

Introduction to GeoCAD

GeoCAD(Geometry CAD) is the equivalent of the famous AutoCAD program for math teacher to draw geometry diagrams and Mechanical engineers doing their 2D precision drawings. GeoCAD have all the 2D functionalities of AutoCAD. But with a simpler interface, faster drawing and many features that AutoCAD does not have. Learning drawing with GeoCAD will be at least 20 times faster than learning all the complexities of AutoCAD.

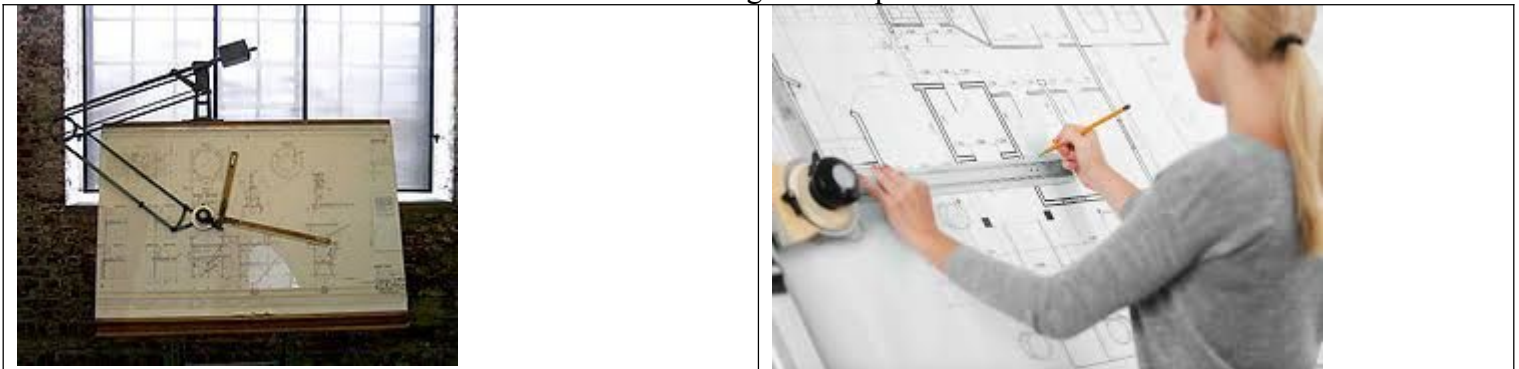
Before use of computer become popular around 30 years engineers used drafting boards similar in these 3 pictures for their drawing. Technical drawing is used in variety of fields like drawing critical parts of an aircraft engine , architectural drawings for buildings and offices, civil engineering drawings for roads and infrastructure or even electronic engineers to draw a complex electronic or electrical circuits. But for mechanical engineering unlike other fields precision drawing is very important and critical. Because their drawing will be later used for making models that later will be mass manufactured . In precision drawing very important for the angles and lengths of the object to be as precise as possible.

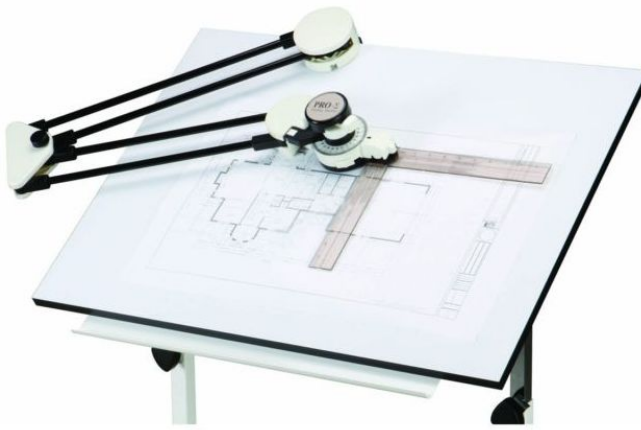
Although **GeoCAD** can be used as a general purpose for engineers of various fields, it is specially customized for high school mathematics teachers . For example teaching Geometry and drawing geometry diagrams for homeworks and exams . For teaching an effective lesson very important the objects the lengths and angles of lines and arcs to be precise and not an approximate drawing. GeoCAD is short for Geometry CAD , CAD is abbreviation for Computer Aided Drafting that became popular 50 years ago. AutoCAD is the most famous CAD program in world.

GeoCAD has been written by a teacher for teachers. Therefore It has some very special tools that makes the math teacher job very easy by using a very simple and intuitive menu system. For a math teacher and students very important to enter the diagrams into a PPT and MS WORD for further documentation. GeoCAD diagrams can be easily exported to these 2 popular program by a simple Ctrl+V.

GeoCAD is a vector graphics program not a bitmap graphics program like MSPaint, Photoshop.. etc . Therefore very limited color management is implemented in it. However the output can be easily exported to popular Bitmap formats like BMP, and JPG and Raster-Vector graphics format like EMF and PDF . With this software teacher can now easily incorporate vector graphics diagrams that will be printed with high quality without any loss.

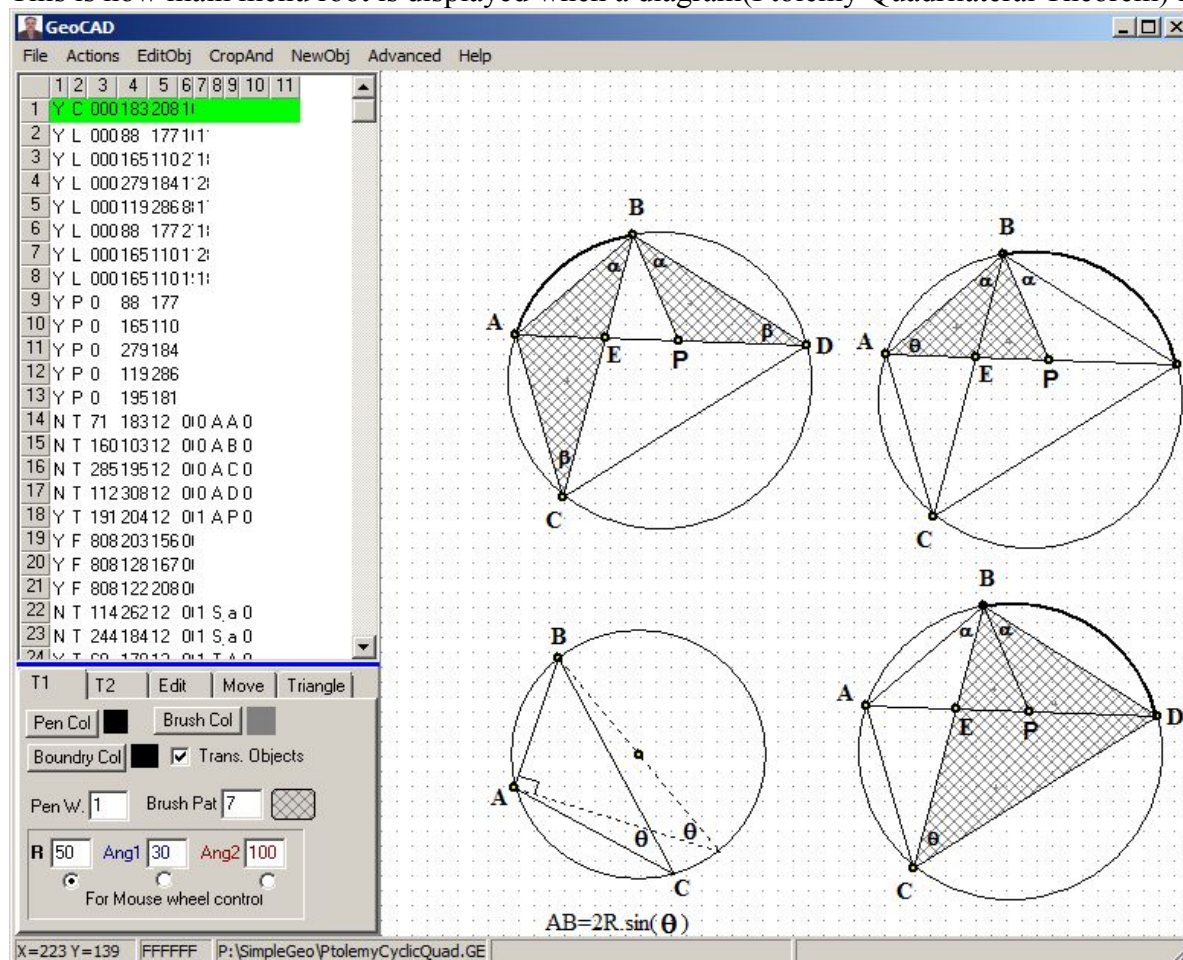
To better understand GeoCAD which is a virtual drafting table implementation lets look at 3 of them here.



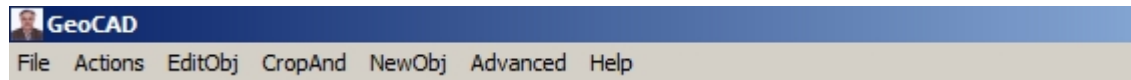


In a drafting table we see a flexible Ruler or Right Angle, Compass and Protractor and an **eraser**. The ruler is used to draw any arbitrary line to any desirable length and it can connect 2 points to draw a new line. Ruler can be used for measuring the length also. Right Angle can be used to draw perpendicular lines and also as ruler. Compass is used to draw circles with specific radius. In geometry **arcs** are used frequently for constructions. Compass is can also be used to draw an arc instead of a full circle. Protractors are used to measure angles or draw a new angle with specific value. Finally a very important object not shown here is a pencil eraser. A pencil eraser is as important device for drafting as is a break for a car. An erase allows mistakes to be cleared and part of drawing to be erase to achieve the optimal drawing.

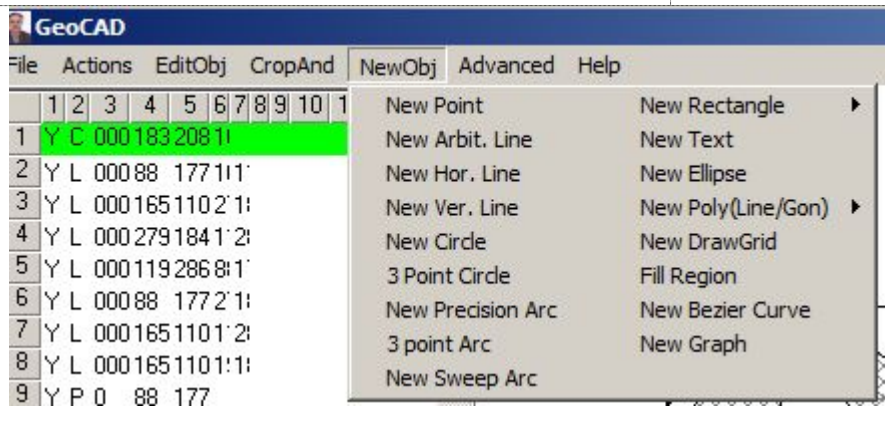
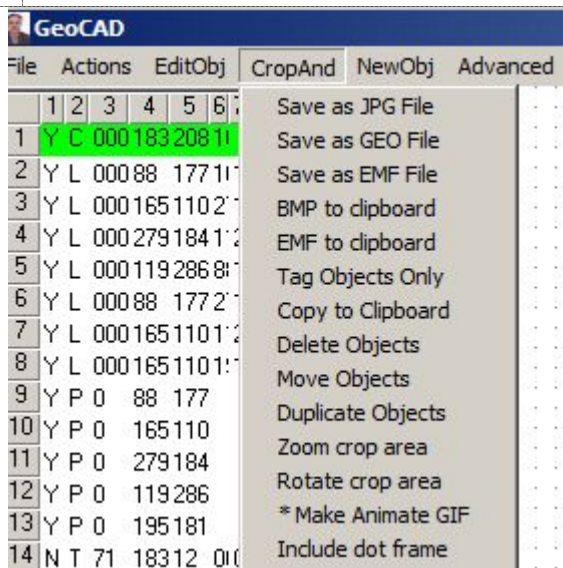
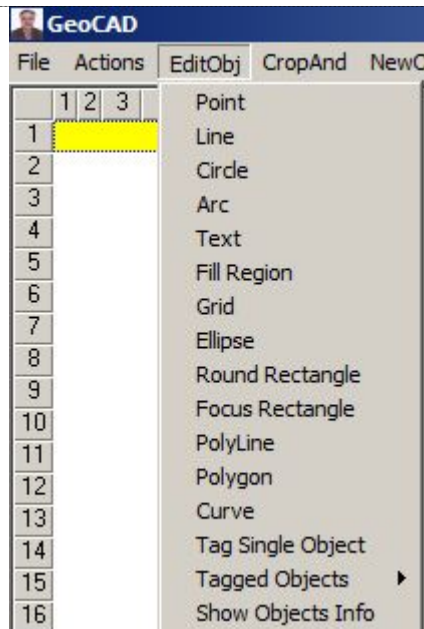
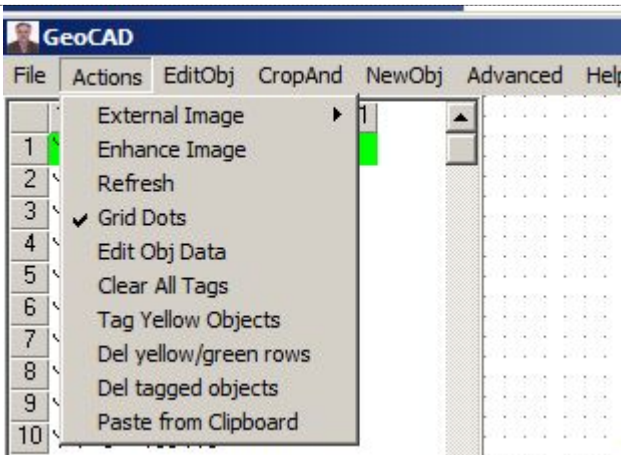
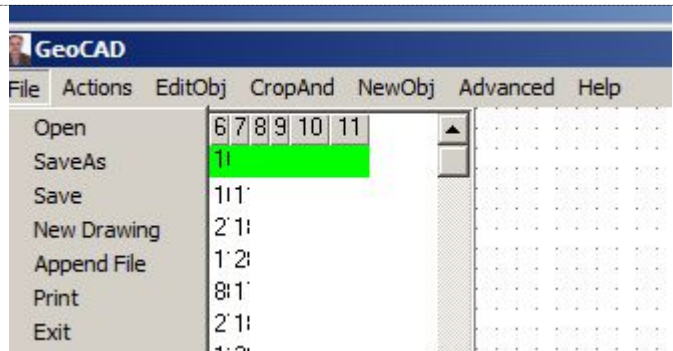
Using GeoCAD is like using a drafting table that those mechanical devices have been implemented in virtual manner. To learn **GeoCAD** all you have to learn is its simple menu layout. This is how main menu root is displayed when a diagram(Ptolemy Quadrilateral Theorem) is displayed

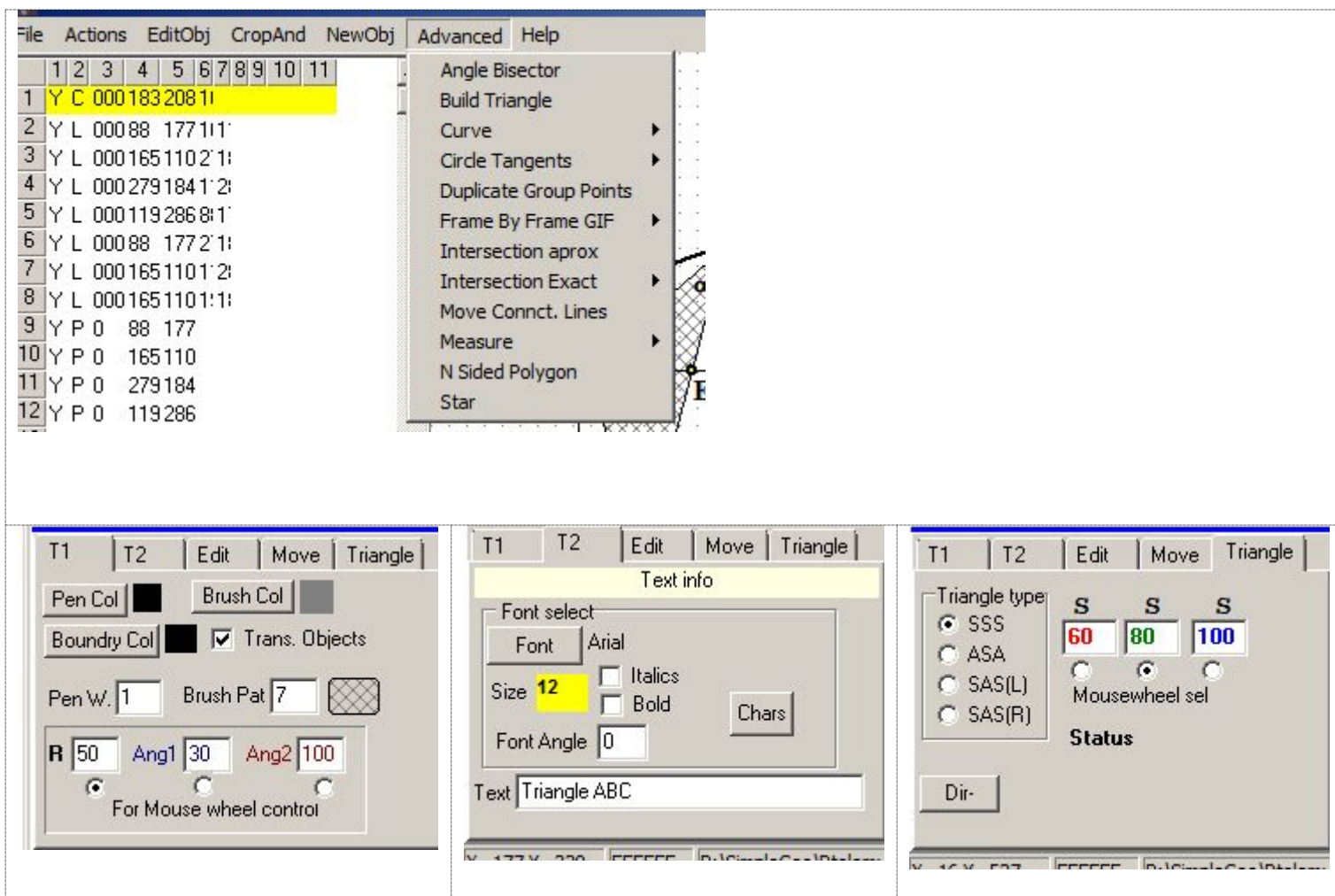


The screen is divided into **5 parts**. The top part main menu is displayed. On the right hand side 4 diagrams shown. On the top left the list of current objects displayed. On Left bottom 5 TABS displayed which allows further customization to the objects are displayed. On the bottom the status bar contains various information about the objects.

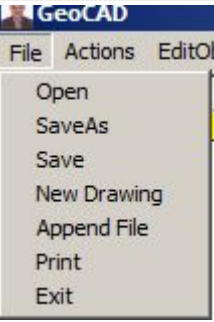
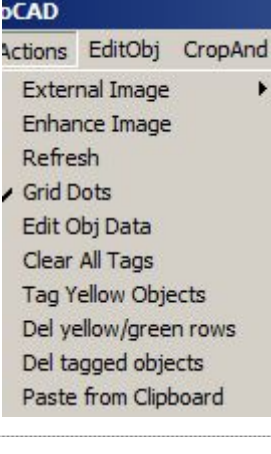


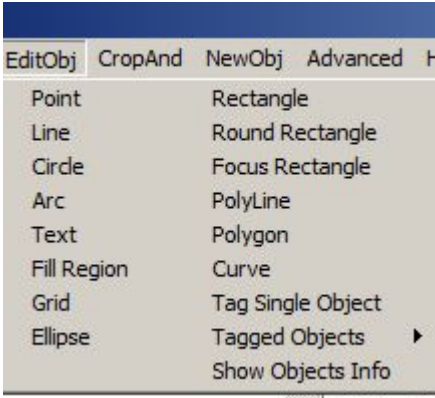
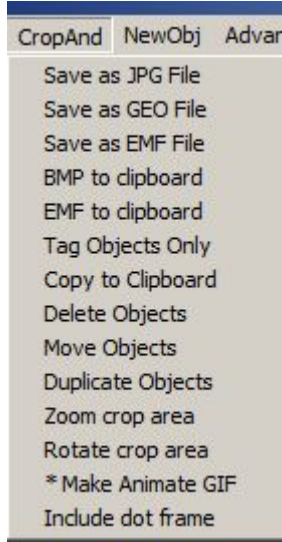
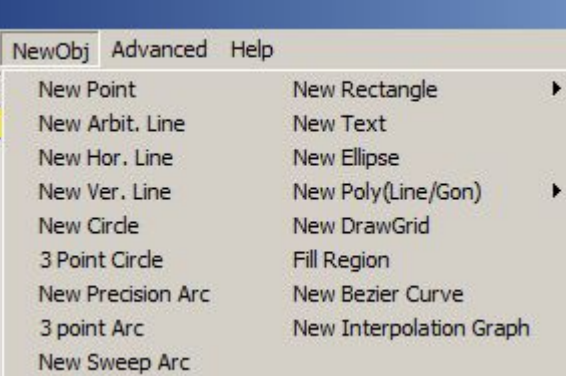
Now the above main menu is displayed in more details as you see in bellow. By careful reading these 76 menu items is all you need to know to run the software. No hidden action in software except for 2 hot keys F4 and F10 keys.





Now lets discuss details of each menu function

<p>File</p>		<p>Open- Will open an existing GeoCAD file with file extension GEO. SaveAs- Save - Similar to other software actions. New Drawing - Screened will be cleared for new drawing. Append File - Allows different drawings to be incorporated into an existing drawing. Therefore instead of 1 file for each geometric diagram you can have as many as you want. Print will send the entire diagram to the local printer</p>
<p>Actions</p>		<p>External Men- External images from file or clipboard can be inserted into the drawing canvas. This way external objects like a bicycle image can be faster drawn Enhance Image-Make image sharper before saving it as JPG and BMP Refresh - For debugging not used Grid Dots - They can be removed if desired Edit Obj Data - For debugging not used. Clear All Tags - For debugging not used Tag Yellow Objects - For debugging not used Del yellow/green rows - For debugging not used Del tagged Objects -For debugging not used Paste from Clipboard - For debugging not used</p>

<p>Edit Obj</p>		<p>GeoCAD have 14 basic construction objects that can be used to draw a more complex object. All these objects can be individually edited or deleted. For each object there is a special edit menu that will popup when you click on the desired object. To edit an Line object you click on Line then move the mouse very close to desired like until it become red. Then left click to see the debug menu. Later each object debug menu is described. The last 3 menu items are for debugging and not used</p>
<p>CropAnd</p>		<p>Object Cropping is the most important and powerful feature of GeoCAD. In 1 diagram you may have many different parts . You can easily select the desired diagram by a simple crop rectangle using 2 mouse click. In GeoCAD no need to hold the mouse key down. 1st click for top left and 2nd click for bottom right. A rectangular cropped region its objects are identified. BMP to Clipboard and EMF to Clipboard allows you to enter the cropped objects directly into MS WORD and PowerPoint by a simple paste(CtrlV) action. BMP may give nicer screen diagram but EMF objects when printed have much higher quality.</p> <p>Cropped objects can become individual frames of a GIF animation file. GeoCAD can be used to create powerful GIF animations with full control over each frame and their delay time. For example a teacher can demonstrate the steps required to draw an inscribed Pentagon inside a circle by simple GIF animation. The GIF frames can be exported as file and therefore a PPT of same construction can be made in minimum amount of time.</p>
<p>NewObj</p>		<p>The basic 14 objects that GeoCAD support are displayed in this menu . However for drawing a circle 2 methods can be used. For drawing an arc 3 different methods can be used to achieve the best result. Later you will see picture of each object.</p>

Advanced	<div> <div>Advanced Help</div> <div> Angle Bisector Build Triangle Curve ▶ Circle Tangents ▶ Duplicate Group Points Frame By Frame GIF ▶ Intersection aprox Intersection Exact ▶ Move Connect. Lines Measure ▶ N Sided Polygon Star </div> </div>	GeoCAD allows some very complex drawings to be drawn in minimum amount of time. Currently Angle Bisector and ASA, SAS, SSS triangles can be constructed with minimum effort. An important feature of this menu item is Measure menu with its 4 submenus for measuring length a line, angle between 2 lines, calculate pixel area of any closed region and calculate exact value of any triangle

Editing various objects . Each object has its own special edit menu. Line is the most important component and has the largest number of actions that can be done on it.

Editing menus for various objects

Line	<div> <div> Adjust Length Append Angle Arbitrary Parallel Line Build Parallelogram by side Build Parallelogram by diag Build Square by Diag Build Square Given 1 Side Construct Arc Construct Circle Construct Semicircle Delete line Duplicate Line(parallel) Divide into N segs </div> <div> Gap in Middle Hide Line Measure Length & Angle Mark point on line Mirror point to line Mark mid point Modify Pen Move Line Move conn endpoint Parallel Line Perpendicular to line Perpendicular Bisector Tag Line </div> </div>	<p>1)Adjust length- Allows the length of line to be increased or decreased(similar to eraser)</p> <p>2)Append Angle- From any point on this line you can draw a precise adjacent angle.</p> <p>3)Arbitrary Parallel Line- A parallel line that its end points and distance can be varied</p> <p>4)Build Parallelogram by side - The line will be converted to parallelogram as its side</p> <p>5)Build Parallelogram by diag. - Like No 4 a parallelogram will be constructed using that line as its diagonal</p> <p>6)Build Square By Diag- Like No 5 a square can be constructed fast and accurate.</p> <p>7)Construct Arc - Not implemented yet</p> <p>8)Construct Circle - A circle that its diameter will be the edited line.</p> <p>9)Construct SemiCircle- Similar to No 8 a semicircle will be drawn. Very important in geometry problems.</p> <p>10>Delete Line- The line will be permanently removed from database.</p> <p>11)A parallel line with same exact length will be drawn.</p> <p>12)Divide into N segs(segments) . The line will be marked with equal spaced points, very useful for mechanical objects.</p> <p>13)Gap in Middle . The middle part of line is erased useful for writing dimensions</p> <p>14)Hide Line - This is very similar to delete line but the object is till in database and it can be quickly become visible.</p> <p>15)Measure Length and Angle- The precise length of line in pixels and its horizontal angle is displayed.</p> <p>16)Mark Point on line - you can easily mark a point on any line with accurate distance from its end points.</p> <p>17)Mirror point to line - Any arbitrary point can be easily mirrored.</p> <p>18)Mark Mid Point - The middle point of line is marked. Useful for drawing angle bisectors.</p> <p>19)Modify Pen - The the thickness of line and its color can be modified.</p> <p>20)Move Line - The line can be moved in parallel direction to any desired location on diagram</p> <p>21)Parallel Line - Same as No3 with 1 click</p> <p>22)Perpendicular to Line - Useful when you want to draw perpendicular lines like altitudes of triangles.</p> <p>23)Perpendicular Bisector - same as No 22 but the perpendicular line will be drawn at mid point of line</p> <p>24)Tag Line- For debugging only(dont use)</p>
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Here is the complete list of editing menus for other objects

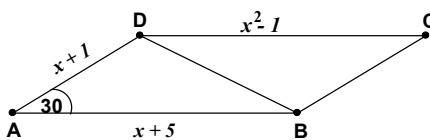
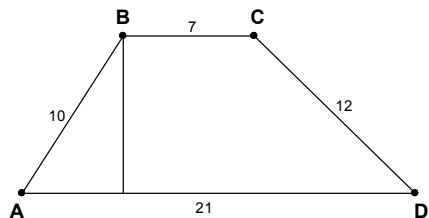
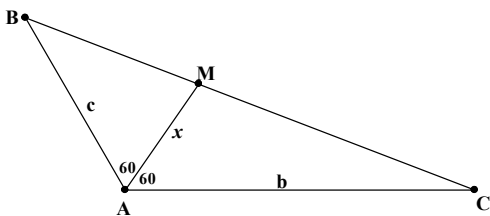
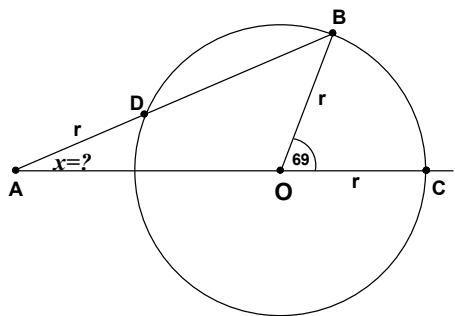
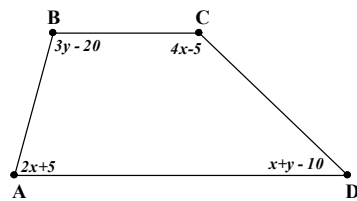
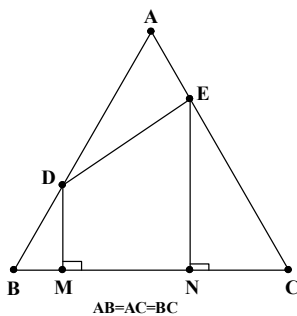
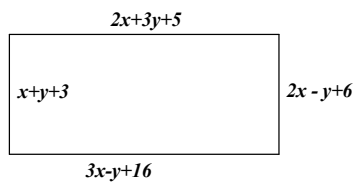
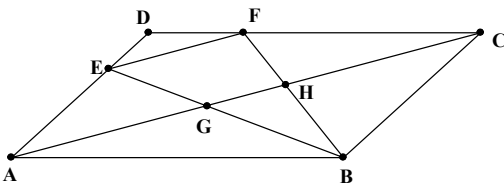
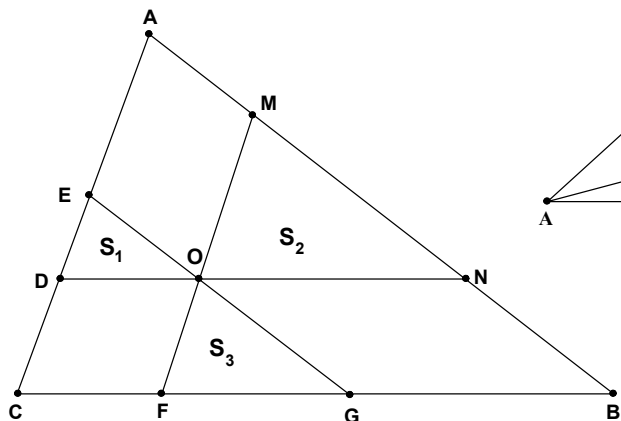
Point Delete Point Yellow Center Solid Back 3 Solid Black 2	Circle Show circle info(R, C) Modify circle Pen Circle ---> Arc Delete Circle Duplicate circle Mark N equal points Hide circle Move Circle Mark Circle Center Mark degree on Circle Perpendicular to Circle Tangent to Circle Tao Circle	ARC Show Arc Info Modify Pen Delete Arc Hide Arc Move Arc Dup Arc Arc ----> Circle Modify R, Ang1, Ang2 Complement Arc Mirror Arc Mark Arc Midpoint Mark Arc Center Perpendicular to Arc Tag Arc	Text Delete Text Hide Text Modify Text Modify Text Attribs Move Text Duplicate Text Msg	Round Rectangle Focus Rectangle PolyLine Polygon Ellipse
Fill Region Delete Fill Modify Style			Grid Modify Pen Delete Grid Hide Grid Move Grid Dup Grid ID grid cross points	Modify Pen Delete Object Hide Object Move Object Dup Object

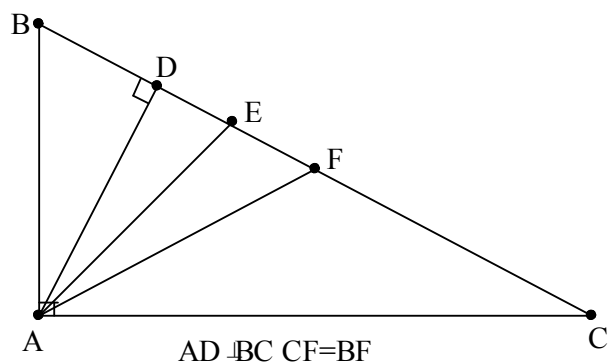
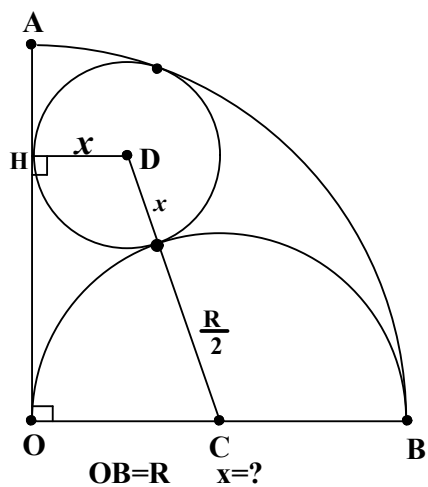
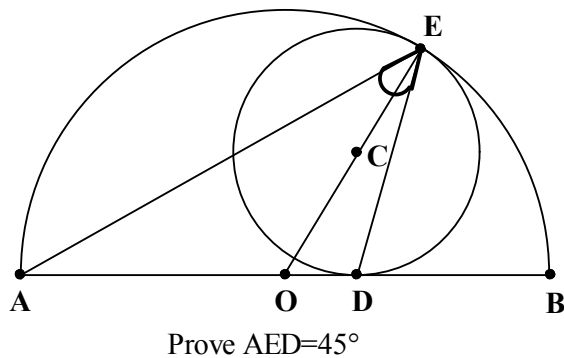
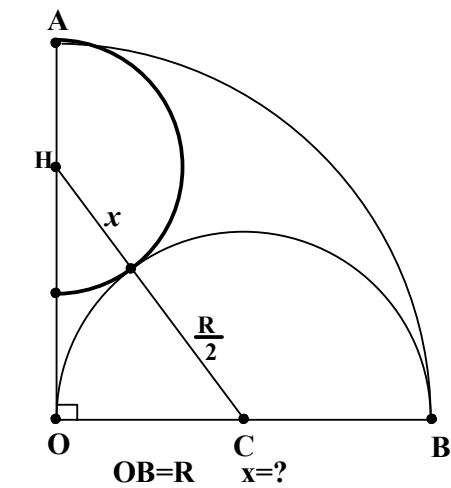
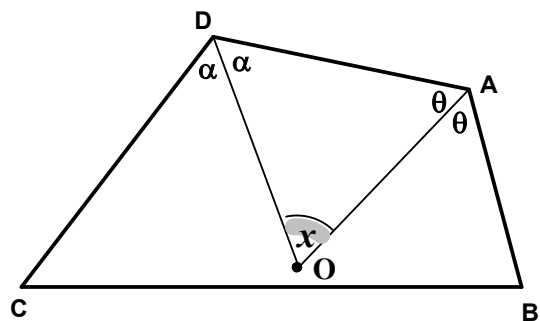
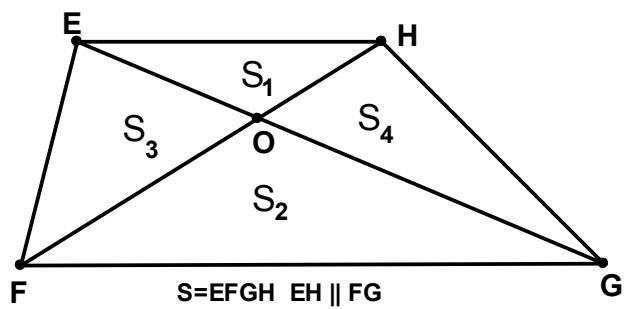
Keyboard shorts cuts .

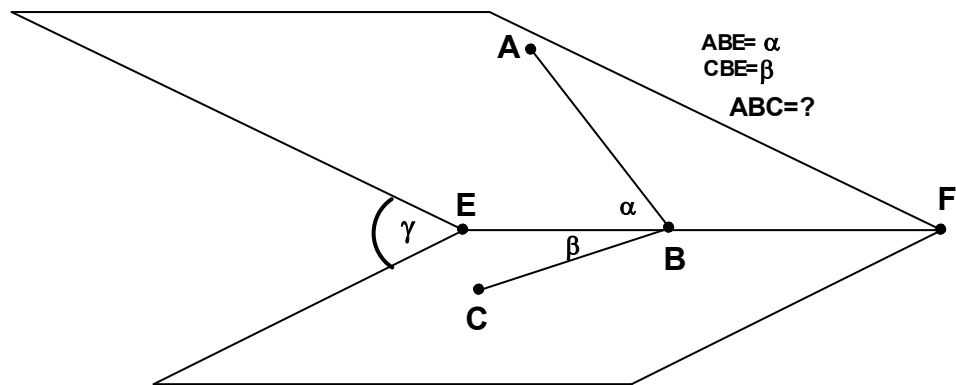
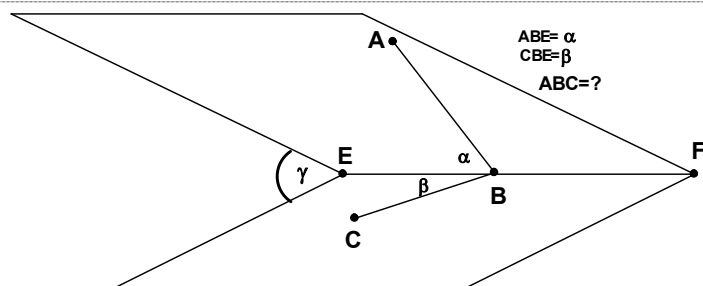
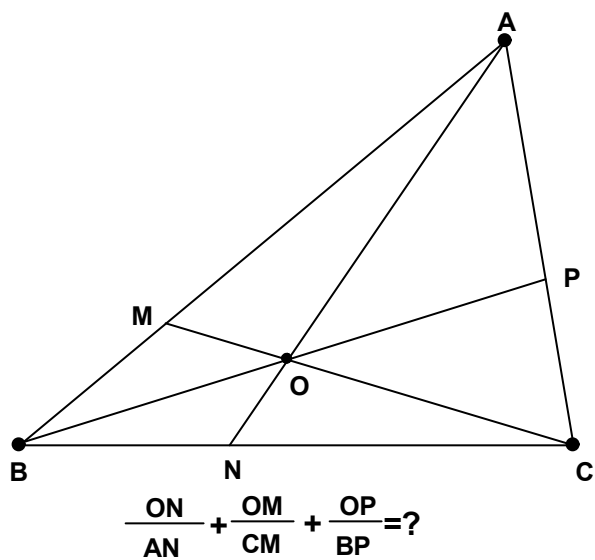
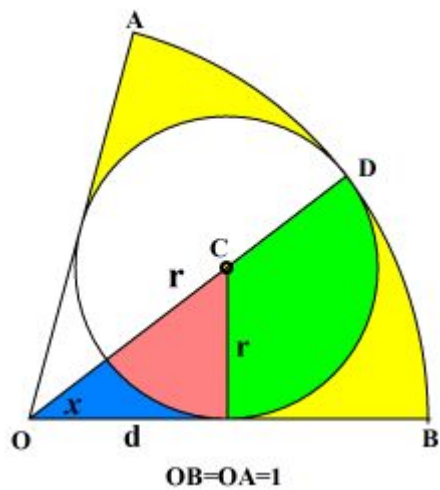
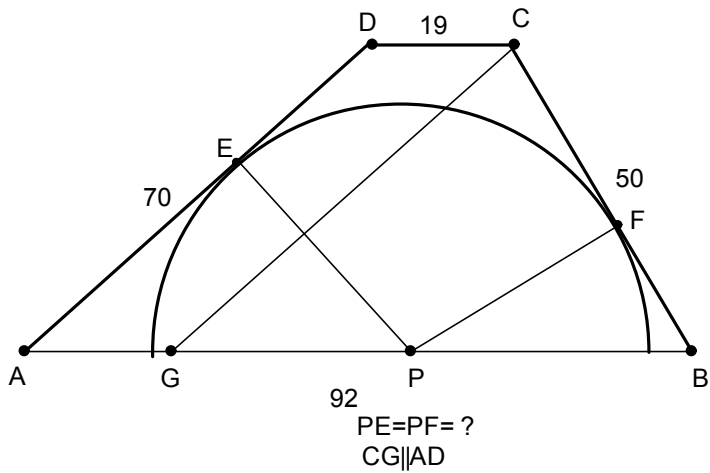
F4 Key - Make sure mouse is on the image. By pressing **F4** key your mouse point will jump to the nearest point. For example if mouse is close to the end of an ARC by pressing F4 key mouse will jump exactly at the point of ARC. When you want to draw a a good and accurate drawings it is necessary to start a new object where the last one was finished. For example you draw a line and you want to draw another line that is connected to that line. Although it is possible manually move the mouse to the desired point, or even use **arrow keys**, it will be a lot faster by just pressing the **F4** key. . Finally press Enter key or mouse left click to complete the action. In this software pressing **Enter** key is same as **mouse left key**. Finally **F10** key is used to mark the end of Polyline and Polygon . A PolyLine and Polygon can have many sides up to 1000 . Each new point is entered by 1 mouse left key. When Polyline and Polygon finished just press the **F10** key to enter the new object in database . The difference between Polyline and Polygon is Polygon is always a closed region. The last point of Polygon will automatically connected to its first point. But Polyline is simply a collection of sequential connected lines. A Polyline can be also made into Polygon.

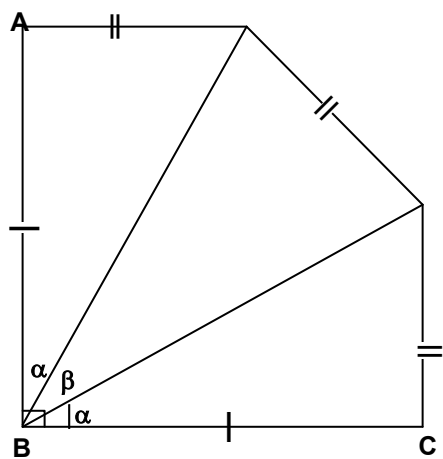
I hope you find this program useful

Here are few diagrams that has be drawn using **GeoCAD**



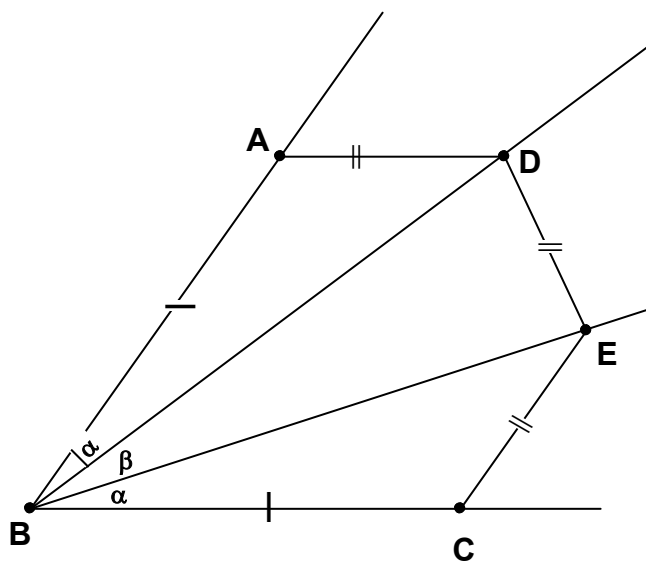






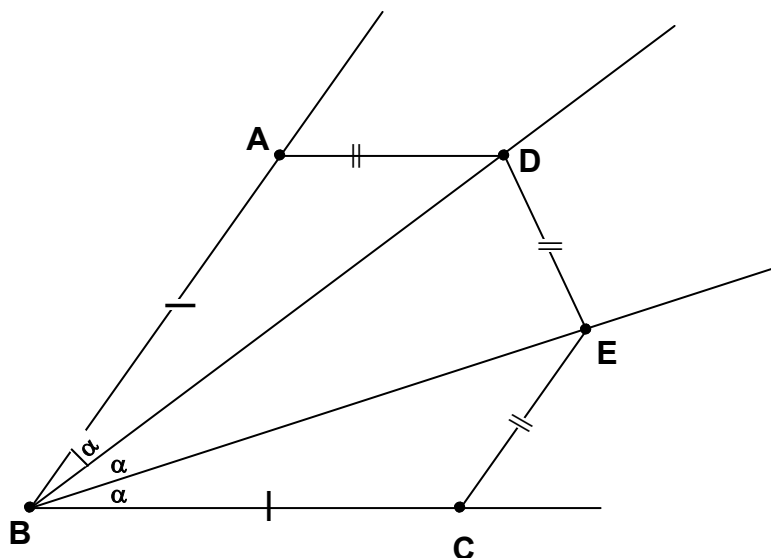
$$\theta=90 \quad \alpha=30.36 \quad \beta=29.27$$

$$\text{Error } 1-(30/30.36)=\%1.18$$



$$AD=DE=CE \text{ (} AB=BC \text{) \& (} AD \parallel BC \text{) \& (} CE \parallel AB \text{) } \angle ABC = \theta$$

$$2\sin(\beta/2) = \sin(\alpha)/\sin(\theta)$$



$$AD=DE=CE \text{ (} AB=BC \text{) \& (} AD \parallel BC \text{) \& (} CE \parallel AB \text{) } \angle ABC = \theta$$

$$\underline{3\pi}$$