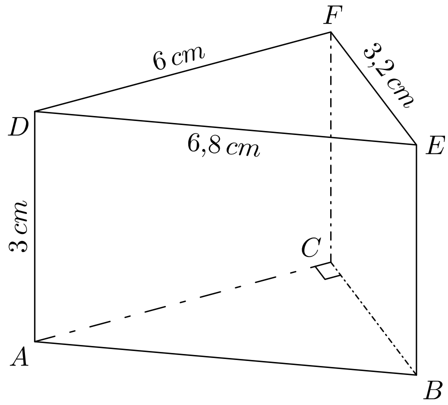
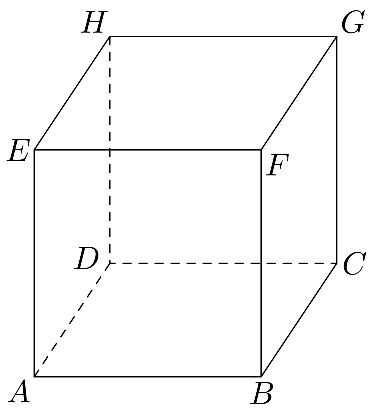
1. *Lateral surface*

E.6604 Consider the right prism $ABCDEF$ shown below:



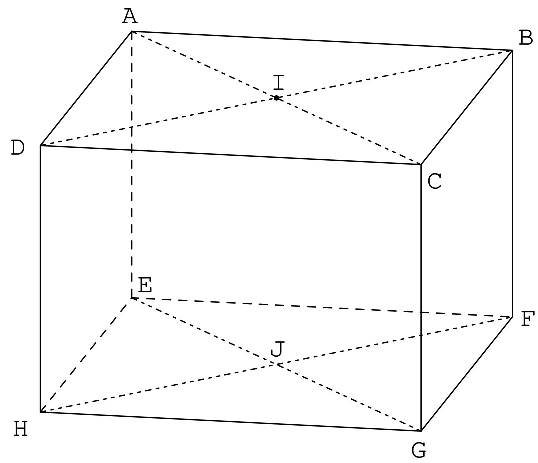
1. a. What is the nature of the face DEF?
   b. Determine the area of face DFE.
2. a. Of what natures are the faces $ABED$, $ACFD$ and $BCFE$?
   b. Determine the area of each of these faces.
3. Give the lateral area of this right prism.

E.4949 Consider the cube $ABCDEFGH$ with side $4\,cm$ shown below:



1. a. How many vertices does this cube have?
   b. How many edges does this cube have?
   c. How many faces does this cube have?
2. Determine the volume of this cube.
3. Determine the lateral area of this cube.

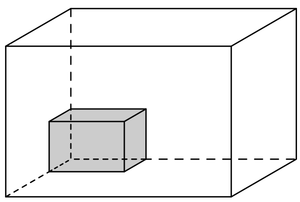
E.586 Consider the right block $ABCDEFGH$; note I and J the respective middles of the $ABCD$ and $EFGH$ faces.



The following measurements are now assumed to be known:
$AB=8\,cm$; $AD=6\,cm$; $AE=7\,cm$
and we admit that the solid $IDCJHG$ is a right prism:

1. Calculate the volume of the prism $IDCJHG$.
2. Calculate the lateral surface area of the prism $IDCJHG$.

E.9123

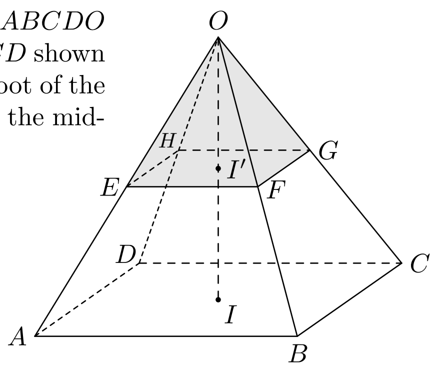


The volume of the parallelepiped has been multiplied by 27. By how much have its dimensions been enlarged? And its lateral area?

2. *Volume expansion and reduction*

E.5461

Consider a pyramid $ABCDO$ with a square base $ABCD$ shown opposite. Let I be the foot of the pyramid's height and E the midpoint of $[OA]$.



We have the dimensions: $AB=3\,cm$; $IO=4\,cm$
The plane parallel to the base passing through point E intersects the pyramid, forming quadrilateral $EFGH$.

1. a. What is the nature of the quadrilateral $EFGH$?
   b. Justify that point F is the midpoint of segment $[OB]$.
   c. What can be said about pyramid $EFGHO$ in relation to pyramid $ABCDO$?
2. a. Determine the length of segment $[EF]$.
   b. Give the area $\mathcal{A}$ of the base $ABCD$ and the area $\mathcal{A}'$ of the vase $EFGH$.
   c. Give the value of the ratio $\dfrac{\mathcal{A}'}{\mathcal{A}}$ of the areas.
3. The formula for a pyramid is given by the formula:
   $\mathcal{V}=\dfrac{1}{3}\times\mathcal{A}_B\times h$
   It is assumed that: $OI'=2\,cm$

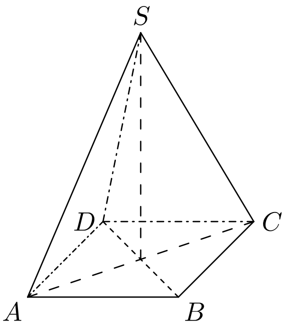
a) Give the volume $\mathcal{V}$ of the pyramid $ABCDO$ and the volume $\mathcal{V}'$ of the pyramid $EFGHO$.

b) Give the value of the ratio $\dfrac{\mathcal{V}'}{\mathcal{V}}$ of the volumes.

E.6299

Paul visiting Paris admires the Pyramid, made of laminated glass in the center of the Louvre's inner courtyard. This regular pyramid has:

- base a square $ABCD$ side 35 meters;
- for height the segment $[SO]$ of length 22 meters.



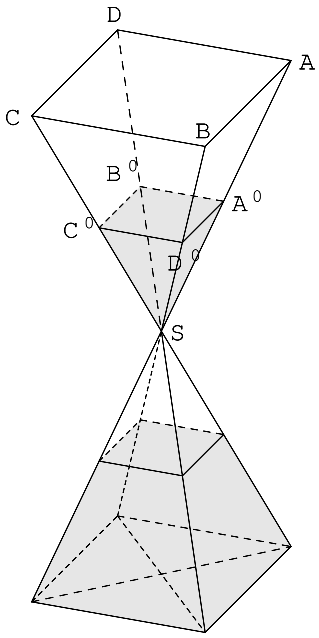
Paul enjoyed the pyramid so much that as a souvenir of his visit he bought an oil lamp whose glass reservoir is a scale reduction $\dfrac{1}{500}$ of the real pyramid.

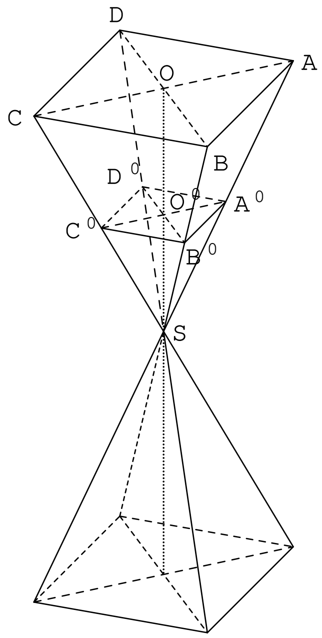
The lamp's instructions state that, once lit, it burns $4\,cm^3$ of oil per hour.
After how long will there be no oil left in the reservoir? Round off to the nearest hour.

Reminder: *Volume of a pyramid = one-third of the product of the area of the base times the height.*

Show the approach used on the copy. Any trace of research will be taken into account during assessment even if the work is not completely finished.

E.987 An hourglass consists of two superimposed pyramids, as shown in the sketch below. The sand flows at point S. The surface of the sand is represented by the plane $A'B'C'D'$ horizontal and parallel to the bases of the pyramids $SABCD$





The pyramid $SABCD$ is regular, its base is a square $ABCD$, recall that the height (SO) is perpendicular to the plane $ABCD$.
The sand level is marked by the length SA' on the pyramid edge $SABCD$.
We give: $OA=27\,mm$ et $SO=120\,mm$.
Throughout this problem, A' is the middle of $[SA]$.

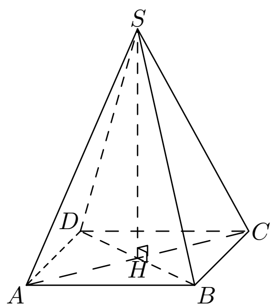
1. Represent the base $ABCD$ in full size.
2. a) Justify that the triangle AOB is isosceles rectangle.
   b) Show that: $AB=27\sqrt{2}\,mm$
3. a) Calculate the area of the square $ABCD$
   b) Deduce the volume $\mathcal{V}$ of the pyramid $SABCD$ is $58\,320\,mm^2$
4. The triangle SOA is right-angled. Show that: $SA=123\,mm$.
5. Pyramid $SA'B'C'D'$ is a reduction of the $SABCD$ pyramid.
   a) What can we say about the straight lines (OA) and $(O'A')$?
   b) Determine the coefficient of reduction $\dfrac{SO'}{SO}$.
6. Note $\mathcal{V}'$ the volume of the pyramid $SA'B'C'D'$. Calculer $\mathcal{V}'$.
7. It is assumed that the volume of sand lowered is proportional to the time elapsed. all the sand runs out in 4 minutes.
   After how long is the sand level in the position studied?

E.5920 A regular pyramid with vertex S has base $ABCD$ square such that its volume V is equal to $108\,cm^3$.
Its height measures $9\,cm$.
The volume of a pyramid is given by the relationship:

$$\text{Volume of a pyramide} = \frac{\text{aire of the base}\times\text{hauteur}}{3}$$

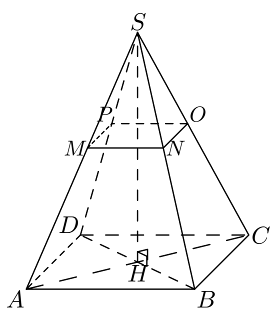
1. Verify that the area of $ABCD$ is $36\,cm^3$. Deduce the value of AB.

   Show that the perimeter of the triangle ABC is equal to $12+6\sqrt{2}\,cm$.



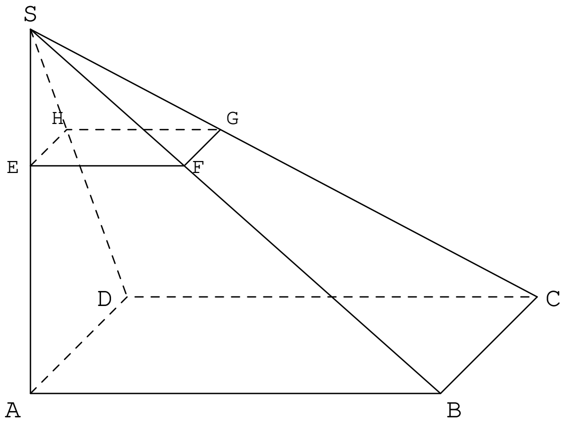
2. $SMNOP$ is a reduction of the pyramid $SABCD$.

   We then obtain the pyramid $SMNOP$ such that the area of the square $MNOP$ is equal to $4\,cm^2$
   a) Calculate the volume of the pyramid $SMNOP$.
   b) *For this question, any trace of research, however incomplete, will be taken into account in the evaluation.*
   Elise thinks that to obtain the perimeter of the triangle MNO, we simply divide the perimeter of the triangle ABC by 3.
   Do you agree with her?



3. *Pyramid, enlargement, reduction, affine functions*

E.991 In the figure opposite, $SABCD$ is a square-based pyramid of height $[SA]$ such that : $AB = 9\,cm$; $SA = 12\,cm$.
The triangle SAB is right-angled at A.

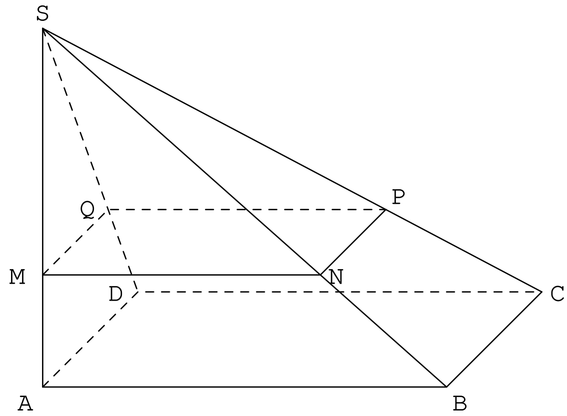


First part

$EFGH$ is the section of the pyramid $SABCD$ by the plane parallel to the base and such that : $SE = 3\,cm$.

1. a. Calculate EF.
   b. Calculate SB.
2. a. Calculate the volume $\mathcal{V}$ of the pyramid $SABCD$.
   b. Give the reduction coefficient to go from pyramid $SABCD$ to pyramid $SEFGH$.
   c. Deduce the volume $\mathcal{V}'$ of $SEFGH$. A value rounded to unity will be given.

Second part



Let M be a point of $[SA]$ such that $SM = x\,cm$, where x is between 0 and 12.
We call $MNPQ$ the section of the pyramid $SABCD$ by the plane parallel to the base passing through M.

1. Show that : $MN = 0.75 \cdot x$
2. Let $\mathcal{A}(x)$ be the area of the square $MNPQ$ as a function of x.
   Show that : $\mathcal{A}(x) = 0.5625 \cdot x^2$.
3. Complete the table below :

Longueur x *(en cm)*	0	2	4	6	8	10	12
Area $\mathcal{A}(x)$ of the square $MNPQ$							

4. Draw a reference frame where :
   - on the x-axis, $1\,cm$ represents 1 unit ;
   - on the ordinate axis, $1\,cm$ represents 10 units.
   - the x-axis and y-axis are perpendicular.

   Place in this frame the points with abscissa x and ordinate $\mathcal{A}(x)$ given by the table.
5. Is the area of $MNPQ$ proportional to the length SM? Justify using the graph.

