

## Module 5: Drawings

This chapter deals with the basic aspects of drawing, which when mastered help you make all kinds of drawings very easily.

### Lesson1: The basic objects

Basic objects can be classified in two categories; the **basic plane geometric objects** ( points, segments, triangles, circles, ellipses, Bezier curve, customized curves, i.e. self-defined curves etc ) and the **three-dimensional objects** ( prisms, cylinders, cones, spheres etc... ).

Some objects can be found from the Geometry Toolbar ( Fig1 ), in plane geometry ( Fig2 ), in Solid Geometry ( Fig3 ) or from Science Graphics window in Plane Geometry ( Fig4 ) and Solid geometry ( Fig5 ).

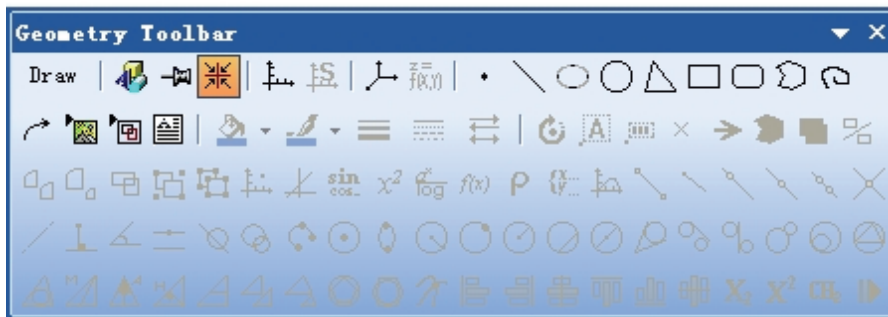


Fig1

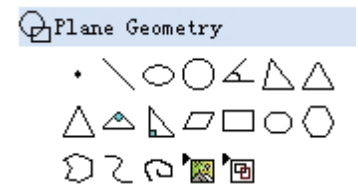


Fig4

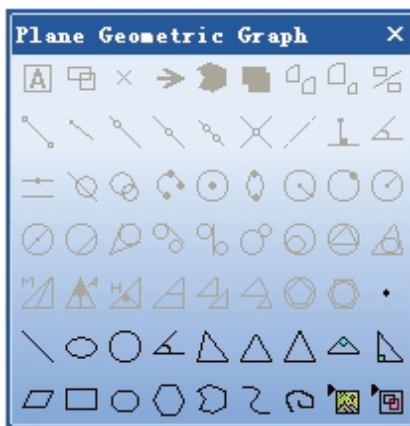


Fig2

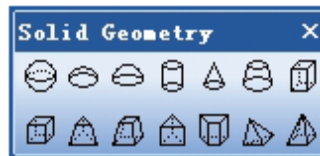


Fig3

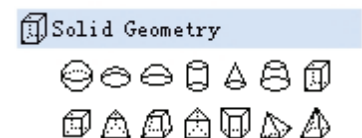


Fig5

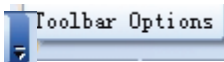
When any basic plane geometric object is drawn ( but under selection ), some useful geometry tools pop up automatically.

*For example, when a point of a plane is selected, the tools for drawing a half-line originating from this point or a circle centered on this point pop up in the drawing toolbar . Similarly, when two points of the plane have been selected, the tools appear in the drawing toolbar for the purpose of: drawing the segment linking these two points, subdividing this segment into a number of equal parts, determining the symmetry of one of the points in*

relation to the other, drawing the circle centered on one of the points and passing through the other.

**There is generally a perfect correspondence between the basic geometric drawings under consideration and the geometric tools required for creating a geometrical object.**

Some of these geometric tools can be found in in Geometry Toolbar ( Fig1 ) or Plane Geometric Graph ( Fig2 ), but activated only when the corresponding geometric objects are selected!

The complete list of drawing tools can be scrolled from the vertical button  of toolbar options ( Fig6 ) of drawing toolbar.

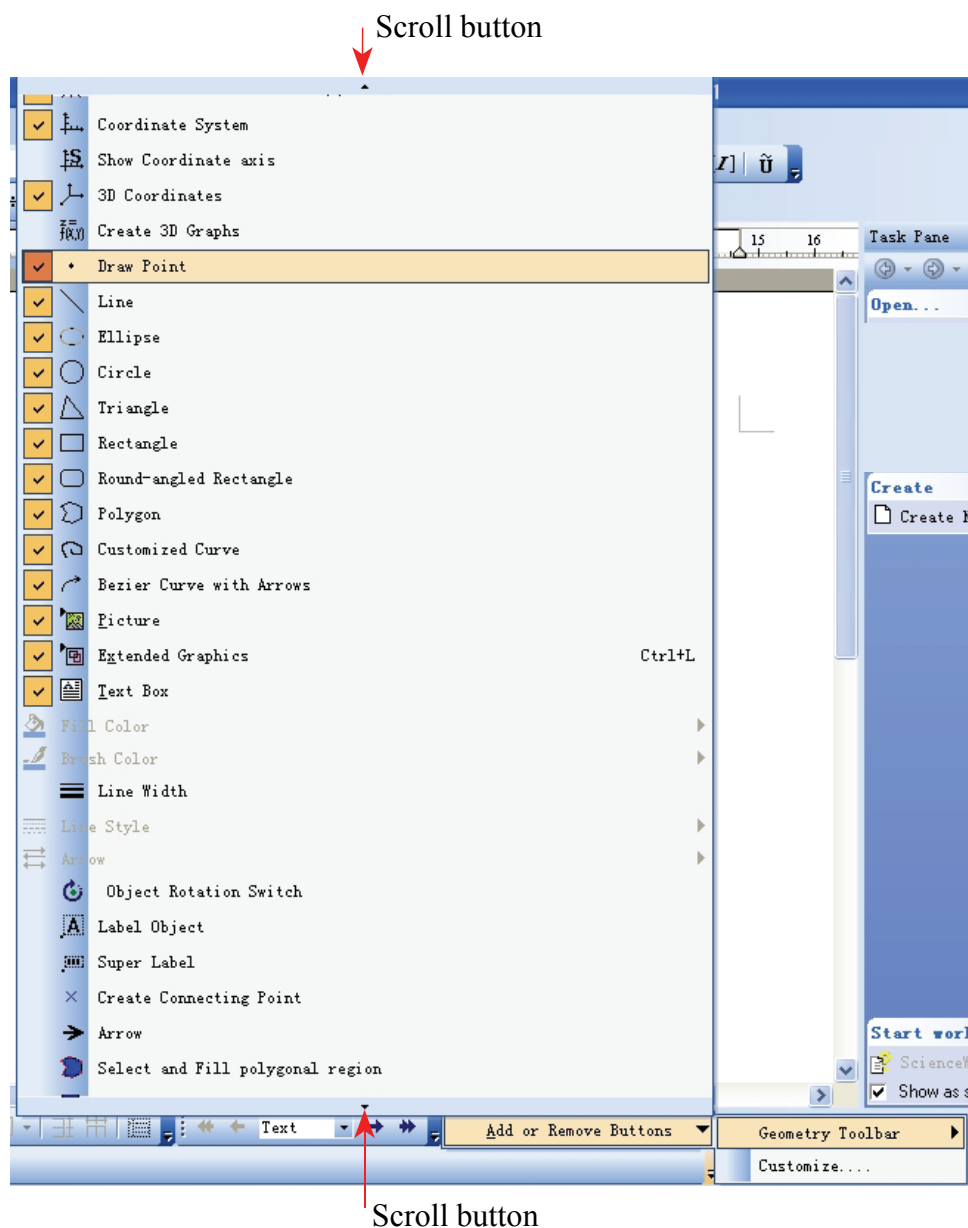



Fig6


## Lesson2; Manipulation of geometry basic tools.



The principle of manipulation is simple:

- Firstly, place the pointer on the tool momentarily to make the function it executes appear
- Secondly, click on the tool.




\* Either a result is obtained immediately; this is the case for example with the inscribed circle of a triangle.

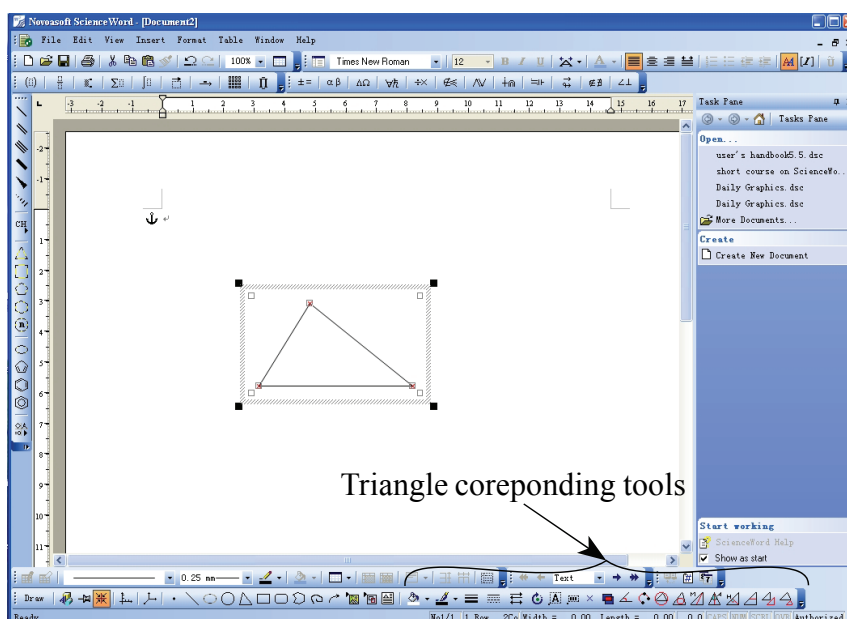
\* Or a dialogue box appears and you simply type simple text; this is the case for example in "Label Object" (  ).

\* Or text zone appears and where you can a text including formulae. this is the case for example in "Super Label"  "

\* Or the pointer takes a particular shape: the shape , when clicking directly onto the workspace; the shape  when clicking at a precise place, for example on the vertex of a triangle (to draw a median line, to create an arc of a circle) or at a point of a straight line in order to select this point, etc.

### a - Example of geometric corresponding tools of the triangle

For example, to draw a triangle, click once on the "" button in the geometry toolbar, then slide the pointer to the workspace. When the pointer changes to a cross , click on your workspace to get the triangle. It appears in a rectangular region called the "Selection Region" which has a tiny white square at every corner: this is the "Selection Mode" ( see the figure below ). After selecting it , you can shift it using the directional keys (  $\rightarrow$  ,  $\leftarrow$  ,  $\uparrow$  ,  $\downarrow$  ). You could also move it with the mouse whilst it is selected. Practically, move the pointer towards the triangle and when it takes the form , make a left-click and slide the mouse to get the shift desired..



In fact, as soon as the triangle appears, the tools also appear in the geometry toolbar.



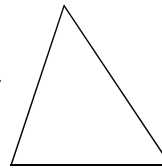
The tasks assigned to these tools are listed as follows in increasing numerical sequence:


1- Fill Color; 2- Brush Color; 3 - Line Width; 4 - Line Style; 5 - Arrow; 6 - Object Rotation Switch; 7 - Label Object; 8 - Super Label Object; 9-Create Connecting Point; 10 - Fill Combined Region; 11 - Angle Label Arc; 12- Arc passing three known points; 13- Draw circumscribed circle of triangle; 14 - Draw inscribed circle of triangle; 15 - Draw median of triangle; 16 - Draw angle bisector of triangle; 17 - Draw altitude of triangle; 18- Draw line segment bisecting two sides of triangle; 19 - Draw congruent triangle; 20 - Draw similar triangle.

*Note: When you click outside the triangle, the tools beneath would disappear. This indicates simply the fact that the triangle is no more selected. To select again the triangle, move the pointer to one of its sides, then click on this side when the pointer changes to mouse shape.*

*In the following, we shall be seeing the effect of each of the mentioned above tools . In each case*

*here, the tool shall be applied on the triangle opposite:*



**"Fill Color (  )"**

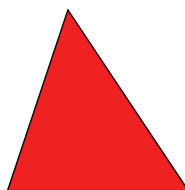
To colour the inside of the triangle, click on the  button. The following palette of colours pops

up;




Click for example on the red colour.

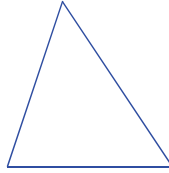
The inside of the triangle would get coloured red as in the following figure.




### "Brush Color ( ) "


To colour the sides of the triangle, click on the  button. To select a colour, click on the corresponding drop down arrow and the same palette of colours pops up as previously.


For example, by clicking the colour blue, you would get the following figure;




Similarly, you could define the sides of the triangle with;

- "**Line Width**" (  ), for getting the desired thickness of the line.

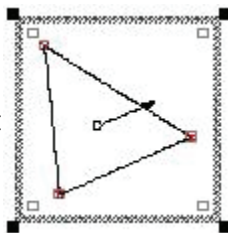
- "**Line Style**" (  ), for getting the desired style of the line.


- "**Arrow**" (  ), for putting the arrowheads desired on the ends of the line, i. e. sides of the triangle.

### "Object Rotation Switch ( ) "

To make the triangle undergo a rotation, click on the  button


You would obtain the figure:




Move the pointer to the arrowhead of the arrow that appears by default (automatically) at the center of gravity of the triangle. When the pointer takes the following shape , hold down the left button of the mouse and then move the mouse in the direction you wish, in order to effect slight movements of the triangle and then get the desired rotation.

To move the center of rotation to a given point, just move the arrow so as to place its origin at the chosen point which then becomes the new center of rotation.

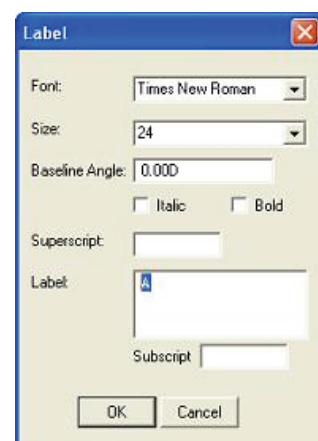
### "Label Object" ( )

ScienceWord makes possible label objects by using the "**Label Object**" function (  ).

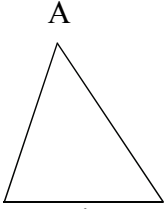
We are for example going to label the top point of the triangle ( let's label it "A" for example ).

To do this, select the triangle and then click on the  button in the geometry toolbar.


The oppositedialogue box appears:

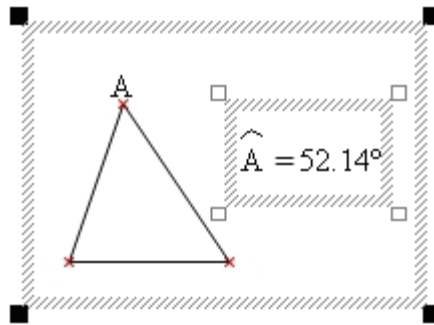


You could for example select the size 12 by clicking on the drop down arrow of the "size" field. Confirm your choice by clicking on "OK".


You could get the following figure  by adjusting the position of "A" with the arrow keys. Actually, the letter "A" appears as an image.

### "**Super Label Object**" ( )"

ScienceWord makes possible label objects by using the "**Super Label Object**" function  where it is possible to write text with several lines, symbols, formulae of all kinds and even insert pictures exactly like in Text Box! ( See picture below ).



### "**Connecting Point**" ( )"

You could also create an interdependent point of the triangle by clicking on the  button, then click at the place desired on your workspace.



Generally, any modification of the position of the interdependent point is made by means of the mouse ( the arrow keys are not suited for this ).

### "**Fill Combined Region**" ( )"

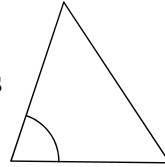
You could fill and make the insides of the triangle selectable by clicking on the  button.

Generally, this tool pops up when several objects that can be filled out are selected at the same time. It helps filling-in intersection, difference or union of domains of these objects. The options of filling can be found in the properties of this tool.






### "**Angle Label Arc**" ( )"

To create an arc at any corner of the triangle, click on the button "". When the point changes on the workspace to , click exactly on the corresponding vertex to the corner in question.


An arc of the circle centered at the vertex chosen appears



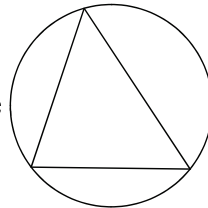
Using a process similar to that of the creation of the arc of any corner of the triangle, you could draw:

- An arc of a circle intersecting the vertices of the triangle; by using the  button.
- The median line exiting from a vertex of the triangle; by using the  button.
- The interior angle bisector exiting from a vertex of the triangle; by using the  button
- The altitude exiting from a vertex of the triangle; by using the  button.
- The segment joining the middles of two sides of the triangle, by using the  button.


**"Draw circumscribed circle of a triangle (  )"**

To draw the circumscribed circle of a triangle, just click on the  button.

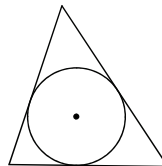
You will automatically obtain the following triangle




**"Draw inscribed circle of triangle (  )"**

To draw the inscribed triangle, click on the  button.

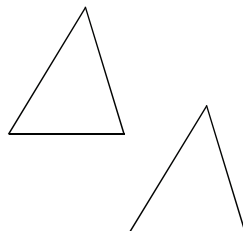
You would automatically get the following figure




**"Draw congruent triangle (  )"**

To draw a triangle congruent to a given triangle, click on the  button.

You would obtain in this way a triangle congruent to the initial

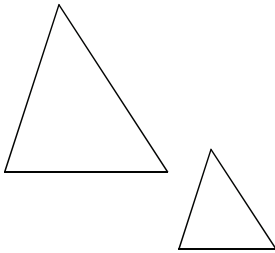


You cannot modify the size of a congruent triangle.

**"Draw similar triangle (  )"**

To draw a triangle similar to a chosen triangle, click on the  button.

In this way, you would obtain a triangle similar to the original



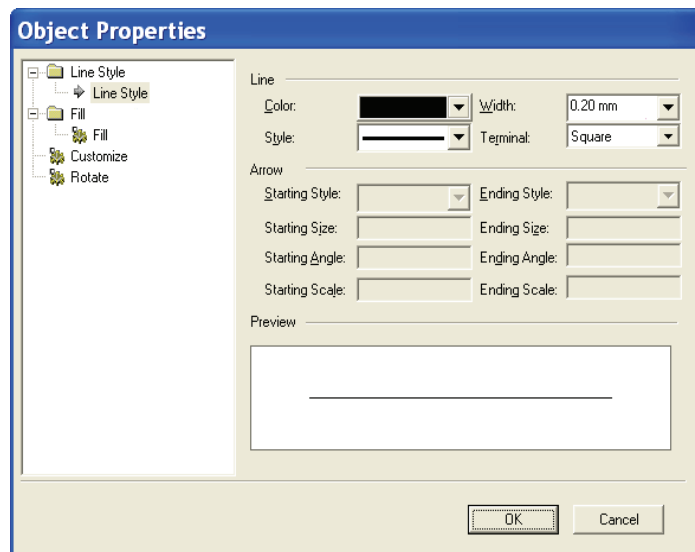
**Remark:**


*The tools (of the triangle) above that appear in the geometry toolbar are part of the functions that help carrying out modifications to this triangle. Other functions can be found in the properties of the triangle as is usual for all objects in ScienceWord.*

**Properties of triangles**

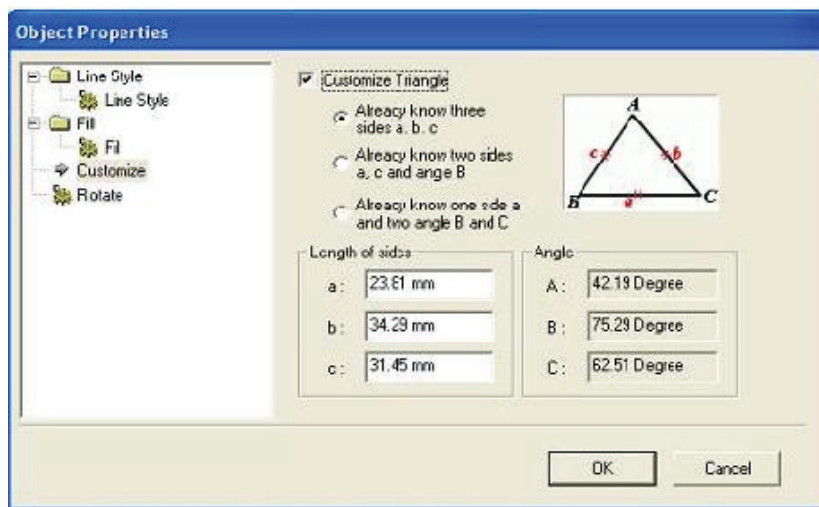
They provide information on the variable elements of a triangle. Modifications can be brought about to a triangle by acting directly on its properties. The properties of the triangle are accessed as follows:

- Select the triangle ( click on any of its sides ) ;
- Make a right-click when the triangle appears as described far above in "Selection Mode ". A menu that is the *contextual menu* then pops up.
- Click on "**Properties**" ( the last element at the bottom ) in the contextual menu.
- The following window that opens up provides properties of the triangle.



- Click on "  Customize " and then tick off the "  **Customize Triangle** Customize Triangle " box within the window which opens up. Then the dialogue box appears as shown

next.



You could also read up the information on the sides or the angles of the triangle. Likewise, you could modify them in order to configure the triangle in another way. There are in all, three options for modifying the dimensions of the triangle. Select each of these options and make modifications corresponding to the properties of a triangle ( $a \leq b + c$  and  $A + B + C = 180^\circ$ ) and then confirm by clicking on "OK".

## b- Principles of selecting drawings

- *Every selection of a drawing is based on the plane geometric objects, i. e. **basic geometric shapes**.*
- *A basic shape consists of **points** or **segments** designated here by the term **elements**.*
- *In a simple selection (selection of **a single** object or of **a single element**).*

*A basic shape is selected by just left-clicking with the mouse on this object, whether the key "Shift" is depressed or not (See polygone ABCDEF of Fig1).*

*Any element of a basic geometric shape is selected by just depressing the "Ctrl" key and clicking on this element (See Fig2 where only the side AB of the polygone is selected).*

*During a multiple selection (selecting or deselecting **several** elements or objects), the rule is as follows:*

*To select or deselect any object, only the "Shift" key must be depressed simultaneously whilst you click on the object.*

*To select or deselect an element of any object, both "Ctrl" and "Shift" keys must be pressed simultaneously whilst you click on the element.*

**Examples of objects and elements selected**

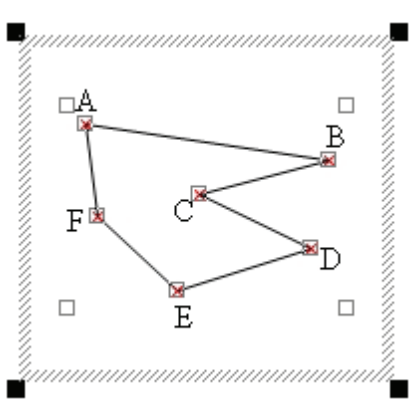


Fig1  
The polygon ABCDEF is selected

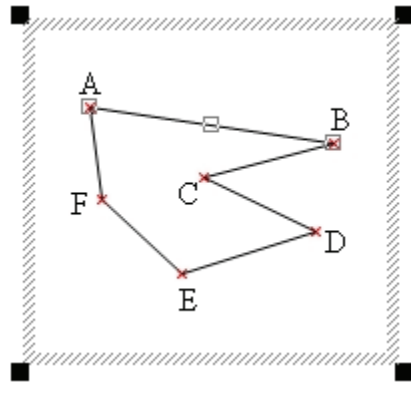


Fig2  
Only segment AB is selected

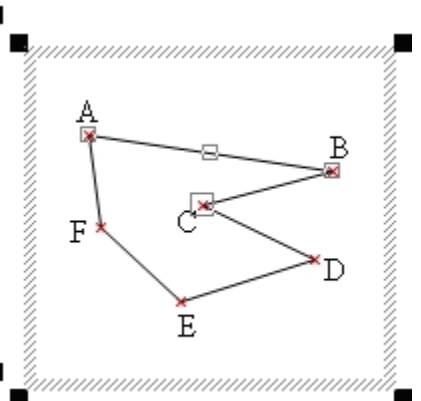


Fig3  
Point C and segment AB are selected.

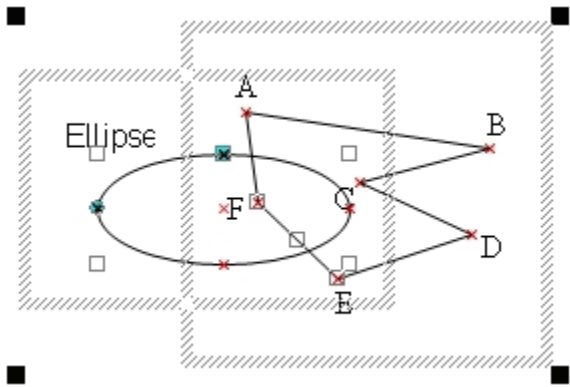


Fig4  
Segment EF and Ellipse are selected

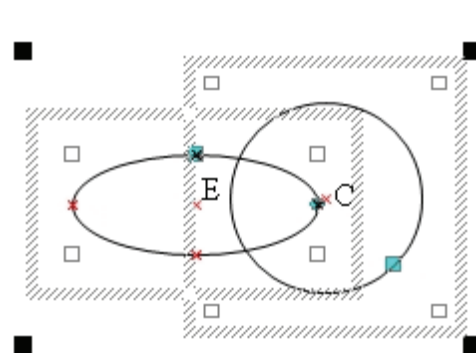
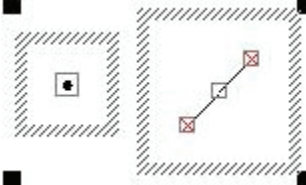

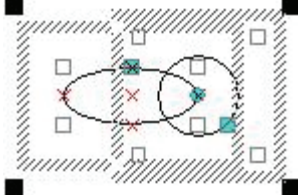

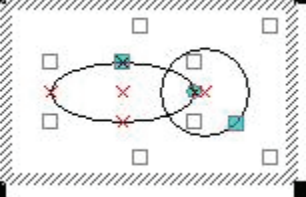
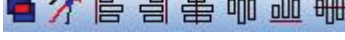
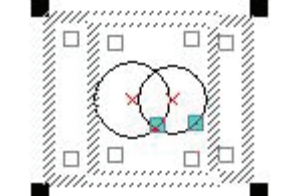
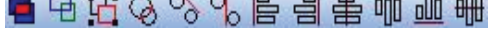
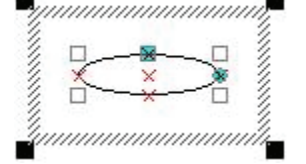

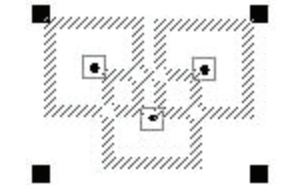


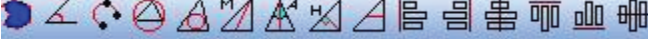


Fig5  
Circle and Ellipse are selected

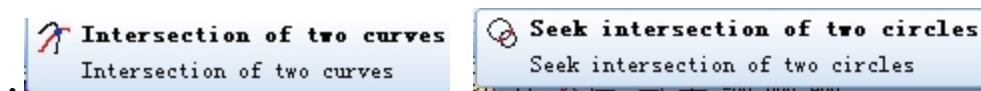
**c- Selected objects and corresponding tools**

We are giving in the following some examples of objects selections and the corresponding tools that appear in geometry toolbar.

Type of selection	Appearance of the selection	Tools that appear in geometry toolbar
A point is selected		
Two points are selected		

<p>A point and a line are selected</p>		
<p>A circle and an ellipse are selected</p>		
<p>A circle and an ellipse are selected and grouped with Combine tool</p>		
<p>Two circles are selected</p>		
<p>An ellipse is selected</p>		
<p>Three points are selected</p>		
<p>Three points are selected and grouped with Combine tool</p>		

Note that you can place the pointer on the tool momentarily to make the function it executes appear as shown as follow::



**Draw circle centered at a known point**

Draw circle centered at a known point

**Produce mirror image of an object**

Produce mirror image of an object

**Draw line tangent to two circles**

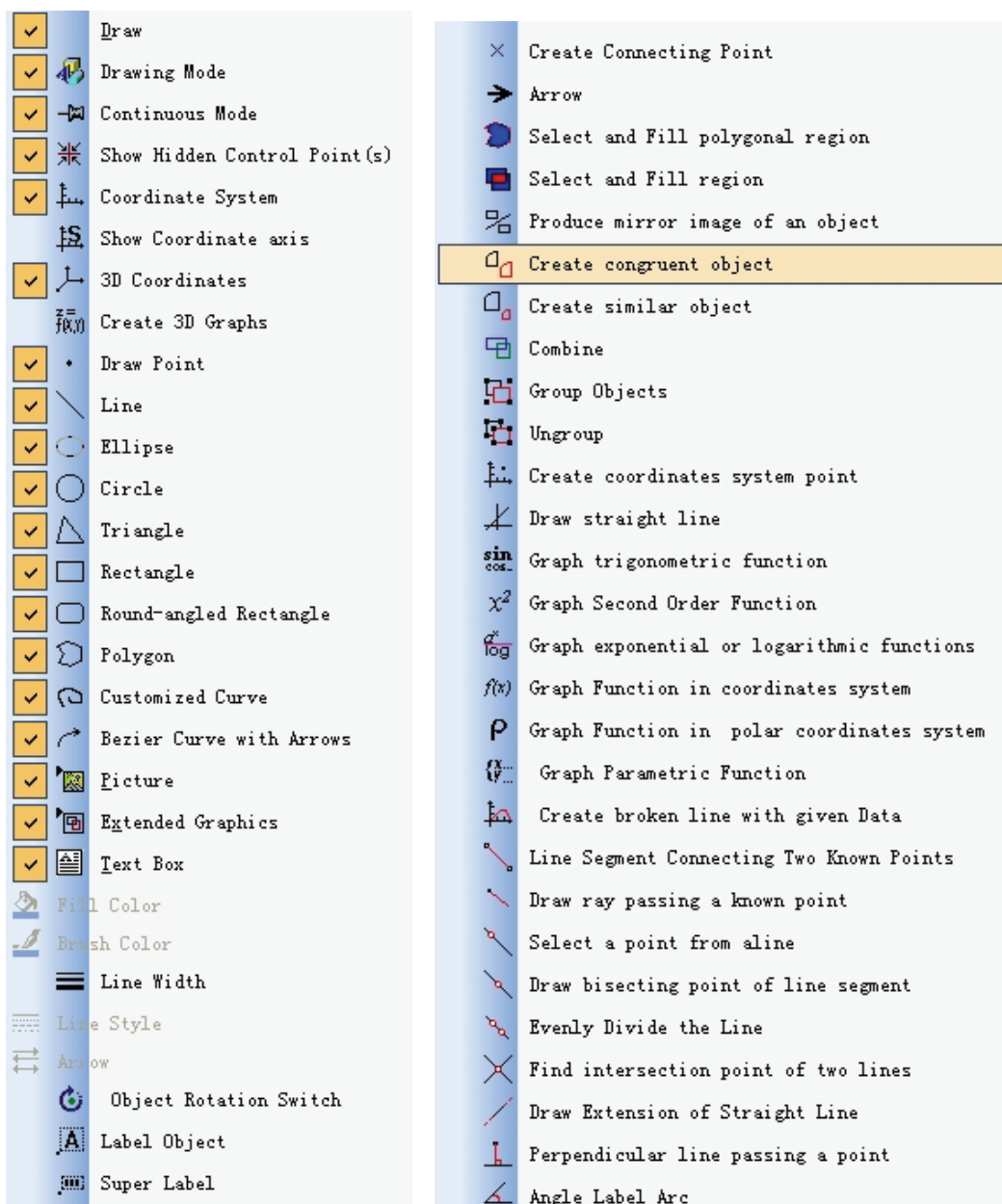
Draw line tangent to two circles, circle on one side of line




























**Select and Fill region**











Select and Fill region

**d- The complete list of tools that appear in Geometry toolbar**

We are showing as follows the complete list of tools that appear in geometry toolbar. As said above, these tools appear only when the corresponding selection of geometry objects ( or physics and chemistry objects ) have been made.




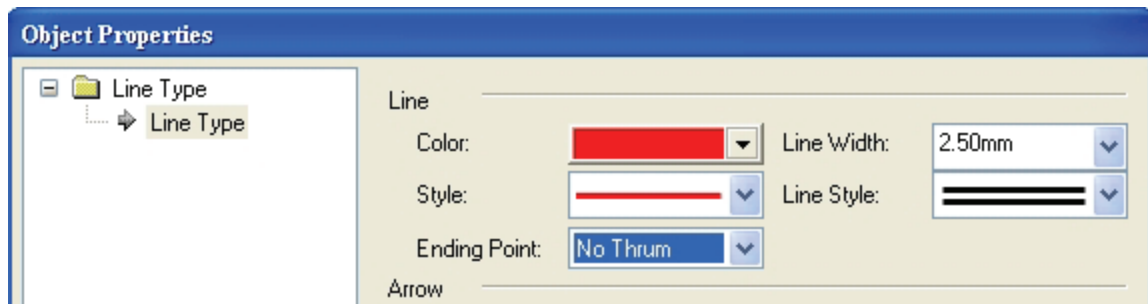
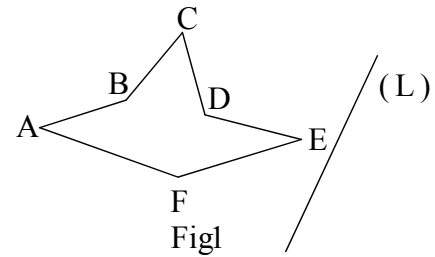
-  Parallel line passing a point
-  Seek intersection of line and circle
-  Seek intersection of two circles
-  Arc Passing Three Known Points
-  Draw circle centered at a known point
-  Draw ellipse passing two points
-  Draw circle centered at one point passing another point
-  Select point on a circle
-  Draw radius of circle
-  Draw Chord of Circle
-  Draw diameter of circle
-  Draw line passing known point and tangent to know circle
-  Draw line tangent to two circles, circle on one side of line
-  Draw line tangent to two circles, circle on each side of line
-  Draw circle tangent to and outside of current circle
-  Draw circle tangent to and inside of current circle
-  Draw circumscribed circle of a triangle
-  Draw inscribed circle of triangle
-  Draw mid-line of triangle
-  Draw angle bisector of triangle
-  Draw altitude of triangle
-  Draw line segment bisecting two sides of triangle
-  Draw congruent triangle
-  Draw similar triangle
-  Draw circumscribed circle of regular polygon
-  Draw Inscribed Circle of Regular Polygon
-  Intersection of two curves

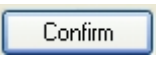
-  Left aligned object group
-  Right Aligned object group
-  Object group justified alignment
-  Top aligned object group
-  Bottom aligned object group
- 
-  Subscript
-  Superscript
-  Numeric Autosubscript
-  Play Stroke Flash

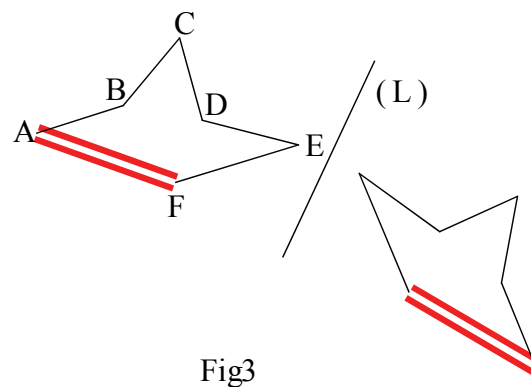
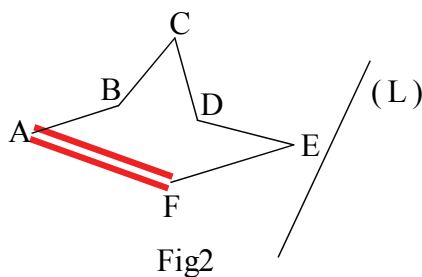
### Lesson3: Practical examples


#### Example 1 (Symmetry )

- i Click on the button  in the geometry toolbar to draw six sides ordinary polygon ABCDEF. Then move the vertices in order to get the polygone as show in Fig1.
- ii Select the side AF, right click to access object properties dialogue box and customize the line color, the line style and the ending point as shown as follow




Click on button . Then you obtain the result as shown in Fig2.

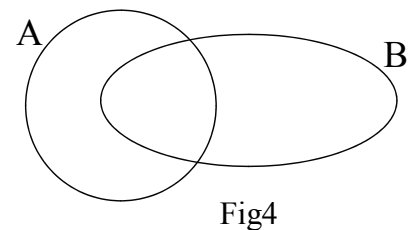


Select the polygone and the line in that order, then click on the icon  that pops up in the geometry toolbar to obtain the symmetric accross the line ( L ) of the polygone ( see Fig3 ).

#### Example 2 (Intersection of two domains )

Draw a circle and an ellipse as shown in Fig4. S

Select them and click. in geometry toolbar on the icon  Select and Fill. The result is shown in Fig5.



Click in the hatched region to select it and right click to access object properties dialogue box.

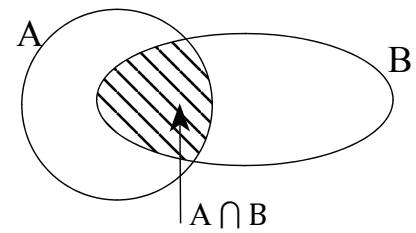
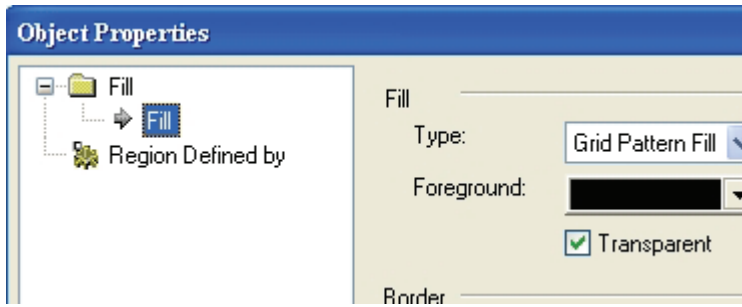
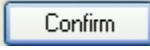


Fig5

Select "Region defined by" and click on button  to get the following dialogue box

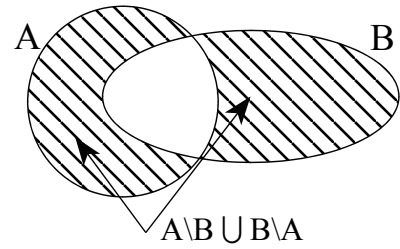
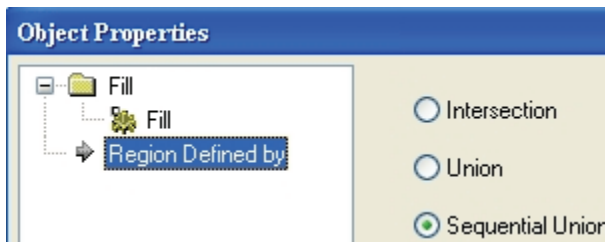
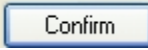


Fig5


Check Sequential Union and click on button  to get the result of Fig6..

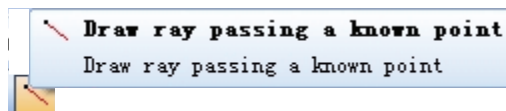
### Label hatched domains


Select the hatched domain under consideration, and click in geometry toolbar on the icon



that becomes available.

Then move the cursor that turns into  $+$  form and click in the domain to get a small red cross .



Then, the icon  becomes available. Click on this icon and move the cursor (that turns into  $+$  form) and click outside of the domain to get a line having as starting end the connecting point previously drawn.. As the line is under selection, click on the super label icon from geometry toolbar and complete the label.