Universitatea Babeş-Bolyai

Facultatea de Matematică-Informatică

June, 04, 2016

GEOMETRY, FIRST YEAR, ROW 2

Nume					Group/Signature				
Barem	of. (**1 p**)	1 (**1p**)	2 (**1p**)	3 (**1p**)	4 (**1p**)	5 (**1p**)	6 (**1,5p**)	7 (**1p**)	8 (**1,5p**)	Total
Punctaj obţinut										

(1) Fill in the blanks in the following definitions and statements:

(a) The .... is the locus of points of a plane whose sum of distances to two fixed points, called, ... , is constant.

(b) The surface generated by a variable line passing through a fixed point, called vertex, which intersects a given curve, called ...., is called .... surface.

(2) Determine whether the given statement is TRUE or FALSE and circle the correct alternative.

(a) The coordinate planes are planes of symmetry for $\mathcal{H}_1: \frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$. (***True/False***).

(b) xOz is a plane of symmetry for $\mathcal{P}_h: \frac{x^2}{p}-\frac{y^2}{q}=2z$, $(p,q>0)$. (***True/False***).

(c) $O(0,0,0)$ is a center of symetry for $\mathcal{P}_e: \frac{x^2}{p}+\frac{y^2}{q}=2z$, $(p,q>0)$ (***True/False***).

(d) The hyperboloid of one sheet is a bounded surface. (***True/False***).

(3) (a) Determine the coordinates of the foci of the hyperbola $\mathcal{H}: \dfrac{x^2}{9}-\dfrac{y^2}{4}-1=0$.

(b) Determine the focus and the director line of the parabola $\mathcal{P}: y^2=16x$.

(4) Consider the ellipse $\mathcal{E}: x^2+4y^2-20=0$.

(a) Find the equations of the tangent lines to the ellipse $\mathcal{E}$ having a given angular coefficient $m\in\mathbb{R}$.

(b) Find the equations of the tangent lines to $\mathcal{E}$ which are orthogonal to the line $d: 2x-2y-13=0$.

(5) State and prove the optical property of the hyperbola.

(6) Find the locus of points on the hyperbolic paraboloid $(\mathcal{P}_h)$ $y^2-z^2=2x$ through which the rectilinear generatrices are perpendicular.

(7) Define the torus and write its equation.

(8) Write the homogeneous transformation matrix of the concatenation (product) of the rotations $R_{\frac{\pi}{4}}(M_0)$ and $R_{\frac{7\pi}{4}}(M_1)$, where $M_0(1,2)$ and $M_1(2,-1)$.

(9) **(bonus 1.5p)** Write the homogeneous transformation matrices of the spatial reflections r_α, r_β and r_d with respect to the planes $\alpha: x-y+z=0$, $\beta: 2x+y-z=0$ and the line

$$d=\alpha\cap\beta: \begin{cases} x-y+z=0 \\ 2x+y-z=0 \end{cases}$$

respectively.