

# BACCALAURÉAT - Session 2014

## Epreuve de Discipline Non Linguistique

### Mathématiques/Anglais

#### Perinatal HIV

Among children in the United States, roughly 91% of HIV infections are due to mother-to-child transmission at birth. During the 1990's mother-to-child (or *perinatal*) transmission of HIV was dramatically reduced in the United States, and part of this success has been attributed to the use of drugs such as *zidovudine*.

In sub-Saharan Africa, HIV follows a very different pattern since mother-to-child transmission (approximately 15% of new cases) is the second largest exposure category. On June 19, 2002 President Bush announced the creation of a new White House initiative to combat perinatal HIV called the "International Mother to Child HIV Prevention Initiative". This IMCHPI emphasized prenatal care and the use of drugs to eliminate mother-to-child HIV transmission. In the following example you will investigate the efficacy of drugs such as *zidovudine* in eliminating perinatal HIV infection in the United States.

*Table 1* shown below gives the number of perinatal HIV cases registered in the United States from 1985 to 1998. In this example,  $x$  will always represent the number of years since 1985 and  $y$  the number of new cases of perinatal HIV infection.

year	1985	1986	1987	1990	1993	1994	1996	1998
$x$	0	1	2	5	8	9	11	13
$y$	210	380	500	780	770	680	460	300

*Source: Centers for Disease Control and National Institute of Allergy and Infectious Diseases.*

#### Questions:

1. Plot points  $(x; y)$  in a Cartesian coordinate system in order to show the relationship between these two quantities. Based on the appearance of your graph, what sort of function (linear, quadratic, exponential...) would do the best job of representing this relationship? (You may plot the graph on your calculator).
2. On the same diagram, sketch the parabola of which an equation is :

$$y = -13x^2 + 167x + 225$$

Would you say that function  $f$  defined by  $f(x) = -13x^2 + 167x + 225$  is a good model for our problem? Justify.

3. The data given in *Table 1* shows that the number of cases of perinatal HIV infection rose to a peak and then started to fall. One interpretation of this is that as soon as the number of perinatal infections began to fall, we had started winning the battle against this form of HIV transmission. Use function  $f$  to answer the following questions.
  - a) When did we start winning this battle?
  - b) At that point, how many cases of perinatal HIV transmission occurred?
  - c) Is it possible to win the battle definitively?