

Extending a Problem of Apollonius

Problem 07-007, by Y. N. ALIYEV¹ (Baku State University and Qafqaz University, Baku, Azerbaijan).

How many normals can be drawn from a point A in three-dimensional space to a given ellipsoid? Alternatively, let A be a fixed point in space. How many points B exist on the given ellipsoid for which the line AB is perpendicular to the ellipsoid at B ? For which points A is this number maximal?

Comments. The corresponding question for two dimensions was formulated and solved by Apollonius of Perga in book five of *Conics*. Apollonius proved that there are 2, 3, or 4 normals from A , depending on the position of A relative to a certain astroid. For information on this problem and its solution, see [1, pp. 132–135], [2, pp. 260–261].

In the problem posed here, it is necessary to find the surfaces that separate the regions of space where there are a specified number of normals, namely from 2 through 6.

Status. This problem is open.

REFERENCES

- [1] V. M. TIKHOMIROV, *Stories about Maxima and Minima*, Translated from the Russian by Abe Shenitzer, Mathematical World, Vol. 1, American Mathematical Society and the Mathematical Association of America, Providence, RI, 1990.
- [2] B. L. VAN DER WAERDEN, *Science Awakening*, English translation by Arnold Dresden, with additions by the author, P. Noordhoff, Groningen, Holland, 1954.

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