and 5.
Organized with the assistance of the regional mathematics educational inspection of the Strasbourg Academy

Mathématiques Sans Frontières

DISCOVERY ÉDITION 2025

- ✓ **Submit only one answer sheet per exercise.**
- ✓ **All working will be taken into account.**
- ✓ **Care, quality of writing and precision of reasoning will be taken into account.**

Exercise 1 7 pts
Tik-Tak

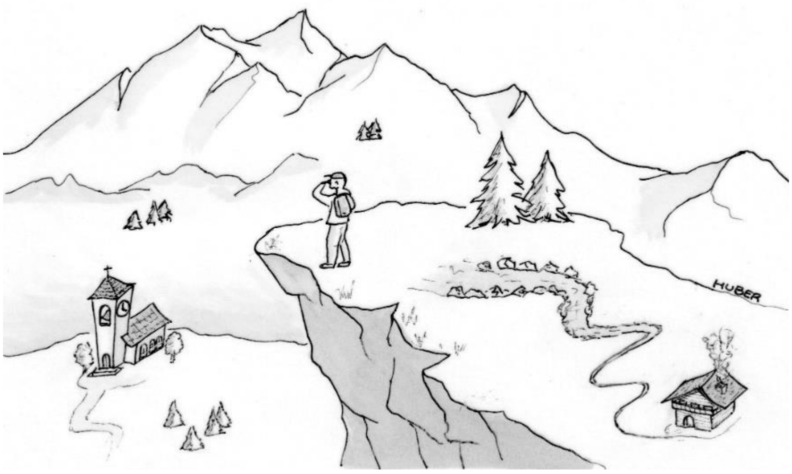
Solution to be written in German, French, Spanish or Italian in a minimum of 30 words..

Jean ist in die Berge gefahren. Er verbringt das Wochenende in einer Hütte im Tal. Dort hat er weder Strom noch Handy-Empfang.
Ohne Uhr und Mobiltelefon weiß Jean in der Hütte nicht, wie spät es ist. Es gibt dort zwar eine batteriebetriebene Wanduhr, aber sie ist stehengeblieben.
Jean möchte die Wanduhr wieder richtig stellen. Neue Batterien hat er dabei. Er weiß, dass es im nächsten Dorf eine Kirche mit einer Kirchturmuhr gibt. Um die Uhrzeit abzulesen, steigt er auf einen Hügel. Von dort kann er die Kirchturmuhr sehen. Der Weg auf den Hügel ist steil, und so braucht Jean für den Aufstieg doppelt so lang wie für den Abstieg.

Erklärt, wie Jean vorgehen muss, um die Wanduhr in der Hütte so genau wie möglich zu stellen.

Jean trascorre un fine settimana in un rifugio in montagna in fondo a una valle. Il rifugio non ha né elettricità né rete telefonica.
Giunto sul posto, senza orologio né telefono, Jean non ha possibilità alcuna di conoscere l'ora. Nel rifugio c'è un orologio a pila, fermo, che non si può spostare.
Jean ha con sé delle pile nuove e spera di riuscire a regolare l'orologio sull'ora corretta.
Sa che nel villaggio vicino c'è una chiesa con un orologio. Sale, quindi, sulla cima di una collina da cui può vedere l'orologio per leggere l'ora indicata in un tempo trascurabile e scende immediatamente. Nella salita, data la ripidità, impiega il doppio del tempo rispetto alla discesa.

Spiegate come Jean possa procedere per regolare l'orologio del rifugio sull'ora corretta con la maggiore precisione possibile.



Jean passe un week-end dans un chalet de montagne au fond d'une vallée. Ce chalet n'a pas d'électricité et aucun réseau téléphonique.
Une fois arrivé sur place, sans montre ni téléphone, Jean n'a aucun moyen de connaître l'heure. Dans le chalet il y a une horloge à pile, arrêtée, qu'on ne peut pas déplacer.

Dans ses affaires, il a des piles toutes neuves. Il souhaite régler cette horloge à la bonne heure. Il sait qu'il y a une église avec une horloge dans le village le plus proche. Pour lire l'heure sur son clocher, il monte au sommet d'une colline d'où il aperçoit le clocher. Comme la pente est raide pour monter sur la colline, il met deux fois plus de temps pour monter que pour descendre.

Expliquer comment Jean peut procéder pour régler l'horloge du chalet sur la bonne heure le plus précisément possible

Jean pasa un fin de semana en un chalé de montaña en el fondo de un valle. Este chalé no tiene electricidad y ninguna red telefónica. Una vez llegado al sitio, sin reloj ni teléfono, Jean no tiene ningún medio para saber la hora. En el chalé hay un reloj de pared de pilas, parado, que no podemos trasladar. Entre sus cosas hay pilas nuevas. Quiere poner este reloj en hora. Sabe que hay una iglesia con un reloj en el pueblo más cercano. Para leer la hora en su campanario, sube a la cima de una colina desde donde ve el campanario. Como la cuesta para subir la colina es empinada, tarda el doble de tiempo en subir que en bajar.

Explica como Jean puede proceder para poner en hora el reloj del chalé de la manera más precisa posible.

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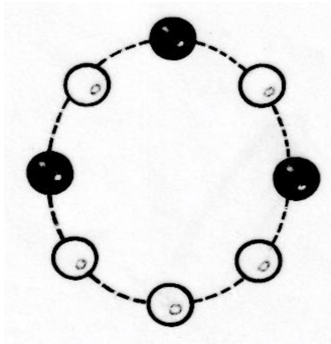
Exercise 2 — 5 pts
Necklaces



Marion makes necklaces each made up of five white pearls and three black pearls.
The figure opposite shows an example.

Draw the different pearl necklaces that Marion can make.

Exercise 3 — 7 pts
Square of Keys

Laura randomly chooses four adjacent keys, from the keys 1 to 9 of the numeric keypad of her calculator, forming a square.

Then, she presses each of these four keys successively, starting with any one, but always turning clockwise.

She can thus write four different four-digit numbers.

She remembers the following divisibility criterion: “Let abcd be a four-digit number. If a – b + c – d is zero then abcd is divisible by 11”.

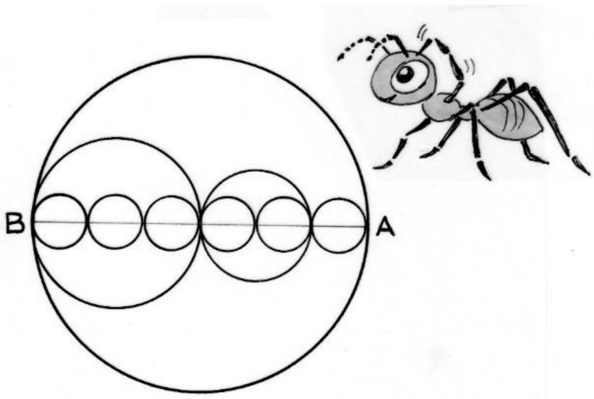
She states the following proposition: “The four numbers thus obtained are all divisible by 11 whatever the square of keys chosen.”

Labelling the first digit typed as n, prove this proposition using the divisibility criterion.

Exercise 4 — 5 pts
Fourmidable

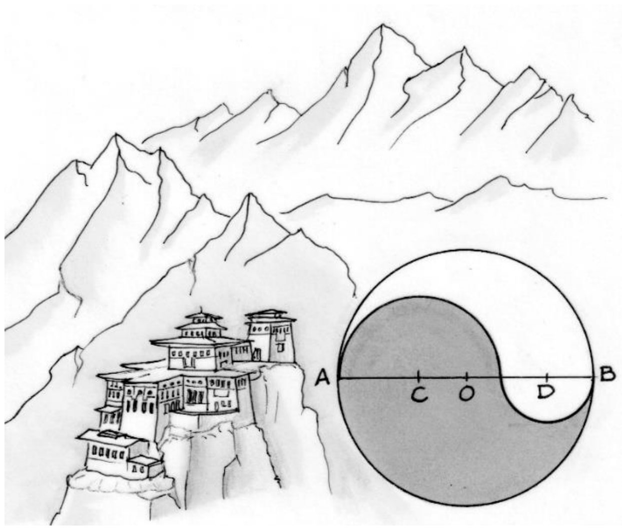
An ant must go from point A to point B following only circular arcs. The centers of all circles are aligned and AB = 12.

Calculate the shortest path length.

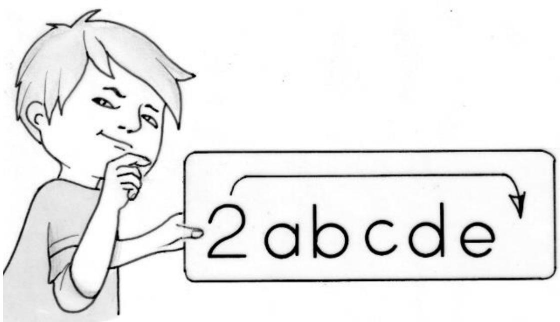


Exercise 5 — 7 pts
Dark Side

In a monastery in the Himalayas there is a strange disk with a diameter of 1 m. It represents the balance of energies on earth. When everything goes well, the two parts, light and dark, have the same area. For some time now, the dark side has been gaining energy. On the disk, the area of the dark part is 1.5 times larger than the area of the light part.



Calculate the radius AC.
Draw this disk at 1/10 scale.



Exercise 6 — 5 pts
The Beginning of the End

A six-digit number begins with the number 2.
If I move the number 2 to the end of the number, the resulting six-digit number is 461,214 larger than the first number.

Obtain the starting number. Explain.

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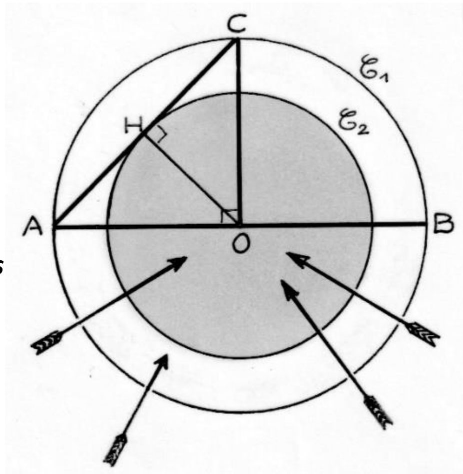
Exercise 7 7 pts
Target Sharing

For his school fair, Samuel plans to make a target for a dart throwing game.

The target will consist of two concentric circles, defining two zones, one white and the other grey. For the sake of equal opportunities, he wants these two zones to have the same area.

He begins by drawing the circle C_1 with centre O and radius 20 cm. To draw the circle C_2, he makes the constructions indicated in the drawing.

Trace, on a 1/2 scale, the target with both areas and detail your construction step by step. Do the grey and white areas have the same area? Justify your answer.

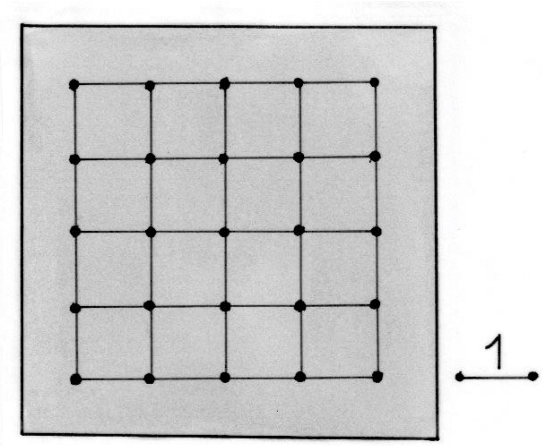


Exercise 8 5 pts
Points²

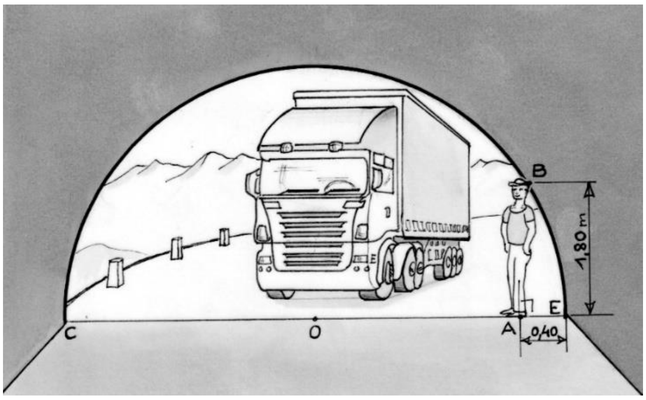
On this grid, we placed 25 points on a square of side 4 units.

We can draw many squares whose vertices are grid points.

Give all possible dimensions of these squares.



Exercise 9 7 pts
Impossible Roads



A truck driver would like to cross a semi-circular tunnel with centre O.

He is worried because the height of the tunnel is not indicated. He gets out of the truck.

He places himself at point A and takes two measurements:
EA = 0.40 m and AB = 1.80 m. [AB] is perpendicular to the ground. The truck measures 2.40 m wide and 4.10 m high.

Calculate the height of the tunnel and then explain if the truck can pass through it.

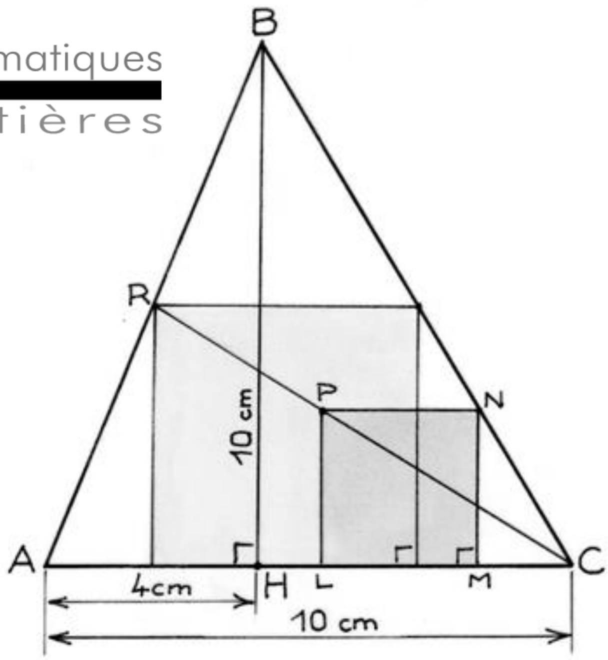
Exercise 10 10 pts
Downright Grandiose

Consider a triangle ABC with base AC = 10 cm and height BH = 10 cm.
The figure opposite allows you to construct the largest square inside the triangle ABC, one side of which rests on the base [AC].

We consider a square LMNP whose vertices L and M are on [AC] and whose vertex N is on [BC]. The line (CP) intersects [AB] at R.

R is one of the vertices of the largest square which answers the problem.

Construct the figure.
Calculate the side length of this square. Explain your approach.



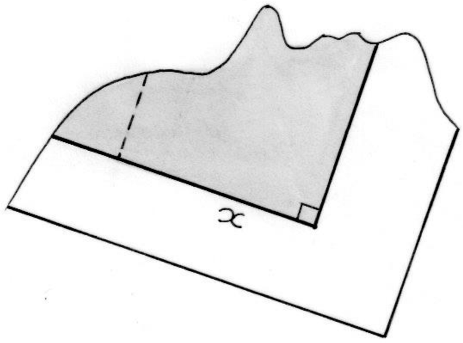
SECOND SPECIAL

ExerciSe 11 5 pts
Skillful Play

Frieda has five red marbles and five blue marbles that are indistinguishable by touch.
She divides these ten marbles into two opaque bags. Julia, her friend, picks, without looking, a marble from each bag.

How should Frieda distribute the marbles between the two bags so that Julia has the best chance of drawing two red marbles? Explain your answer.

Exercise 12 7 pts
It Rocks !



On the torn piece of paper opposite, there remains a piece of a figure whose perimeter is $10x + 4$ and area $5x^2 + 4x$.

Draw a figure with its dimensions as a function of x that could meet the constraints. Justify your answer.

Exercise 13 10 pts
2nde GT
Triplets

A Pythagorean triple, denoted (a, b, c) is made up of three integers a, b and c such that $a^2 + b^2 = c^2$.
These are the side lengths of a right-angled triangle.
We obtain all the Pythagorean triples (a, b, c) using the formulae:

$a = m^2 - n^2$

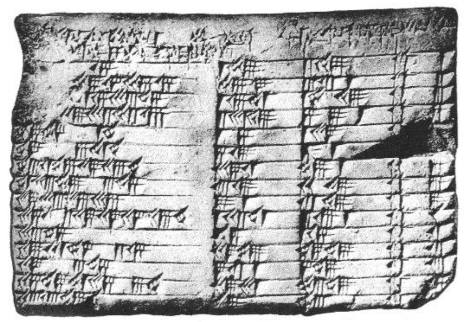
$b = 2mn$

$c = m^2 + n^2$

where *m* and *n* are non-zero positive integers and *m* is greater than *n.*

A triple (a, b, c) is said to be primitive if a, b and c have only one positive common divisor 1.

Calculate the primitive Pythagorean triple (a, b, c) obtained with m = 5 and n = 4.
Obtain the four primitive Pythagorean triples obtained with b = 2024.



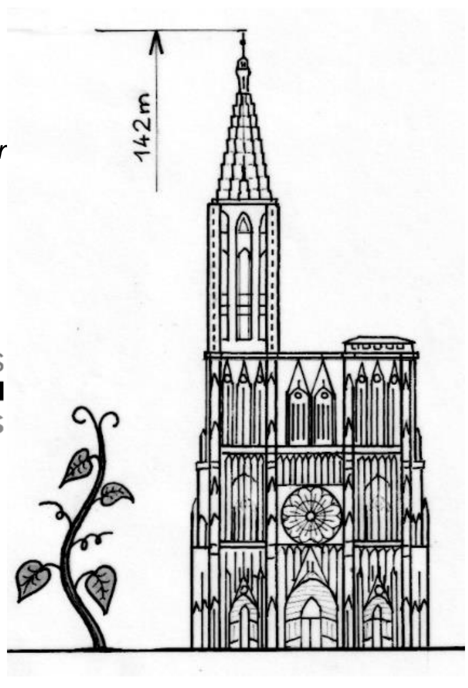
Tablette babylonienne – Plimpton 322

Exercise 13 10 pts
2nde PRO
Mathematical Bean

Jacques planted a magic bean at ground level. On the morning of April 1, the small shoot measured 0.5 cm. Every morning, Jacques notices that the bean has doubled in height.
Strasbourg Cathedral has a height of 142 m.

On the morning of which day will the height of the beanstalk be greater than the height of Strasbourg Cathedral?

The use of a spreadsheet is recommended for the resolution of this exercise.



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