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Computer Assisted Education

Plane Analytic Geometry EduVirtualLabs

Curvilinear and Panageos

The Plane Analytic Geometry is a mathematical tool indispensable to students of Mathematics, Physics, Chemistry, Engineering and Economics.

Curvilinear and Panageos are two softwares designed to learn, teach, enjoy and master the subject of Plane Analytic Geometry, both are very easy to use, there is no need of manuals and a great deal of information on what the user is dealing with can be obtained by just mouse-clicking an icon. Both softwares have the same appearance. Curvilinear is addressed to the user who is learning, Panageos is oriented to the intensive solution of problems.

In this document a description of both softwares is presented.

Curvilinear: Easy Learning Plane Analytic Geometry

Curvilinear is a visual interactive software, it is intuitively easy to use, and it is oriented to overcome the abstraction that exists in the Plane Analytic Geometry (PAG), this is a tool that makes it easy to learn and master the PAG, the user is allowed to literally "see" the mathematics while carrying out operations and problems by hundreds in a very short time with the help of the mouse.

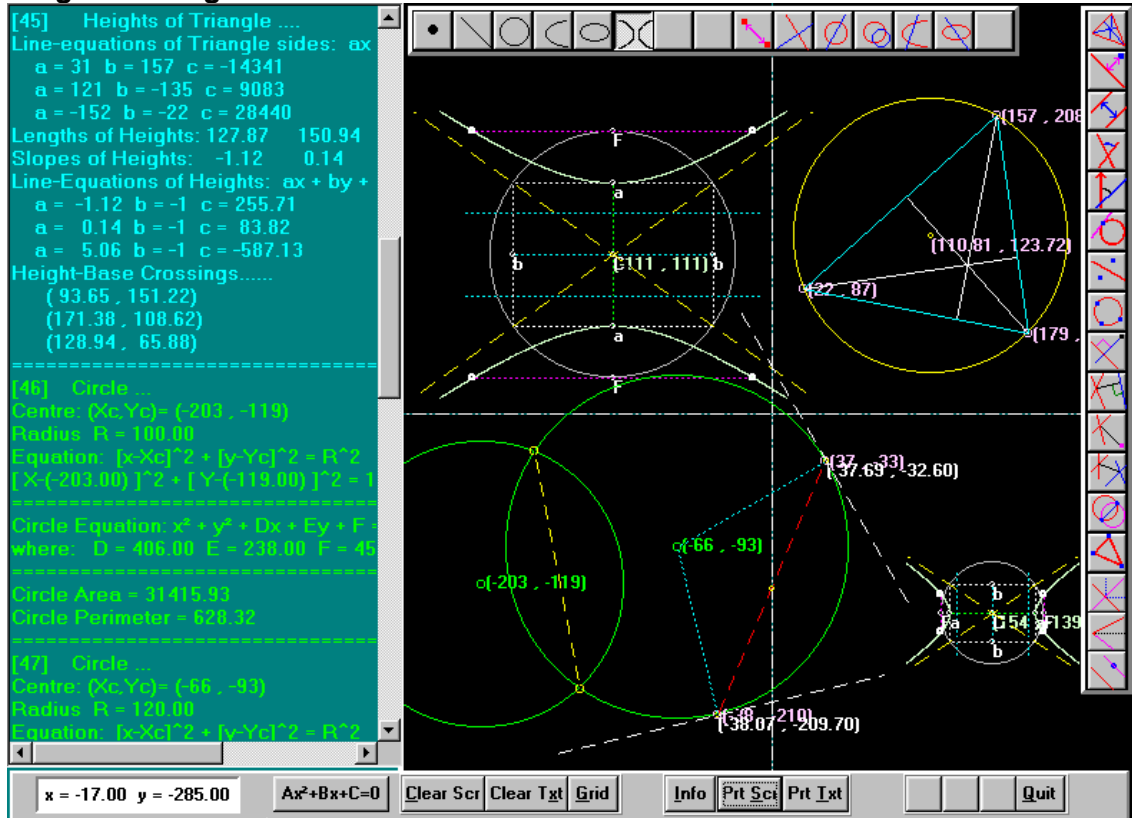
One thing is to study and try to solve problems on Plane Analytic Geometry with a book (and if you can afford it, with a private teacher), definitively the number of solved problems is limited and the grasping of the subject is not always total. Using Curvilinear as a tool to learn PAG while solving problems is not only effective, it is also amusing and rewarding, Curvilinear is a tool with

which hundreds of problems can be solved very quickly once and again, until the subject is understood. Hundreds of variations of a given problem can be made with very few mouse clickings.

Curvilinear processes the (x,y) coordinates entered by the user by either of two methods: mouse or keyboard. In order to choose the data-input mode it is enough to click the button Mouse/Keyboard.

When entering data under the Keyboard option, the selection of objects (point, line, circle, etc) is made with a mouse click on the object icon, then a small window shows up where the user enters the (x,y) coordinates via keyboard. This data input mode is

Image of Panageos :



Panageos: Plane Analytic Geometry Problem Solver

Unlike Curvilinear this is a software not recommended for beginners because it is oriented neither to learning nor to have fun while solving PAG problems, but to the intensive solution of problems.

Panageos solves basically the same problems Curvilinear does, the main feature of Panageos being its power to read the user's equations and interpret them, for this reason the data input is exclusively through the keyboard (The coefficients of several types of equations are entered via keyboard).

In order to solve problems with Panageos, both the mouse and keyboard are used, clicking the icon of an object (point, line, circle, etc) opens a small menu with several options for user's data entry for each object. Both, coordinates and coefficients of equations can be input.

Panageos reads and interprets several types of equations for the straight line, the circle, the parabola, the ellipse, and the Hyperbola.

Some examples of the problems that can be solved with Panageos:

- 1) Determine the crossing of the straight lines L_1 y L_2 which equations are:
 $L_1: y = x / 2 + 25$ $L_2: 4x + 3y + 17 = 0$
- 2) Determine if the following equation corresponds to a circle, if so, find its area, perimeter and center: $x^2 + y^2 + 122x + 7y - 27 = 0$
- 3) Find the crossings of the circle of equation $x^2 + y^2 + 100x + 77y - 33 = 0$, with the straight line which equation is $-x / 100 + y / 120 = 1$
- 4) Construct the equations of the asymptotes of the hyperbola which equation is: $9x^2 - 16y^2 - 18x - 64y - 199 = 0$.

As it can be seen, from the point of view of the teacher, Panageos is an ideal software to quickly propose problems for homeworks and tests. From the point of view of the student, Panageos is a powerful tool to solve problems. This software may also be used to verify the hand-made solution of problems.

Panageos includes a solver for the quadratic equation $Ax^2 + Bx + C = 0$

Curvilinear and Panageos were developed by
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 under the sponsorship of Virtual Dynamics / Virtual Labs: Science and Engineering,
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Table of icons in Curvilinear and in Panageos

The following table shows the icons that when clicked by the user, select the objects to work with. The produced reports are mentioned.

The mouse is dragged on screen only while on Mouse input-mode, the Keyboard input-mode does not allow any mouse dragging on screen.



















	Places a point on coordinates (x,y). Coordinates (x,y) are any point on screen or a pair entered (via keyboard) by the user.
	Places a straight line between points (x1,y1) and (x2,y2). As the mouse is dragged on screen, the numerical values of its slope and inclination are shown. Reports: Line slope and line angle of inclination (respect to x-axis), three equations of the line ($ax+by+c=0$ and $X/X_o + Y/Y_o = 1$ and $Y = mX + b$), Intersections of line with the X and Y coordinated axes.
	Places a Circumference centered in (x1,y1), and which radius goes up to (x2,y2). As the mouse is dragged on screen, the numerical value of the radius length is shown Reports: The coordinates of the point diametrically opposing (x2,y2), the centre of the circumference (x1,y1), its radius, area, perimeter, circle equations $(x-h)^2 + (y-k)^2 = R^2$ and $x^2 + y^2 + Dx + Ey + F = 0$.
	Places an Ellipse (Horizontal or vertical) centered in (x1,y1), the numerical values of its axes (major and minor) are shown as the mouse is dragged. The axes are defined by the differences between (x2,y2) y (x1,y1). Reports: coordinates of centre, Focus and vertices, Lengths of axes and of Latus rectum, Eccentricity, Center-Focus distance, Linear equations of Directrices, two Ellipse equations: $(x-h)^2 / a^2 + (y-k)^2 / b^2 = 1$ and $Ax^2 + By^2 + Dx + Ey + F = 0$
	Places a Parabola (Horizontal or Vertical), which vertex is on (x1,y1) and which Focus is on (x2,y2). Reports: The axis, the Latus Rectum and the Directrix, their linear equations and slopes, the coordinates of the intersections of the Latus rectum with the parabola, Distances Focus-Vertex and Focus-Directrix, two Parabola equations: $(y-k)^2 = 2p(x-h)$ and $x = Ay^2 + By + C$.
	Places a Horizontal (Vertical) Hyperbola centered on (x1,y1). The lengths of the focal and the conjugate axes are shown as the mouse is dragged on screen, these lengths are defined by the differences between initial (x1,y1) and final (x2,y2) clicks. Reports: The coordinates of Vertices and Foci, Distances Centre-Vertex and Centre-Focus, Semi focal and semi conjugate axes, linear equations of directrices, Asymptotes, Latus Rectum, Eccentricity, Intersections Hyperbola-Latus Rectum. Two Hyperbola equations $(x-h)^2 / a^2 - (y-k)^2 / b^2 = 1$ and $Ax^2 - By^2 + Dx + Ey + F = 0$.






Notice: Before carrying out a computation that involves one or more objects it is necessary to place the object(s) on screen.

Example: Given three points (Triangle vertices), determine the numerical values of the inner angles and the lengths of the triangle sides.

In this case the coordinates of three points must be entered (either by directly mouse clicking on screen or through the keyboard), next, the icon showing three points as a triangle vertices must be clicked. Immediately a triangle will be visualized on screen and on the reports (screen left side) column the numerical values will be displayed.

Operations and corresponding icons in Curvilinear and in Panageos

	Finds the midpoint (x,y) between two given points, the distance between them, reports the linear equation $ax + by + c = 0$ of the straight line between the two points and its slope.
	Finds the coordinates of the point (x1,y1) of interception of two given lines.
	Determines the intercepting points of a line with a circumference.
	Finds the intercepting points (x1,y1) y (x2,y2) of two circumferences.
	Finds the intercepting points (x1,y1) and (x2,y2) of a parabola with a straight line.
	Finds the intercepting points (x1,y1) and (x2,y2) of a ellipse with a line.
	Given three points (triangle vertices), finds the three heights of the triangle, their respective linear equations and slopes. Determines the intercepting points of the triangle heights with the triangle bases. Reports the linear equations of the three triangle sides.
	Given a line and a point, finds the point-to-line distance.
	Given two lines, determines the line-to-line distance. If the lines meet somewhere (maybe out of screen), the line-to-line distance is null.
	Given two lines, finds the angle (degrees) between them.
	Given a line, finds its angle (degrees) with the vertical Y-axis.
	Given a circumference centered on C(x0,y0) and a point P(x,y) on the circumference, finds the line tangent to the circumference through P, its linear equation and slope. When P is not on the circumference but just close to it, the tangent to the circumference crossing the line from C to P is reported.
	Given two points, the set of equidistant points is detected, this corresponds to a straight line, its linear equation and slope are reported.
	Given three points, the circumference through them is detected, the Circle/Circumference center, area, perimeter, radius are reported. Also the coefficients D, E and F of the equation $x^2 + y^2 + Dx + Ey + F = 0$ are reported.
	Given a point and a line, the perpendicular to the line through the point is detected. The equation $Ax + By + C = 0$ and its slope are reported. Also the intercepting point (x,y) is reported.
	After having found the intercept (xo,yo) of two lines, the perpendicular to a third line through (xo,yo) is detected.. The equation $Ax + By + C = 0$ of the perpendicular and its slope and the intercepting point (x,y) are reported.
	After having found the intercept (xo,yo) of two lines, the line through (xo,yo) and a given point is detected. The equation $Ax + By + C = 0$ of the line and its slope and the distance from crossing to point are reported.
	After having detected the intercepts (x1,y1) and (x2,y2) of two pairs of lines, the line passing through both intercepting points is detected. The linear equation $Ax + By + C = 0$ of the line between the two crossings and its slope and distance between crossings are reported.

	Given two Circles/Circumferences, the line through the intercepting points is found. Reports: the coordinates of the crossing points, the linear equation of the line through the points, its slope and inclination angle.
	Given three points (triangle vertices). The area, perimeter and baricenter of the triangle is determined, also the value of the inner angles is detected, as well as the length of the triangle sides. A message stating whether isosceles or rectangle triangle shows up.
	Having detected the intercepting point of two lines, the linear equations of the bisectrices of the formed angles as well as the bisectrices slopes are found.
	Given two lines and a common point, the linear equation of the bisectriz is reported.
	Given a line and an exterior point (x_0, y_0) , the line parallel to the given line through the given point is detected, also its slope is reported.