New Perspectives in Science Education
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NEW PERSPECTIVES in SCIENCE EDUCATION

LaTeX as an ideal tool for integrating of ICT and mathematics in science education

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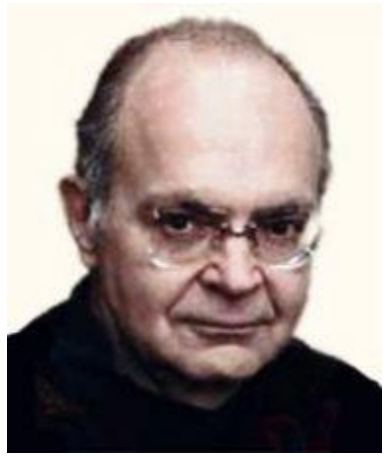
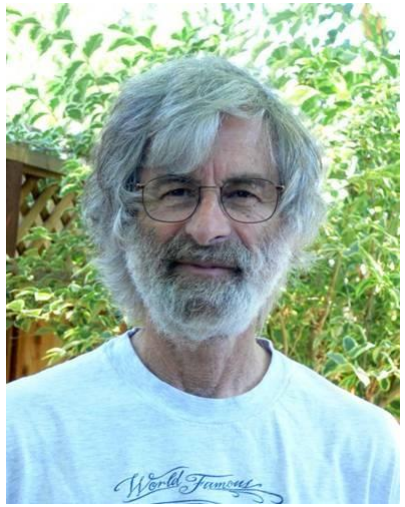
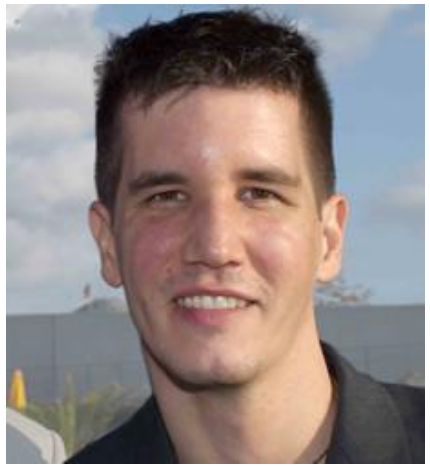




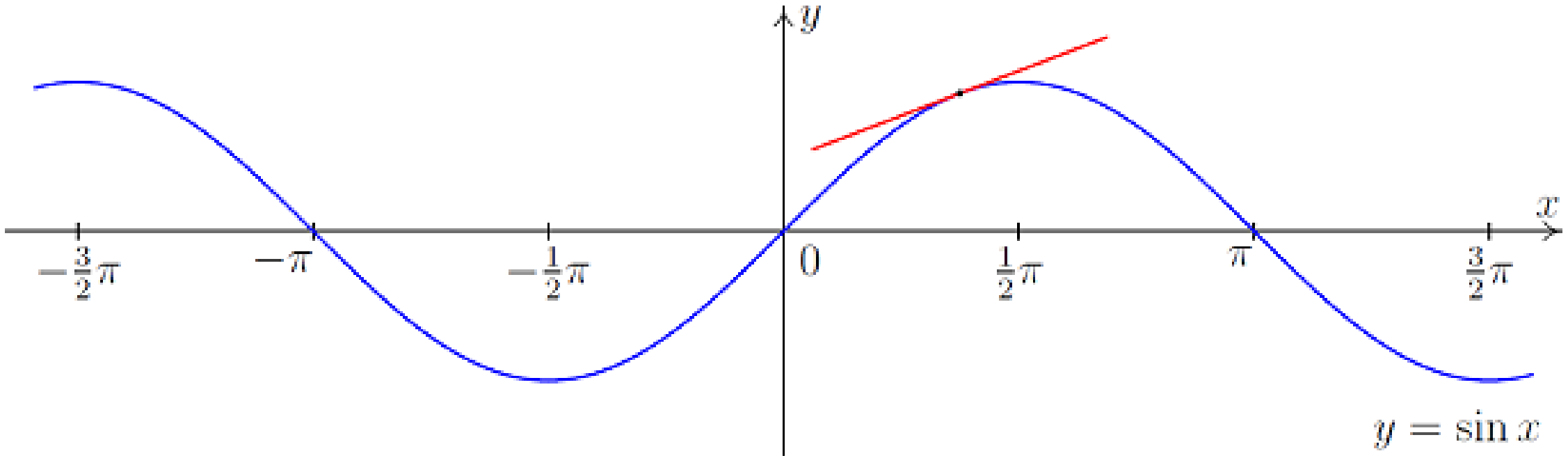
0. Our talk is about integration of ICT and mathematics in science education with the help of LaTeX. Generally speaking, LaTeX is desktop publishing system made by Donald Knut (top photo; "TeX") and Leslie Lamport (bottom photo; "La"). We show that made by these grate programmers system LaTeX is the ideal tool for the integration of ICT and mathematics in the science teaching. Well, LaTeX is best known as a system of computer typesetting and is popular among scientists because of its possibility to produce the complex scientific texts (mathematical, physical, technical, chemical and even musical) of the highest typographical quality. But the ideal means of integration of ICT and mathematics it is due to its numerous extensions appeared in the last 15–20 years.



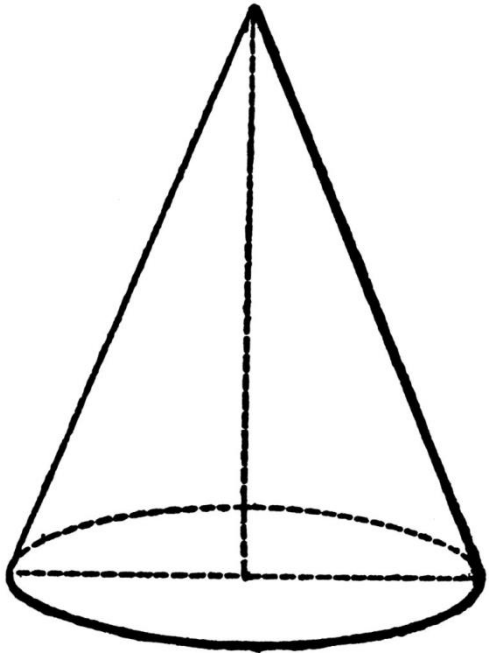
One of such extensions is a package **TikZ** *and its extension* **tkz-euclid**. *Features of these packages are described in detail by their authors Till Tantau (top photo) and Allan Mattes (bottom photo). From these descriptions (see references) we know that the packages allow to produce and describe plane geometric drawings in the TeX notation in much the same way as in the ordinary course of geometry:* **tkzDrawPoint** *(take a point),* **tkzLabelPoint** *(denote it),* **tkzDrawLine** *(draw the line), and so on.*

Recently, we found that the package **tkz-euclid** *permits comfortably and quite naturally produce not only plane geometric but also space geometric drawings of the school type. To these findings is devoted our paper.*

1. Now we demonstrate the interaction of ICT and mathematics with the help of the example from the beginning calculus. Suppose we want to prepare a dynamical model of the tangent line sliding on the waves of the sinusoid. What must we know to do it? We need to know the equation of the tangent line to the graph of a differentiable function at the arbitrary point, the derivation of the sine function and something from LaTeX, namely, that in LaTeX there exist the drawing tool **mfpic** and the package **multido,** which permits to repeat easily calculations by one and the same formula in many points. Doing so, we obtain a dynamical model one of slides slides from which is shown on the next slide of this presentation.

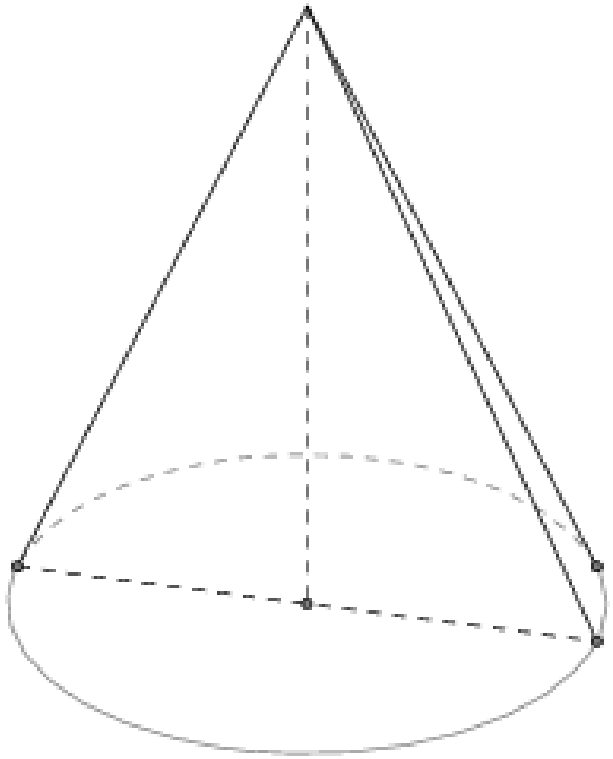

y
x
$-\frac{3}{2}\pi$
$-\pi$
$-\frac{1}{2}\pi$
0
$\frac{1}{2}\pi$
π
$\frac{3}{2}\pi$
$y = \sin x$

2. Now we turn to drawings in the stereometry. First of all, we look at drawing a cone. In the literature and the Internet one can find a lot of incorrect drawings of cones similar to the following:

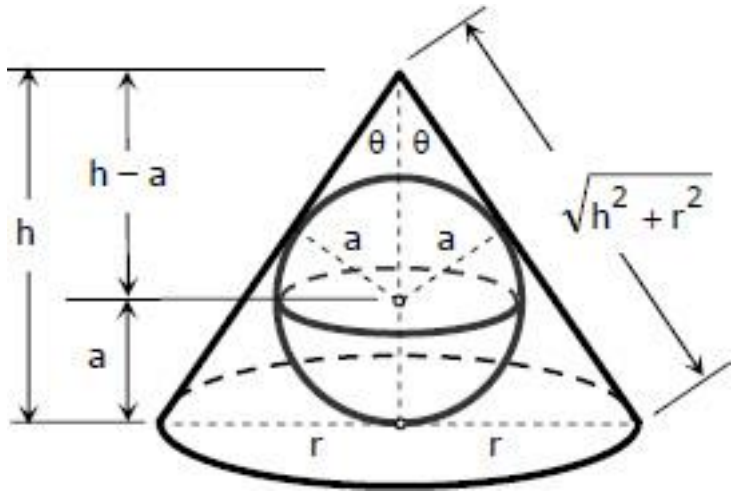


What is incorrect in this picture? The base of a cone must be represented by an ellipse. Contour generators of the conic surface must be tangential to this ellipse. But the tangent lines to the ellipse in the ends of any diameter are parallel. So, contour generators of the conic surface (which both go through the point representing the vertex of the cone) cannot go through the ends of a diameter.

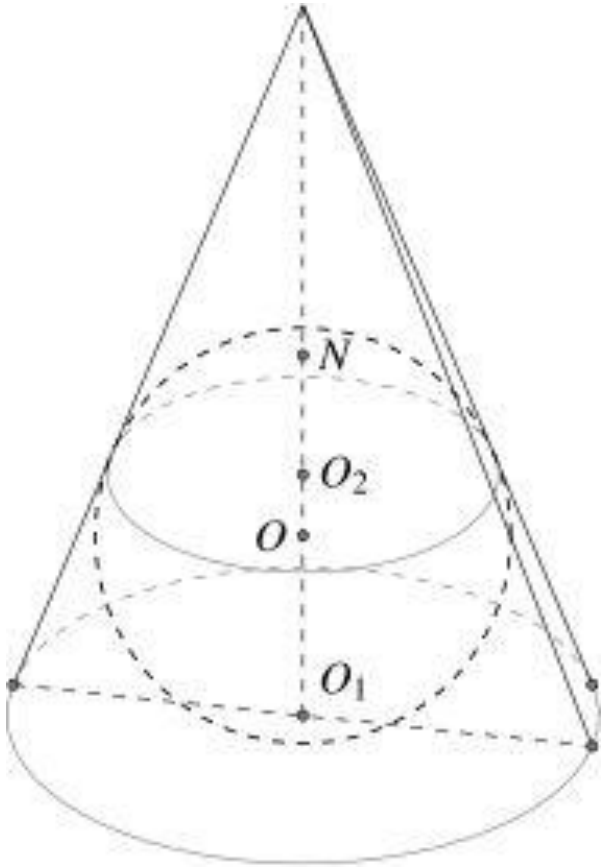
Now we must draw a correct picture of a cone. In order to do this, remember that ellipse is compressed or stretched circle. Let us choose compression. Draw a circle, select a point for the vertex of a cone, draw two tangents to the circle through this point and compress this picture along the height. We obtain a correct picture of a cone! To do this we use the package **tkz-euclide** [3].



3. Now we turn to the drawing of the sphere inscribed in a cone. Again, in the literature and the Internet one can find a lot of incorrect drawings of cones similar to the following:



Here is correct drawing, obtained with the help of LaTeX:



References

[1] http://www.ctan.org/pkg/ CTAN (Comprehensive TeX Archive Network)

[2] Tantau, T. “TikZ & PGF: Manual”, http://sourceforge.net/projects/pgf, 2011.

[3] Matthes, A. “tkz-euclide 1-16c”, http://altermundus.com, 2013.

[4] http://www.mathalino.com/sites/default/files/users/Mathalino/differential-calculus/065-sphere-inscribed-in-cone.jpg.