BACCALAURÉAT GÉNÉRAL ET TECHNOLOGIQUE
ÉPREUVE SPÉCIFIQUE DES SECTIONS EUROPÉENNES
MATHEMATIQUES – ANGLAIS

SUJET 21

Ce sujet comporte 1 page. L'usage de la calculatrice est autorisé.

Telescopes, antennas and parabolas

The idea of using parabolic reflectors for radio antennas was taken from optics, where the power of a parabolic mirror to focus light into a beam has been known since classical antiquity. The designs of some specific types of parabolic antenna, such as the Cassegrain and Gregorian, come from similarly named analogous types of reflecting telescope, which were invented by astronomers during the 17th century.

German physicist Heinrich Hertz constructed the world's first parabolic reflector antenna in 1888. The antenna was a cylindrical parabolic reflector made of zinc sheet metal supported by a wooden frame (...). With two such antennas, one used for transmitting and the other for receiving, Hertz demonstrated the existence of radio waves which had been predicted by James Clerk Maxwell some 22 years earlier. However, the early development of radio was limited to lower frequencies at which parabolic antennas were unsuitable, and they were not widely used until after World War 2, when microwave frequencies began to be exploited.

Laurent Cassegrain (1629 – 1693) was a French priest and physicist.
James Gregory (1638 – 1675) was a Scottish mathematician and astronomer.
James Clerk Maxwell (1831 – 1879) was a Scottish scientist in the field of mathematical physics. His most notable achievement was to formulate the classical theory of electromagnetic radiation, bringing together for the first time electricity, magnetism, and light as manifestations of the same phenomenon.

Sources : Wikipedia

1) Read out loud the first paragraph.
2) Comment on the text.
3) Work out the following exercise.

Let C_f the curve which equation is $y=x^2$.
Let M be the point of C_f which abscissa is 1.

1. What is the ordinate of M?
2. The equation of Δ is one of the following :

$y = 2x-1$ $y = -2x-1$ $y = 2x+1$

Find the right answer and explain your choice.
Let F be the point which coordinates are $\left(0;\frac{1}{4}\right)$ and let H be the point of the line d : $y = -\frac{1}{4}$ which abscissa is 1.

3. Compute MH and MF.
4. Prove that M belongs to the perpendicular bisector of [FH].
5. Explain why the angles α and β on the graph are congruent.