

**BACCALAURÉAT GÉNÉRAL  
ÉPREUVE SPÉCIFIQUE DES SECTIONS EUROPÉENNES  
MATHÉMATIQUES – ANGLAIS**

**SUJET 16**

**NASA's disastrous year  
Functions**

Ce sujet comporte deux pages. L'usage de tout modèle de calculatrice, avec ou sans mode examen, est autorisé.

The disappearance of the Mars Polar Lander in December concluded a year of major failures for NASA. The lander vanished less than three months after NASA lost its sister spacecraft, the Mars Climate Orbiter, in highly-embarrassing circumstances. The \$125M craft, which was to study the Red Planet's climate, went missing on 23 September after a mix-up between imperial and metric measurements. It transpired that one team had been working in centimetres, metres and kilogrammes, while another was using inches, feet and pounds. The error meant that instead of the craft passing 150km above the planet's surface it flew at 60km, and probably burnt up. Mystery still surrounds the loss of the \$165m Mars Polar Lander which vanished on 3 December just hours before it was due to land.

Extract from <http://news.bbc.co.uk/2/hi/science/nature/686674.stm>

[Wednesday 22 March 2000](#)

Reminder : "\$ 35m" means "35 million dollars"

**I. Explain what the text deals with and comment on it.**

**II. Exercise.**

The aim of this exercise is to understand the consequences of NASA's mistake. We are going to study the trajectory of a ball. This trajectory depends on the original speed of the ball, which can be given in feet per second or in kilometres per hour (1 foot is 30.48 cm).

Let's consider Cartesian coordinates system  $(O, I, J)$  where we launch the ball from point  $O$  and where line  $(OI)$  represents the floor. We can consider that the trajectory of the ball

is given by the following function: 
$$f(x) = x \left( \frac{-6.94}{v^2} x + 1 \right)$$
 where  $x$  is in metres,  $f(x)$  is the altitude of the ball in metres, and  $v$  the original speed of the ball given in metres per second.

1.

- a. What type of function is  $f$ ? What is the shape of the trajectory?
- b. What equation should you solve to determine the distance between the origin and the point where the ball touches the floor?

c. Show that the solution this equation is  $\frac{v^2}{6.94}$ .

2. We consider that the original speed is 50, but we don't know if it's given in kilometres per hour or feet per second.

- a. Convert 50 km/h into m/s
- b. Convert 50 ft/s into f/s

3. Answer the question of this exercise.