

## Sujet n°27

*Please do not write on this document, and do not forget to hand it back to the jury at the end of the test.*

### Linear Programming – The cake study

A school class is planning a trip abroad. To raise money, the pupils decide to sell cakes. But they cannot cook more than 60 cakes (small and big ones). One egg is enough to cook a small cake, but two are needed for big cakes. The pupils only have 100 eggs. Big cakes are quicker to prepare than small ones: 9 minutes are enough for a big cake, but 27 minutes are required for a small cake.

Moreover, pupils cannot spend more than 18 hours preparing cakes.

Let us call  $x$  the number of big cakes and  $y$  the number of small cakes.

We want to find the number  $x$  of big cakes and the number  $y$  of small cakes that the class has to cook to maximize its profit.

1. Write an inequality showing that no more than 60 cakes can be cooked.

Write another inequality showing that the pupils only have 100 eggs.

Write a third one showing that the pupils cannot spend more than 18 hours cooking.

2. In a Cartesian plan with 2 cm unit, draw the graph of each function and shade the unwanted region.

The part of the graph respecting the constraints of the problem is called the feasibility region.

Each big cake gives a profit of £3 and each small cake a profit of £2.

3. Let  $b$  be the total profit. Express  $b$  in terms of  $x$  and  $y$ .
4. Find the coordinates of the corners of the feasibility region. How many cakes of each type should the class cook in order to maximize its profit?

Constraints : contraintes