CABRI® 3D V2

Innovative Math Tools

USER MANUAL

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Cabri 3D v2.1 User Manual:
Original designers and authors: Sophie and Pierre René de Cotret (Montréal, Québec, Canada) prcotret@colba.net
Original English translation: Simon Horn, shorn@colba.net
Latest update: Oct 2007, Kate Mackrell and Cabrilog
Adaptation for the UK: Kate Mackrell
New versions: *www.cabri.com*
To report errors: *support@cabri.com*
Graphic design, page layout & second readings: Cabrilog

INTRODUCTION

Welcome to Cabri 3D v2's world of space geometry and interactive mathematics!

Cabri technology was born in the research labs of France's Centre National de la Recherche Scientifique (CNRS) and Joseph Fourier University in Grenoble. The project began in 1985, when Jean-Marie Laborde, the guiding spirit behind Cabri, set out to make two-dimensional geometry easier to learn and more enjoyable to teach.

Using computers to construct geometrical figures opens up a world of new possibilities compared to the classic methods of construction using pencil, paper, ruler and compass. Around the world, more than 100 million people are using Cabri Geometry II , Cabri II Plus and Cabri Jr on computers and Texas Instruments graphing calculators.

Today, Cabri 3D v2 brings the Cabri philosophy to the world of 3D!

Using Cabri 3D v2, you will quickly learn to construct, view and manipulate all sorts of objects in three dimensions: lines, planes, cones, spheres, polyhedra… You can build dynamic constructions, from the simplest to the most complex. You can measure objects, integrate numeric data and even replay the process by which you built your constructions. With Cabri 3D v2, you will discover a remarkable tool to help you study and solve geometry and mathematics problems.

The whole CABRILOG team wishes you many exciting hours of construction, exploration and discovery with Cabri 3D v2.

Note: To get the latest news about our products and for the most recent updates of Cabri 3D v2, including updated versions of this guide, visit our website at *www.cabri.com*. The site also provides links to dozens of web pages and books about geometry with Cabri.

1.1 INSTALLING AND ACTIVATING THE PROGRAM

1.1.1 System requirements

Microsoft Windows
Windows 98 (Internet Explorer 5 or more recent), ME, NT4, 2000, XP or Vista.

Apple Macintosh
MacOS X, version 10.3 or higher.

Minimum configuration for PC
800 MHz or greater CPU, 256 MB or more RAM, OpenGL compatible graphic card with 64 MB or more RAM.

1.1.2 Installation

• **Using the CD-ROM:**
• **PC:** Insert the CD-ROM and follow the instructions. If autostart is deactivated, launch the setup.exe program on the CD-ROM manually.

• **Macintosh:** Copy the Cabri 3D v2 program icon to the Applications folder.

The first time you launch the program you will be asked to enter your user information and the product key (the CD key is shown inside the CD-ROM case).

• **Using the download version:**
The program will run in evaluation mode for one month, with all functions available. After the first month, the program will run in demonstration mode for 15 minutes at a time, with the Copy, Save and Export commands disabled. To activate the program permanently, you must purchase a license from the Cabri website (*www.cabri.com*) or from your local distributor. You will be emailed a "license.cg3" that you must open with Cabri 3D to activate.

1.1.3 Choice of Language

• **On a PC**
During installation Cabri 3D lets you choose to operate the program in one of a number of languages. To change the language once the program has been installed (or to have access to a wider choice of languages), choose Edit-Preferences-General, then choose from the Language dropdown menu.

• **On a Macintosh**
On Macintosh OS X, Cabri 3D automatically uses the same language as the operating system. To change the language once the program has been installed (or to have access to a wider choice of languages), choose Apple-System Preferences… then click International.

You can also start Cabri 3D with a different language than that of the working system, and go back to the initial language once the software has been launched. Click on Apple-System Preferences, and click on International.

1.1.4 Updates

To check if you are using the most recent version of Cabri 3D, choose the Updates… command from the program's Help menu, then follow the instructions to obtain any needed update.

1.2 HOW TO USE THIS GUIDE

Cabri 3D is easy to understand and easy to use, but you will learn the program much more quickly and easily if you take the time to work carefully through the next two chapters.

Chapter [2] BASIC PRINCIPLES is an accelerated introduction to using Cabri 3D, and not just a list of functions and commands. Work through the various procedures in order and you will quickly grasp how the program works, while producing your first Cabri 3D constructions.

Chapter [3] CABRI 3D TOOLS is also designed to be studied step by step, to help you learn Cabri 3D as easily and quickly as possible.

The remaining chapters of the User Guide describe Cabri 3D's various complementary and advanced functions.
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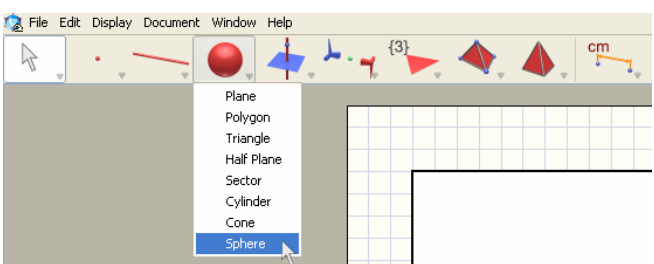
2.1 CREATING YOUR FIRST CABRI 3D DOCUMENT

Double-click on the Cabri 3D v2 icon. The program will automatically create a single-page document containing a **work area**, which is a white area with a gray base plane in the centre.

2.2 YOUR FIRST 3D CONSTRUCTION

First you will construct two three-dimensional objects. This will illustrate a number of Cabri 3D functions.

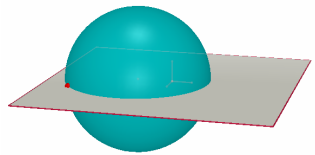
Constructing a sphere
A toolbar at the top of the Cabri 3D document window provides a series of toolboxes. Click and hold the Surfaces toolbox (4th button from the left) and choose Sphere from the dropdown menu.



The mouse pointer changes into a pencil.

Click once about 1 cm to the left of the base plane's centre point, then click again about 2 cm to the left of the first point.

You have constructed a sphere!

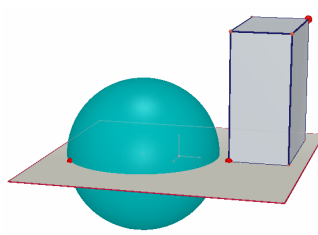


To modify the sphere, click on the Manipulation toolbox.

To change the size of the sphere, use the mouse to click and drag either the first or second point that you constructed.

To move the sphere, select it and drag it to a new position using the mouse.

Constructing a polyhedron
Click and hold the Polyhedron toolbox (the 8th button in the toolbar) and choose XYZ Box from the dropdown menu.



Click on the gray base plane just to the right of the sphere.

Next, move the mouse about 2 cm to the right and 1 cm upwards. Hold down the `Shift` key and move the mouse about 5 cm upwards, then click. You have constructed an XYZ Box.

To modify the XYZ Box, choose the Manipulation tool and follow the same procedures as you used with the sphere (see the previous section).

2.3 CREATING A NEW DOCUMENT

To build a new set of constructions you should create a new document. Choose File-New. The program will create a new document with a work area displaying a natural perspective.

To add pages or work areas to a document, or to choose from a wider selection of perspectives, see Chapter [6] ADVANCED NAVIGATION FUNCTIONS.

2.4 THE CONCEPT OF VISIBLE AND INVISIBLE PARTS OF A PLANE

To really understand how Cabri 3D works, you need to grasp the concept of visible and invisible parts of planes. In this section, each object you construct in Cabri 3D is placed on a plane, known as the base plane.

Create a new document.

The gray surface in the centre is known as the **Visible Part** (**VP**) of the base plane. All constructions that you will build in this section, either on the **VP** or outside it, are necessarily placed on this base plane*.

To see how this works, start by constructing two XYZ boxes on the **VP**.

Next, construct two new boxes outside the **VP**, in the upper part of the work area.

After you construct each box, slide the mouse pointer above the **VP**.

Now construct a box in the lower part of the work area.

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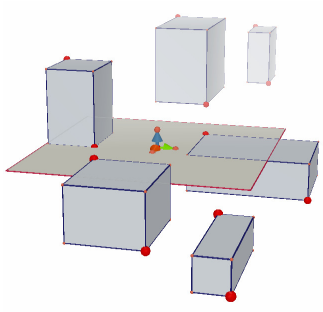
* Later you will see that you can add other planes to your document..



As you can see, the upper boxes are lighter and the lower boxes are darker, which contributes to the effect of depth.

All these boxes are placed on the same plane, either on the **VP**, or on an invisible extension of this **VP**, which is known as the **Non-Visible Part** (**NVP**).

2.5 CHANGING THE VIEW ANGLE

You can view your construction from various angles, as if it were contained in a glass ball that you can rotate in any direction. To change the view angle of the scene, put the mouse pointer anywhere in the work area, hold down the right mouse button, and move the mouse. Begin by moving the mouse up and down.

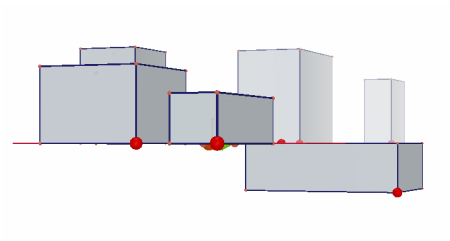
By changing the view angle, you can see that all the boxes you constructed earlier are really on the same plane, whether above or below it.

Now move the mouse left and right, instead of up and down: as you can see, this changes the angle horizontally.

(To change the view angle on a **Macintosh** with a single-button mouse, first hold down either the `Command` or the `Ctrl` key, then click and drag

with the mouse.)

Change the view angle often while you work. It will give you a clearer view of your work and a better grasp of the program's capabilities. If you are building a complex construction, changing the angle may make it easier to add new objects.



2.6 POINTS IN SPACE

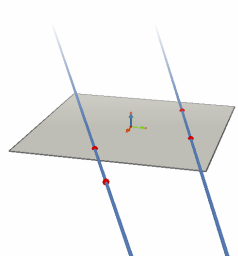
Points that are not constructed on an existing object or plane are points in space. As we saw in section [2.4], by default these points in space are constructed on the invisible extension of the **VP** of the base plane.

However, points constructed in space have the particular property that they can be moved vertically after being constructed.

To illustrate this we will construct two lines.

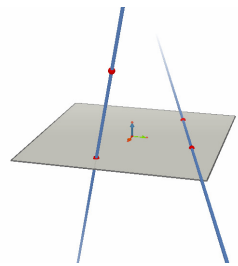
First open a new document.

Click and hold on the Curves toolbox (3rd button) and choose the Line tool from the dropdown menu. Construct a first line by constructing two points on the **VP** of the base plane (see illustration). Next construct a second line, but this time construct the second point in space on the **NVP** of the base plane (see illustration).



Using the Manipulation tool, select the point you constructed in space, hold down the `Shift` key, and move the point upwards. As you can see, the point moves vertically, as does the line.

Next, try to do the same thing with any point constructed on the VP. You will see that it is not possible to move it vertically.



CABRI 3D TOOLS

This chapter describes each of the Cabri 3D tools. Consult it whenever you want to know what a particular Cabri 3D tool does and how to use it.

Like Chapter [2], however, this chapter should be read in order, since each new example is generally based on the functions and operations presented earlier.

To speed up your learning of Cabri 3D, we recommend working through this chapter in sequence, trying out each Cabri 3D tool as it is presented.

Terms and abbreviations used in the tables
Base plane: the plane provided by default when you open the program or create a new document.
VP – the visible part (of a plane): the coloured portion of a plane.
NVP – the non-visible part (of a plane): the invisible extension of the visible part of a plane.

Tool help: Cabri 3D provides interactive help for every tool. To activate it, choose Help-Tool Help.

Note : In general a palette can appear on the figure and display the coordinates of any point or components of any vector. Click on Windows–Coordinates or double-click on the point or the vector in question with the Manipulation tool.

If there is no current selection, the palette contains three boxes, corresponding to the coordinates x, y and z. Fill these in and click on New point to create a new point having these coordinates.

3.1 MANIPULATION

Manipulation

• Lets you select points and objects.
If the coordinates palette appears, it will display the coordinates of the selected point or components of the selected vector; you can modify these by entering new coordinates and clicking on Modify the coordinates. If a point cannot be moved, its coordinates will appear in grey in the palette and you won't be able to change these coordinates.
• Lets you move points and objects, and as a consequence, all objects that depend on them.

Redefinition

The Redefinition tool lets you change the way points can be moved. See sections [3.11] and [3.12] for an explanation of how it functions.

3.2 POINTS

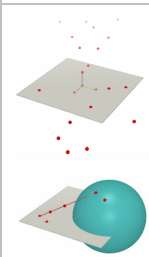
Point (on a plane, in space, or on an object)

Lets you construct points in different ways. These points can then be used to anchor the construction of various objects (segments, planes, polyhedra, etc.).

• Construct points on the **VP** of planes.

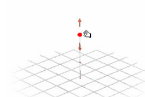
• Construct points in space. By default, these points are constructed on the **NVP** of the base plane.

• Construct points on all objects (except inside non-convex polygons).



Point in space (above or below the base plane)

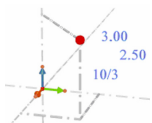
• Lets you construct points in space above or below the base plane:
• hold down the Shift key,
• use the mouse to move the point up or down to the desired position
• you may release the Shift key to move the point at a constant height.
• click to confirm.



• To again move a point vertically which was constructed using the Shift key, use the Manipulation tool, again hold down the Shift key, and move the point.

Point in space defined by its coordinates

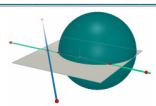
• Lets you construct a new point directly via its coordinates:
• click on any value in the figure to determine the x coordinate of the new point
• click on two other values to determine its y and z coordinates.



Note : it is also possible to modify the coordinates of a point using the Coordinates palette (if this does not appear on the figure, display it by clicking on Windows-Coordinates, or double-click on a point or a vector with the Manipulation tool).

Intersection point(s)

Lets you construct the intersection point or points of objects (two lines, a line and a sphere, three planes, etc.).

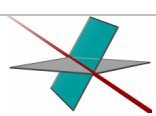


3.3 CURVES

Line

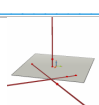
• Lets you construct a line passing through two points.

• Lets you construct the line of intersection of two planes:
• move the mouse pointer near the intersection between two planes to display the line
• click to create the line.



Ray

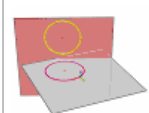
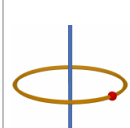
Lets you construct a ray passing through two points. The first point is the origin of the ray.



Segment

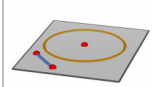
Lets you construct a segment defined by two points.

	Vector	
	Lets you construct a vector defined by two points. The first point is the origin of the vector.	

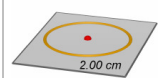
	Circle	
	Lets you construct circles in various ways: • A circle defined by two points (centre and radius) on a plane: • click on the **VP** to select the plane • construct (or select) the centre point of the circle on the **VP** (or the **NVP** if you have chosen the base plane). • construct (or select) the point defining the radius, also on the **VP** (or the **NVP** if you have chosen the base plane). or an existing object on the **NVP**. Note: once constructed, the circle can be moved onto the **NVP** using the Manipulation tool. • A circle defined by 3 existing points: • select the three points. • A circle defined by 3 points, some of which have not yet been constructed: • construct the circle by selecting the existing points and then constructing the others as needed by clicking on the desired objects. Note: you cannot construct the first point on the **VP** of a plane (in this case select an existing point or create a point before using the Circle tool). • A circle around a given axis: • select a line (or part of a line*) • select (or construct) a point. • Compass circle (whose radius is controlled by the length of a vector or segment): • construct a vector or segment (or use an existing vector or segment)	  

- use the Circle tool to select a plane
- construct or select the centre point of the circle
- select the vector or segment that defines the radius.

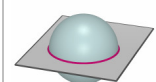
Note: the vector or segment may be situated anywhere.



- Circle whose radius is controlled by a measurement:
- take a measurement using the measurement tools (see section [3.9])
- using the Circle tool, select a plane
- construct (or select) the centre point of the circle
- select the measurement that will define the radius.



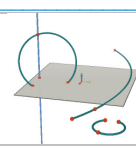
- Circle of intersection of two spheres or of a sphere and a plane:
- move the mouse towards the intersection until the circle appears
- click to create the circle.



* ray, segment, vector, side of a polygon, edge of a polyhedron

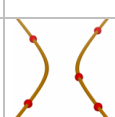
Arc

- Lets you construct the arc of a circle defined by 3 points.
- select (or click to construct) the three points.



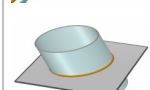
Conic

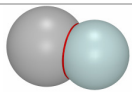
- Lets you construct a conic passing through five coplanar points:
- on the base plane, the points can be on the **VP** or the **NVP**
- on another plane, the points must be on the **VP** (or on an existing object on the **NVP** of this plane).
- a conic can also be constructed by constructing (or selecting) any five coplanar points.



- Lets you construct a conic tangent to five coplanar lines.
- select five lines on the same plane.

- Lets you construct the conic of intersection of a plane and a cone, cylinder or sphere or of two spheres:
- move the mouse towards the intersection until the conic appears
- click to construct the conic.

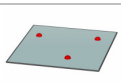


	Intersection curve	
	• Lets you construct the line of intersection of two planes. • Lets you construct the conic of intersection of a plane and a cone or cylinder. • Lets you construct the circle of intersection of two spheres or a plane and a sphere.	

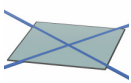
3.4 SURFACES

Plane

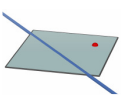
Lets you construct new planes in various ways:



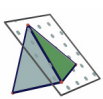
• A plane passing through three points.



• A plane passing through two coplanar lines (or parts of lines*).



• A plane passing through a line (or part of a line*) and a point.

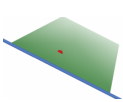


• A plane defined by an existing triangle or polygon:
• move the mouse close to the triangle or polygon until the plane appears
• click to construct the plane.

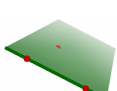
* ray, segment, vector, side of a polygon, edge of a polyhedron

Half-plane

Lets you construct a half-plane :

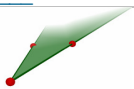


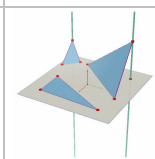
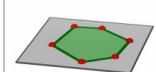
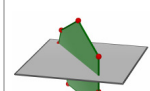
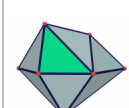
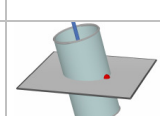
• delimited by a line (or part of a line*) and passing through a point.



• delimited by three points. The first two points define a line which is the border of the half-plane and the third point is in the
Interior of the half-plane.

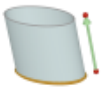
* ray, segment, vector, side of a polygon, edge of a polyhedron

	Sector	
	Lets you construct a sector defined by a point of origin and two other points. • select (or construct) one limiting point, then the point of origin, then the other limiting point.	

	Triangle	
	Lets you construct a triangle defined by three points. • On the base plane: • construct (or select) the points on the **VP** or **NVP**. • On another plane: • construct (or select) the points on the **VP** (or on an object already constructed on the **NVP** of this plane). • You can construct a triangle by constructing (or selecting) any three points.	
	Polygon	
	Lets you construct a polygon defined by three or more points. To finish the construction, click a second time on the last point constructed (or some other point of the polygon) or press the `Enter` key (`Return` key on a Macintosh). • On the base plane: • construct (or select) the points on the **VP** or **NVP**. • On another plane: • construct (or select) the points on the **VP** (or on an object already constructed on the **NVP** of this plane) • You can also construct a polygon by constructing (or selecting) any coplanar points. Note: if your construction disappears it is because you are attempting to select (or construct) a point which is not on the same plane as points already selected. Lets you construct a polygon defined by the face of a polyhedron • select the face.	  
	Cylinder	
	• Lets you construct a cylinder around a line or linear object* (the axis of the cylinder) and passing through a point. If the axis is bounded (segment, vector, side of a polygon, edge of a polyhedron) then its length determines the height of the	

cylinder.

• Lets you construct a cylinder given a circle or an ellipse and a line or vector.



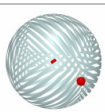
* line, ray, segment, vector, side of a polygon, edge of a polyhedron

Cone

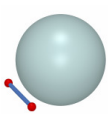
Lets you construct a cone defined by a point (the vertex) and:
• by a circle
• by an ellipse (constructed using the Conic or Intersection Curve tool).

Sphere

• Lets you construct a sphere from its centre point and another point determining its radius.
• select (or construct) the centre point and then the radius point.



• Lets you construct a sphere whose radius is controlled by the length of a vector or a segment:
• construct a vector or a segment (or use an existing vector or segment)
• construct (or select) the centre point of the sphere
• select the vector or the segment that will determine the radius.

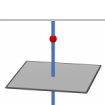


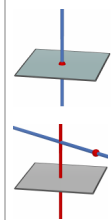
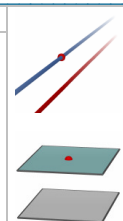
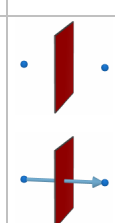
• Lets you construct a sphere whose radius is controlled by a measurement:
• take a measurement using the measurement tools (see section [3.9])
• construct (or select) the centre point of the sphere
• select the measurement that will define the radius.

3.5 RELATIVE CONSTRUCTIONS

Perpendicular (perpendicular line or plane)

• Lets you construct a line perpendicular to a plane surface**.

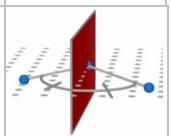


	• Lets you construct a plane perpendicular to a line (or part of a line*). • Lets you construct a line perpendicular to another line (or part of a line*). To use this function you must press and hold the CTRL key (Option/Alt on a Macintosh) · To construct a perpendicular line in the same plane as a reference line, you must select the plane in question before selecting (or constructing) the point through which the perpendicular line will pass.	
	* ray, segment, vector, side of a polygon, edge of a polyhedron ** half-plane, sector, polygon, face of a polyhedron	
	Parallel (parallel line or plane)	
	• Lets you construct a line parallel to a line (or part of a line*). • Lets you construct a plane parallel to a plane surface ** and passing through a point. To construct a parallel plane that will not be contiguous with the selected reference plane, you must use a point that is not on this reference plane.	
	* ray, segment, vector, side of a polygon, edge of a polyhedron ** plane, half-plane, sector, polygon, face of a polyhedron	
	Perpendicular bisector	
	• Lets you construct a plane midway between two points and perpendicular to the line defined by the two points. • Lets you construct a plane in the middle of a part of a line (segment, vector, side of a polygon, edge of a polyhedron) which is perpendicular to the selected part of a line.	

Bisector plane

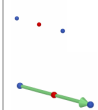
- Lets you construct the bisector plane of an angle defined by three points.
  - select (or construct) a first point
  - select (or construct) the vertex
  - select (or construct) a third point.

Note: The plane which is constructed will be perpendicular to the plane containing the three points.



Midpoint

- Lets you construct the midpoint between two points.
- Lets you construct the midpoint of a part of a line (segment, vector, side of a polygon, edge of a polyhedron).



Vector sum

From a selected point of origin, lets you construct the vector resulting from the addition of two other vectors.

Cross product

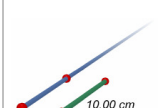
From an origin point lets you construct the vector which is the cross product of two vectors.

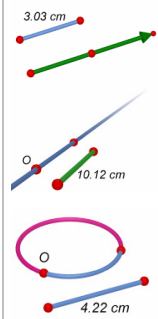
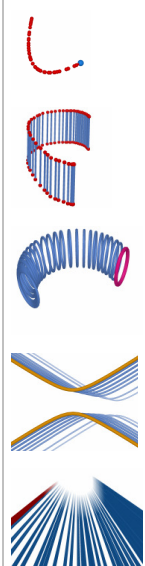
Measurement Transfer

You can transfer measurements made using the measurement tools (see section [3.9]) onto some objects. When transferring the measurement, the tool constructs a new point on the object.

Note: all calculator results and measurements (including areas, volumes and angles) are treated as being in cm when this tool is used.

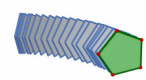
- Measurement transfer on rays and vectors:
  - select the measurement to transfer
  - select the destination ray or vector



	• the point of origin of the ray or vector will be the point of origin for the measurement transfer. Note that the new point may be positioned on the line passing through the ray or vector rather than on the ray or vector itself. • Measurement transfer on lines and circles: • select the measurement to transfer • select the destination line or circle • select (or construct) the point of origin for the measurement transfer. **Note** : to change the direction of the transfer, hold down the Ctrl key (Option/Alt on a Macintosh).	
	Trajectory	
	Lets you draw a trajectory created by the movement of certain objects. Objects that can leave a trajectory are: • points • lines • segments • vectors • circles • conics • polygons. • To draw the trajectory of one of the above objects: • click once to select the object, then • click again on the same object (or on an object that controls this object) and move it while holding down the mouse button. • To erase the trajectory WITHOUT deactivating the function: • select the trajectory using the Manipulation tool • choose Clear Trajectory Contents from the Edit menu. • To erase the trajectory AND deactivate the function: • select the trajectory using the Manipulation tool • choose Delete from the Edit menu. • To change the trajectory length: • select the trajectory using the Manipulation tool • right-click (Ctrl-click on a Macintosh) and choose	

Trajectory Length.

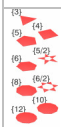
To learn more about the Trajectory tool's capabilities (in particular to create animations), see section [4.5].



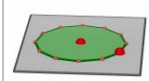
TRANSFORMATIONS

The Transformation tools are presented in section [3.10].

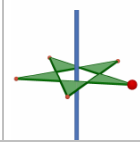
3.6 REGULAR POLYGONS



- Lets you construct regular polygons on a given plane:
  - select a plane
  - construct the polygon by defining the centre point and another point
  - when constructing the polygon, the second point must be positioned on the **VP** of the plane (or on an existing object on the **NVP** of the plane). Once the polygon is constructed, however, you are free to move it into the **NVP**.



- Lets you construct polygons around a given axis:
  - select a line (or part of a line*)
  - select (or construct) a point.



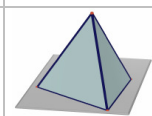
* ray, segment, vector, side of a polygon, edge of a polyhedron

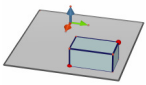
3.7 POLYHEDRA

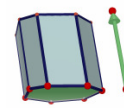
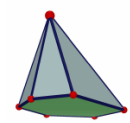
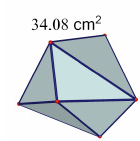
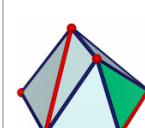
Important note for constructing polyhedra
To construct three-dimensional polyhedra, it is essential to construct at least one point on a different plane than that of the other points. This point may be constructed on an existing object or constructed by holding down the `Shift` key.

Tetrahedron (defined by 4 points)

- Construct (or select) the first three points.
- To construct a three-dimensional tetrahedron, construct (or select) the fourth point on another plane, either on an existing object or by using the `Shift` key



	XYZ Box (defined by a diagonal)	
	• Construct the first point. • Construct a second point (which will define the vertex diagonally opposite the first point). • To construct a three-dimensional XYZ Box, construct the second point on a different plane from the first, on an existing object, or by using the `Shift` key.	

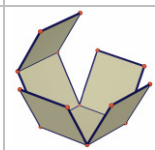
	Prism (defined by a polygon and a vector)	
	• First construct a polygon using another tool (Polygon, Triangle, etc.) or use an existing polygon. • Using the Vector tool, construct a vector on another plane than that of the polygon (or use an existing vector). • Use the Prism tool to construct the prism by selecting the polygon and vector.	
	Pyramid (defined by a polygon and a point)	
	• First construct a polygon using another tool (Polygon, Triangle, etc.) or use an existing polygon. This will be the base. • With the Pyramid tool, select a polygon. Then, to create a three-dimensional pyramid, construct the vertex using the Shift key (or select a point on another plane than that of the polygon).	
	Convex Polyhedron	
	• Lets you construct a polyhedron directly: • To create a three-dimensional polyhedron, use the Convex Polyhedron tool to construct a convex envelope of three or more points, then add one or more points on another plane (using an existing object or the Shift key). • To finish the construction, click a second time on the last point constructed (or some other point of the construction) or press the Enter key (Return key on a Macintosh). • Lets you construct a polyhedron that incorporates existing objects: • Use the Convex Polyhedron tool to select one or more of the following objects: polyhedra, polygons, segments, edges of polyhedra, or points. You can also construct new points during the construction. • To create a three-dimensional polyhedron, at least one of the points or objects must be on a different plane than the others. • To finish the construction, click a second time on the last point constructed (or some other point of the construction) or press the Enter key (Return key on a Macintosh).	 

Open Polyhedron

Lets you open the faces of a polyhedron (and then lay them flat in order to create a printable net).
Construct a polyhedron.

- With the Open Polyhedron tool, click on the polyhedron.
- To open the polyhedron more completely, use the Manipulation tool and drag one of the faces with the mouse.
- To open a single face, hold down the `Shift` key.
- To open the face(s) in multiples of 15°, hold down the `Ctrl` key (`Option/Alt` on a Macintosh).

Once you have created a polyhedron net, you can print it and use it to create a real model.See Section **[4.10] CREATING PRINTABLE NETS.**



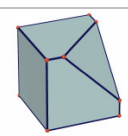
Cut polyhedron

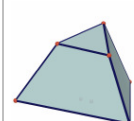
Lets you construct the intersection of a polyhedron and the half-space delimited by a plane, and hide part of the polyhedron.

- Construct a polyhedron.
- Construct a plane that intersects the polyhedron.
- Using the Cut Polyhedron tool:
  - select the polyhedron
  - select the intersecting plane.

The hidden part of the polyhedron is the one closest to the front. To bring another part of the polyhedron to the front, use the View Angle function (section **[2.5]**) to rotate the construction.

To show the hidden part of the polyhedron, use the Hide/Show function (section **[4.1]**).

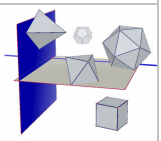




3.8 REGULAR POLYHEDRA (Platonic Solids)

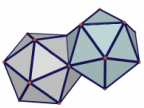
- Lets you construct one of the five regular polyedra directly:
- Select a plane.
- Select (or construct) a first point (the centre of a face).
- Select (or construct) a second poin (a vertex of the face). The second point must be placed on the **VP** of the selected plane (or on an existing object on the **NVP** of this plane).

Note: to place a regular polyhedron somewhere other than on the **VP** of the plane, first construct it on the **VP** and then move it using the Manipulation tool.



- Lets you construct a polyhedron defined by an existing regular polygon:
- Use the appropriate Regular polyhedron tool to select a polygon which has the shape of a face of the polyhedron to be constructed.
- Or, use the appropriate Regular polyhedron tool to select a face of a polyhedron (i.e. a polygon) which has the shape of a face of the polyhedron to be constructed.

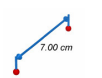
Note: to construct the polyhedron in the half-space opposite to that proposed by default, hold down the `Ctrl` key (`Option/Alt` key on a Macintosh).

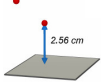


3.9 MEASUREMENT AND CALCULATION TOOLS

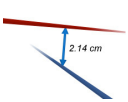
Distance

- Lets you measure the distance between a point and:
- another point
- a line
- a plane (**VP** or **NVP**).

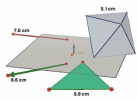
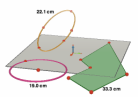
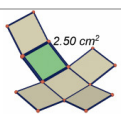
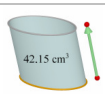
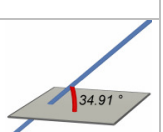


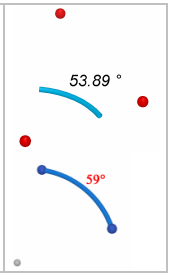


- Lets you measure the distance between two lines.



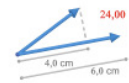
Note: In some cases, the label showing the distance may be displayed outside the work area. To see the label, change the view angle or move one of the objects that determine the distance.

	Length	
cm 	• Lets you measure the length of the following objects: • segments • vectors • sides of polygons • edges of polyhedra • arcs. • Lets you measure the circumference or perimeter of the following objects: • circles • ellipses • polygons.	 
	Area	
cm^2 	• Lets you measure the area of the following plane objects: • polygons • circles • ellipses. • Lets you measure the surface area of spheres, cones, convex polyhedra and cylinders of limited altitude.	 
	Volume	
cm^3 	Lets you measure the volume of spheres, cones, convex polyhedra and cylinders of limited altitude.	 
	Angle	
α 	• Lets you measure the angle between a plane and: • a line • a ray • a segment • a vector.	

	• Lets you measure the angle formed by three points: • select or (construct) the first point • select or (construct) the vertex • select or (construct) the third point. • Lets you measure the angle formed by an arc.	

Scalar (dot) product

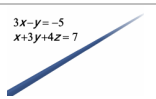
- Lets you measure the scalar product of two existing vectors :
  - select a vector
  - select a second vector

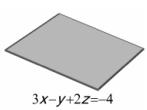


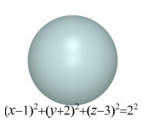
Coordinates and Equations

- Gives you the coordinates of points
- Gives you the components of vectors
- Gives you the equation(s) corresponding to the following objects:
  - lines
  - planes
  - spheres.

It is also sometimes possible to edit coordinates of points or components of vectors. See section [4.2].







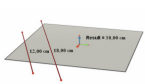
Calculator

Lets you carry out most common operations provided by scientific calculators and display the results in the work area.

Here is an example of simple addition:

- construct two segments as shown in the illustration
- measure the lengths of the segments using the Length tool
- select the Calculator tool
- click on the first measurement to select it
- press the + key
- click on the second measurement
- click on the Insert button.
- click on the screen to position the result (PC only)

The result of each calculation can then be used in subsequent calculations. For the complete list of possible operations and

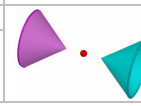


for more information about the Calculator tool, see section [4.8].

3.10 TRANSFORMATIONS

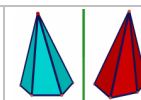
Reflection in a point (central symmetry)

- Select (or construct) a point as the centre of reflection.
- Select the object to be transformed.



Half-turn (defined around a line or part of a line)

- Select a linear object as the axis of reflection.
- Select the object to be transformed.



* line, ray, segment, vector, side of a polygon, edge of a polyhedron

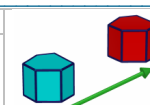
Reflection in a plane

- Select a plane surface** as the plane of reflection.
- Select the object to be transformed.

** plane, half-plane, sector, polygon, face of a polyhedron

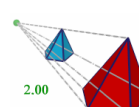
Translation (defined by a vector or two points)

- Select a vector or two points (or construct the points directly).
- Select the object to be transformed.



Enlargement

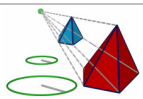
- Enlargement defined by a point and a numerical scale factor:
  - select a point as the centre of enlargement
  - select a number (measurement or calculation) as the scale factor of the enlargement (note that you can simply enter a number into the Calculator and click on Insert to have the number available to use as a scale factor, etc.)
  - select the object to be transformed.



- Enlargement defined by a point and a scale factor calculated from the relationship between two similar objects:
  - select an object
  - select another, similar, object. The scale factor will be the

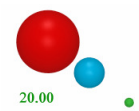
ratio between any length measurement of the first object and the corresponding measurement of the second object.

- select a point as the centre of the enlargement
- select the object to be transformed.

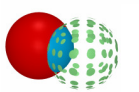


Inversion

- Defined by a point and a number :
- select a point as the centre of the inversion, and a number as its ratio (the ratio is the square of the radius of the corresponding sphere of inversion)
- select the object to be transformed.

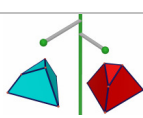


- Defined by a sphere :
- select a sphere as the sphere of inversion
- select the object to be transformed.

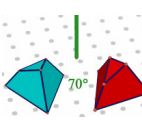


Rotation

- Rotation around an axis with the angle defined by two points:
- select a linear object* as axis of rotation.
- select (or construct) two points.
- select the object to be transformed.



- Rotation around an axis with the angle defined by a number :
- select a linear object* as the axis of rotation
- select an existing number (this is interpreted as representing degrees)
- select the object to be transformed



* line, ray, segment, vector, side of a polygon, edge of a polyhedron

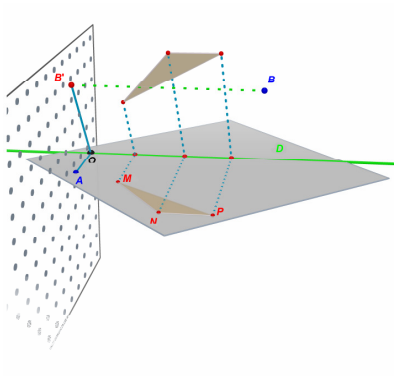
Example of rotation around an axis with the angle defined by two points

In this example, we construct the image of triangle *MNP* by selecting line *D* and points *A* and *B*.

The angle of rotation is the angle between two half-planes:

- the half-plane with border *D* containing point *A*,
- the half-plane with border *D* containing point *B*.

This angle is also equal to (*OA*,*OB'*), *B'* being the orthogonal projection of *B* on the plane perpendicular to *D* and passing through *A* which intersects the axis (or axis extended) at O.



Note : If the objects defining the transformation are different in kind from the object to be transformed, then objects can be selected in any order. If the object(s) defining the transformation are the same kind as the object to be transformed, then the object(s) defining the transformation must be selected first, as in the steps given above

3.11 IMPORTANT INFORMATION ABOUT POINTS AND THE REDEFINITION TOOL

Normally points are "attached" to the objects on which they were constructed. A point constructed on a sphere, for example, can be moved anywhere on the sphere but cannot be moved onto another object or onto a plane. A point constructed at an intersection cannot be moved without moving the objects which intersect.

Points constructed on the **VP** of a plane may be moved off the **VP**, which may give the impression that these points are free to move anywhere. However, such points will remain on the plane, whether on the **NVP** or the **VP**[*].

[*] To construct a point in the same screen location as another object, but not attached to the object (such as a point which appears to be on the VP of the base plane but is free to move vertically when you drag it with the Shift key pressed),

To “free” these points you must use the Redefinition tool.

You may also want to further restrict a point: to place it at an intersection or identify it with another point that you have constructed. The Redefinition tool also enables this type of redefinition.

3.12 USING THE REDEFINITION TOOL

To use the Redefinition tool to define a point to be on a particular object or to identify it with an existing point:

- click once to select the point to be redefined (then release the mouse button)

- move the pointer towards the new object (which might be e.g. a ray, a face of a polyhedron or a fixed point such as an intersection point or a point constructed via one of the transformation tools). The point will follow the pointer.

- click a second time to place the point on the new object in the desired position.

The Redefinition tool also lets you change a point originally constructed on an object or as a fixed point into a free point in space. To do this:

- click once to select the point to be redefined, then release the mouse button

- hold down the `Shift` key

- click a second time.

The object will remain in the same position, but can now be freely dragged horizontally or vertically, independent of its original definition.

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either press Shift as you create the point, or create the point in space and then move it to the desired screen location.

3.13 KEYBOARD-CONTROLLED SHORTCUTS AND FUNCTIONS

Function	PC	Macintosh
Selecting more than one object using the Manipulation tool	Hold down the Ctrl key and select all required objects	Hold down the Shift key and select all required objects
Delete selected objects	Press Delete	Press Delete
Stop construction of an unfinished object	Press Esc	Press Esc
Cancel the selected tool and choose the Manipulation tool	Press Esc	Press Esc
Construct a point or an object above or below the base plane	Hold down the Shift key, move the point vertically, then click	Hold down the Shift key, move the point vertically, then click
Move vertically an existing point or object constructed above or below the base plane	Hold down the Shift key, then move the object vertically	Hold down the Shift key, then move the object vertically
Move vertically, in increments of 5 mm, an existing point or object constructed above or below the base plane	Hold down the Ctrl+Shift keys, then move the object vertically	Hold down the Option/Alt+Shift keys, then move the object vertically
Move horizontally, in increments of 5 mm, an existing point or object constructed above or below the base plane	Hold down the Ctrl key, then move the object horizontally	Hold down the Option/Alt key, then move the object horizontally

3.14 A USEFUL TECHNIQUE FOR MANIPULATING OBJECTS

To move existing objects easily

You can move existing points or objects without switching to the Manipulation tool. For example, even with the Tetrahedron or some other tool selected, you can move a sphere or change the position of a line, etc. Simply move the pointer over a point or an object, hold down the mouse button and drag the selected object.

To identify points that can be manipulated directly
Some points cannot be manipulated directly with the mouse once they have been constructed. This is the case with intersection points, for example, or for points that are the result of a transformation. Cabri 3D provides a way to identify these points, as well as those that can be moved directly with the mouse.

Simply hold down the mouse button in an empty part of the work area. Points that can be manipulated directly will flicker, while the others will stay their normal size.

ADVANCED TOOLS AND FUNCTIONS

4.1 THE HIDE/SHOW COMMAND

This command lets you hide existing objects and show them again as required.

To hide an object, select it using the Manipulation tool, then choose Edit-Hide/Show to hide it. To select several items, hold down the `Ctrl` key (`Command` on a Macintosh).

To show a hidden object, first display all hidden objects in order to select the required object. Make sure the Active View window is open (Window-Active View), then click the Show Hidden Objects check box. Outlines of all hidden objects will appear.

Select the hidden object you want to show, then choose Edit-Hide/Show to show it. Repeat this for all the hidden objects you want to show, or select several objects simultaneously using the `Ctrl` key (`Command` on a Macintosh).

Please note that the outline display of hidden objects only applies to the currently selected work area ("view"). To learn more about creating multiple work areas, see Chapter [6] ADVANCED NAVIGATION FUNCTIONS.

Note : You can also engage the Hide/Show function by selecting the required objects and pressing `Ctrl-M` (`Command-M` on a Macintosh).

4.2 EDITING COORDINATES OF A POINT OR COMPONENTS OF A VECTOR

This function enables you to directly modify the coordinates of a point or components of a vector via a parameters window.

To use it, select the Manipulation tool, and double-click on a point or a vector. Type the new coordinates or components in the three boxes of the window that appears, and click on Modify. The point or vector will move according to its new coordinates or components.

4.3 LOCKING POINTS

Locking and unlocking points
It is sometimes useful to lock points, for example to ensure that they won't be moved accidentally.

To use this function, select a point with the Manipulation tool, and choose Edit-Lock.

To be able to manipulate the point again, unlock it by selecting it and then choosing Edit-Unlock.

This function is also accessible from the Window-Styles parameter window. Select a point with the Manipulation tool and check or uncheck the Locked box.

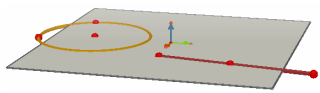
Identification of which points are locked
To easily identify all locked points, choose the Window-Active View parameter window. Check the Show Locked Marks box and a little padlock will appear next to every locked point.

You can also identify which points can be manipulated. Move the mouse pointer over a blank part of the worksheet and click and hold the left mouse button; movable points will flicker.

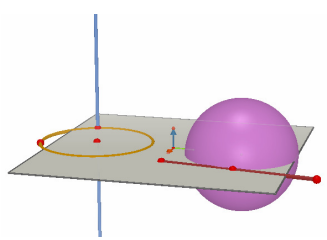
4.4 ANIMATION

Cabri 3D enables you to create automatic animations of your objects. By creating a moving point on a circle, segment or arc, you can then move all types of objects linked to this point. The results can be impressive, since you can cause a line to move, increase or decrease the volume of a sphere, make a triangle oscillate, and so on.

To understand how this works, first construct a circle and a segment in the positions shown in the illustration. Then construct a new point on the circle and a new point on the segment as shown.



Use the Perpendicular tool to construct a line passing through the last point you created on the circle (NOT the radius point) and perpendicular to the base plane. Next use the Sphere tool and construct a sphere with centre about 1 cm away from the point you constructed on the segment and with this point on the segment as radius point. Your construction should look like the illustration below.



To start the animation, follow these steps:

1. Choose Window-Animation to display the Animation box.

2. Use the Manipulation tool to select the moving point, in this case the point through which the line passes.

3. In the Animation box, make sure that the Point Frozen box is not checked.

4. Use the Animation Speed slider to select a speed other than 0 cm/s.

5. Click the Start Animation button. The line will now move around the circumference of the circle.

6. You can control the speed and direction of the animation using the

Animation Speed slider.

Follow the same steps to begin animation of the sphere. As you can see, the volume of the sphere changes as the point moves on the segment.

You can control the speed of each animated point individually. You can also interrupt the animation of each point by checking the Point Frozen box. You must first choose the animated point in question using the Manipulation tool, then use the Animation box to make the required changes.

The Stop Animation button will stop all animated points. The Start Animation button will start all animated points except those whose Point Frozen box is checked.

4.5 ADVANCED USE OF THE TRAJECTORY TOOL

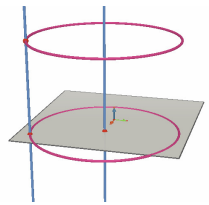
As we saw in section [3.5], the Trajectory tool will display a trace of the trajectory created when an object is moved manually. The Trajectory tool can also be used in conjunction with the Animation function in order to create a whole range of new objects that cannot be constructed using the other tools.

To help you understand this function, this example shows the steps needed to construct a hyperboloid via animation.

1. First construct two lines using the Perpendicular tool, placing them as shown in the illustration.

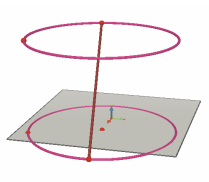
2. Using the Circle tool, construct a circle around the central line and passing through the point used to construct the other line.

3. Construct a second circle around the central line, but higher up and passing through a new point on the other line. Your construction should now look like the illustration below.



4. Using the Manipulation tool, select the two lines and hide them by choosing Edit-Hide/Show.

5. Use the Segment tool to construct a segment defined by a new point on each circle. It should be positioned roughly as shown in the illustration.



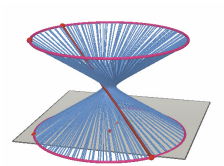
6. Select the segment with the Trajectory tool.

7. Choose Window-Animation to display the Animation box.

8. With the Manipulation tool, select the point at the top end of the segment then, in the Animation box, adjust the speed to 4.00 cm/s.

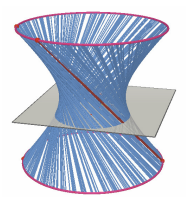
9. Do exactly the same thing with the point at the lower end of the segment.

10. Click on the Start Animation button. The segment will move between the two circles, leaving a trace that `forms a hyperboloid`.



11. To get a longer trajectory, stop the animation and select the trajectory with the Manipulation tool, then right-click (Ctrl-click on a Macintosh), choose Trajectory Length and make a new selection.

To change the shape of your hyperboloid, change the position of one end of the segment on the circle.



You can also vary the relative speeds of the points, change the heights or diameters of the circles, and so on.

4.6 REPLAY CONSTRUCTION MODE

Cabri 3D lets you replay all the steps used to produce a given construction.

It also lets you return to any previous step and restart construction from that point.

To understand how this works, start by creating a construction that includes about twenty objects.

Next, choose Replay Construction from the Window menu to display the Replay Construction box.

Click on the Enter the Replay Construction Mode button. The objects

you have constructed will disappear, leaving only the base plane and base vectors.

To replay the various steps in your construction click on the [>] button. To cycle through the steps automatically, click on Start Cycling. The [>>] button lets you jump directly to the last step in the construction. The [<] and [<<] buttons let you move backwards through the construction.

If you want to restart construction from a given step, click on the Keep the Figure at this Step button. Any later steps will be erased (although you can restore them by choosing Edit-Undo as long as you have not closed the document).

To exit Replay Construction mode, click the Quit the Replay Construction Mode button.

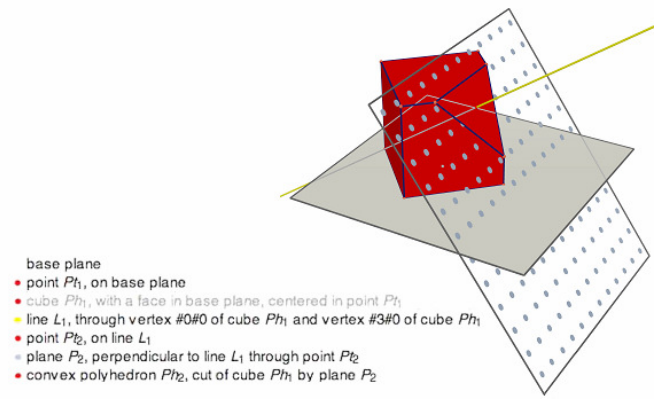
4.7 DESCRIPTION OF THE CONSTRUCTION

This function enables you to display a written description of the different steps of your construction.

It also enables you to add to your construction by choosing objects in the description window without acting on the worksheet. This is particularly useful in the case of complex constructions, when some objects are hidden by others.

Description
To better understand this function, open a new document, do not construct any objects, and choose Document-Description. A window will appear to the left of the worksheet, listing all the objects already constructed (one point, three vectors and the base plane). Construct two points on the worksheet and you'll see their description appear in the description window.

To identify objects in the description list more easily, you can name them by using the labelling function (see chapter 5). If you don't name your objects, Cabri 3D will name them automatically, e.g. Pt_1, Pt_2, etc.. Here is an example of the description of a cube cut by a plane:



Construction from the description window
Instead of selecting objects in the worksheet, select the objects in the description window. For example, to construct a line, select the Line tool. Then, in the description window, click on the two points which will define the line. You'll see the line appear on the worksheet, and its description in the list.

The descriptions of hidden objects appear in grey.
Descriptions of objects which do not exist in the current configuration are crossed out.
Descriptions of objects which are selected appear in red. References to these objects appear in blue in the description.

4.8 ADVANCED USE OF THE CALCULATOR

The Cabri 3D calculator lets you carry out most common operations provided by scientific calculators and display the results in the work area. As well, the calculator works interactively, displaying new calculation results in real time as you move a point or object that changes the value of one of the calculation's parameters.

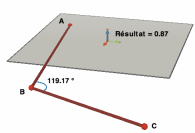
To enter data in the calculator you can either click on data or results already shown in the work area, or simply type in numbers.

Functions are represented by the standard symbols: sin, cos, ln, etc. Data should be entered in parentheses, directly following the abbreviation.

The complete list of supported functions and operators is shown in the tables at the end of this section.

To illustrate the use and possibilities of the calculator, the following example shows how to calculate the sine of an angle:

1. Use the Segment tool to construct two segments with B as their common endpoint, as shown in the illustration.



2. Use the Angle tool to measure the angle at the vertex B by clicking, in order, points A, B and C.

3. Select the Calculator tool and type sin(

4. In the work area, click the angle measurement and then close the parentheses, resulting in this formula: sin(a)

5. Click Insert. On a Macintosh, the value will appear on the worksheet (and may be dragged to a different location): on a PC you need to move the pointer so that it is over the worksheet and then click to position the result.

6. Now move point C. The value of the sine will change automatically as the angle changes.

7. To edit the calculation, double-click on the result : the Calculator tool will appear with the calculation displayed. You can then edit or add

to the calculation (you can, for example, add "+cos(b)" to your expression). Click on Apply when you are finished and the new result will appear.

List of Calculator symbols

Operator	Symbol
Addition	+
Subtraction	-
Multiplication	*
Division	/
Exponent	^

Function	Symbol	Other usable abbreviations
Sine **Cosine** **Tangent**	sin(x) cos(x) tan(x)	Sin Cos Tan
Arc sine **Arc cosine** **Arc tangent**	asin(x) acos(x) atan(x)	ArcSin, arcsin ArcCos, arccos ArcTan, arctan
Hyperbolic sine **Hyperbolic cosine** **Hyperbolic tangent**	sinh(x) cosh(x) tanh(x)	SinH, sh, Sh CosH, ch, Ch TanH, th, Th
Hyperbolic arc sine **Hyperbolic arc cosine** **Hyperbolic arc tangent**	argsh(x) argch(x) argth(x)	ArgSh ArgCh ArgTh
Square **Square root** **Exponent** **Common logarithm (base 10)** **Naperian logarithm**	sqr(x) sqrt(x) exp(x) log(x) ln(x)	Sqr Sqrt Exp Log, lg, Lg Ln

Round (to nearest whole number) **Truncation** **Largest whole number ≤ x** **Smallest whole number ≥ x** **Random number between 0 and 1** **Absolute value** **Sign (-1 if x < 0, +1 if x > 0, 0 if =0)**	round(x) trunc(x) floor(x) ceil(x) rand(x) abs(x) sign(x)	Round --- Floor Ceil Rand Abs Sign
π	pi	Pi, PI

4.9 ADJUSTING THE PRECISION OF MEASUREMENTS AND CALCULATIONS

By default, numbers obtained using the measurement or calculation tools are displayed with either one or two decimal places. To change the number of digits displayed after the decimal point, right-click on the number (`Command` or `Ctrl`-click on a Macintosh), select Digits from the contextual menu and then choose the number of digits (0 - 10) that you require.

The Symbolic display function in the contextual menu will, for example, change the displayed result of the calculation sqrt(2)+3/4 from 2.16 to $(3+4\sqrt{2})/4$. This function may also be used with equations.

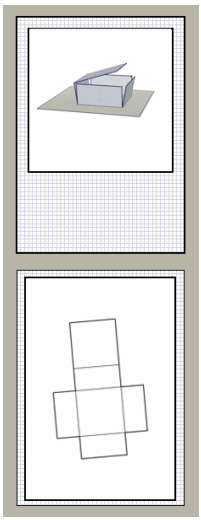
4.10 CREATING PRINTABLE NETS

Creating and printing nets
Cabri 3D lets you create nets of the polyhedra you construct. You can then print these nets and use them to create real models out of paper or cardboard.

To use this function, follow these steps:

1. Construct a polyhedron.
2. With the Open Polyhedron tool, click on the polyhedron. The polyhedron will be hidden and its net (partially folded) will appear.
3. With the Manipulation tool, select the net.
4. Choose Document-Add Net Page.

You can now print the net.



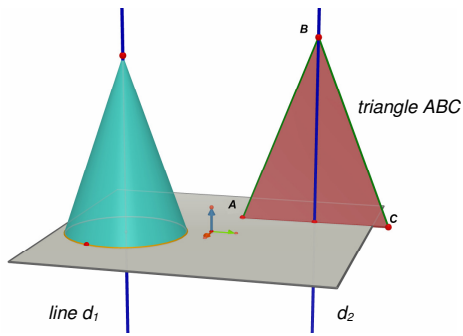
Changing the graphic attributes of nets
To change the default graphic attributes of nets (colour, line width, etc.) choose Edit-Preferences-Default Visible Styles (on a Macintosh, choose Cabri 3D-Preferences, then Default Visible Styles). Then choose Nets from the list.

Attributes can also be changed using the contextual menu. See Section [5.7] CONTEXTUAL MENUS.

COMPLEMENTARY FUNCTIONS

5.1 NAMING OBJECTS AND CREATING LABELS

Cabri 3D lets you associate text labels with the objects in your constructions. These labels can serve as notes to yourself or simply as a means of naming the various objects.



To create a label, select an object (point, sphere, line, plane, etc.) with the Manipulation tool, then enter the desired text.

Note that if you enter a number immediately following a letter, it will automatically be displayed as an index (e.g., line d_1).

To move a label, simply select it with the Manipulation tool and move it.

To change the label text, simply double-click in the text area.

To change the label font or other attributes, click the right mouse button (Ctrl-click on a Macintosh) to use the contextual menu. See section

[5.7] CONTEXTUAL MENUS.

Note : Objects may also be labelled by typing a label immediately after the object is created.

5.2 LEGENDS AND TEXT AREAS

Cabri 3D lets you create text areas that can be used for notes, legends, etc.

To create a text area, choose Document-Add Text Area.

To change the size of the text box, first click on the border to show the resize handles. Then drag one or more of these handles to resize the text box as desired.

To enter text, click in the box. Click again to reposition the cursor if necessary and then type.

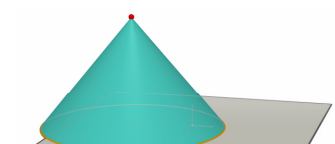


Figure # 24 - Cone - date of construction, etc.

To move the text box, again click on the border to show the resize handles. Next click (and do not release the button) inside the box and drag the box to a new location.

To change the label font or other attributes, click the right mouse button (Ctrl-click on a Macintosh) to use the contextual menu. See Section [5.7] CONTEXTUAL MENUS.

5.3 AUTO ROTATE

Cabri 3D lets you watch your entire construction rotate automatically. Make sure the Active View window is open (Window-Active View), then use the Auto Rotate slider to start rotation and control its direction and speed.

You can also start automatic rotation using the View Angle function. Hold down the right mouse button (`Ctrl` -click on a Macintosh) to activate the view angle control (see Chapter **[2] BASIC PRINCIPLES**). Change the view angle with a quick movement of the mouse to the left or right, then release the mouse button. Rotation will start. To stop the rotation, click again with the right mouse button.

5.4 CHANGING THE CENTRE OF ROTATION

By default, the vertical axis at the centre of the **VP** of the base plane is the axis around which the construction will rotate. To change the axis of rotation, right-click on a point (`Command` or `Ctrl`-click on a Macintosh) and select Centre current view from the contextual menu. The new axis of rotation will be the perpendicular from this point to the base plane, around which you can rotate the whole construction using the Auto Rotate or Changing the view angle functions.

5.5 CHANGING THE LOCATION OF THE ENTIRE CONSTRUCTION WITHIN THE WORKSHEET

To work more easily on a complex construction, it can be very useful to be able to move the entire construction within the worksheet window. To do this, all that is needed is to simultaneously press the right mouse button (`Command` or `Ctrl` on a Macintosh before pressing the mouse button) anywhere on the worksheet and press the `Shift` key. Now drag to move the construction to a new location within the window.

5.6 MODIFYING GRAPHIC ATTRIBUTES OF OBJECTS

Cabri 3D lets you change the appearance of planes and objects.

Changing the graphic attributes of existing objects
You can easily see the possible results of changing the graphic attributes of existing objects.

To do this, make sure the Styles window is open (Window-Styles). Next, use the Manipulation tool to select an object. The objects' attributes will be listed in the Styles window, and you can change them and see the results immediately.

To change the colour of an object, click the colour box to the left to display the colour palette.

You can also change objects' attributes using the contextual menu. See section [5.7] CONTEXTUAL MENUS.

Changing default attributes
You can also change the default graphic attributes Cabri 3D uses when creating new objects. To change the defaults, choose Edit-Preferences-Default Visible Styles (on a Macintosh, choose Cabri 3D-Preferences, then Default Visible Styles). You can change the defaults for all families of objects (points, lines, planes, etc.).

To change the colour of an object, click on the colour box to the left to display the colour palette.

Changes to the default attributes will not affect already existing objects. They will be applied to all new objects.

Viewing the hidden parts of objects
When you change an object's attributes you can choose to select the Render Object Hidden Parts check box.

If this option is NOT selected, objects selected will be hidden if any objects appear in front of them. If this option IS selected, objects will be visible through any objects in front of them.
.

Graphic attributes of the hidden parts of objects
You can change the graphic attributes of the hidden parts of objects. For example, the portion of a line that is hidden by a sphere could be dotted,

appear in a different colour, etc.

To change the default attributes of hidden parts of objects, choose Edit-Preferences-Hidden Styles (on a Macintosh, choose Cabri 3D-Preferences, Hidden Styles).

5.7 CONTEXTUAL MENUS

Cabri 3D provides various contextual menus. To access them, move the mouse pointer into any of the following environments, then click briefly with the right mouse button.

On a Macintosh with a single-button mouse, first hold down either the `Command` or `Ctrl` key, then click briefly.

Environment	Examples of functions provided by the contextual menu
Object	- Change graphic attributes - Some Edit menu commands
Trajectory	- Clear Trajectory Contents - Trajectory Length
Text label	- Text colour and font - Some Edit menu commands
Text area	- Text box background colour - Some Edit menu commands
Text selected in a Text area	- Text colour and font, alignment, etc. - Some Edit menu commands
Blank portion of a work area	- Show hidden objects - Background colour - Auto rotate - Some Edit menu commands
Page	- Document menu commands (Add Page, etc.) - Some Edit menu commands
Net (on a net page)	- Change graphic attributes - Some Edit menu commands

CHAPTER 6

ADVANCED NAVIGATION FUNCTIONS

6.1 THE CONCEPT OF WORK AREAS

A Cabri 3D document can include a number of pages and work areas (or "views"). No matter how many pages or work areas you create in a document, they all contain the same group of constructions. The purpose of multiple pages or views is precisely to let you see, and modify, your group of constructions from various perspectives.

6.2 CREATING NEW WORK AREAS

To understand how work areas operate, open a new document by choosing File-New. Construct an XYZ box and a sphere.

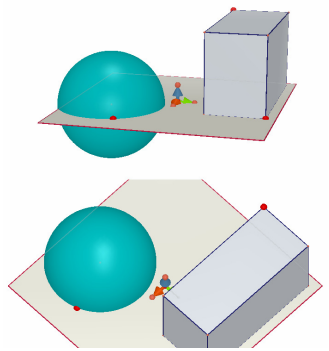
To create a new work area with a different perspective choose Document-Add View…-Dimetric k=1/2.

In this new work area you are looking at your construction from above.

To enlarge or reduce a work area, choose the Manipulation tool. Click the border of the work area to show the resize handles, then drag one or more of these handles to resize the work area as desired.

To move a work area, first click its border to show the resize handles, then click inside the work area and drag to move it.

To delete a work area, first click its border to show the resize handles, then press the `Delete` key to remove it.



Simultaneous updating of work areas
Select the Manipulation tool and change the size of the sphere or the box. As you can see, your changes are immediately visible in the bottom work area. Do the same thing again, but this time in the bottom work area. Once again, your changes are visible in the top work area as well.

If you make a change in any work area, it will always be immediately visible in all other work areas, as well as in any new work areas or pages you add to a document.

6.3 CREATING NEW PAGES WITHIN A DOCUMENT

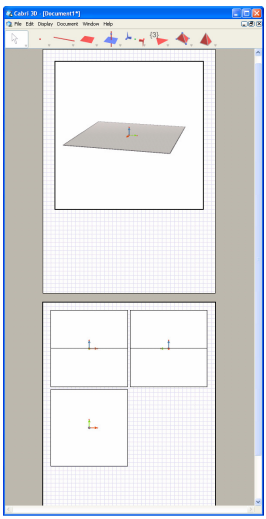
Every Cabri 3D document can contain multiple pages. Every page can also contain several work areas, as we saw in the previous section.

New page with pre-selected perspectives
To add a page to your document, choose Document-Add Page… Cabri 3D will present several choices. You can choose from a number of pre-selected perspectives for your page, as well as several paper sizes (US letter, A4, etc.). As an example, choose Technical Drawing US Layout.

Note that each new page is placed immediately following the active page.

To remove a page, click anywhere in the page to select it, then choose Edit-Delete Page.

New page with a greater choice of perspectives
Choose Document-Add Page… then select a blank page (e.g., Empty US Letter Portrait). Click in the new page to select it, then choose Document-Add View… You can now choose a view from among all the perspectives provided by Cabri 3D.



6.4 CREATING A NEW DOCUMENT WITH A CHOICE OF PERSPECTIVES

To choose a perspective when creating a new document, choose File-New From Template… You can now select one of the standard pre-selected perspectives. For a wider choice, create a blank page and select a new view with a specific perspective, as explained in the previous section.

6.5 CHANGING THE DEFAULT PERSPECTIVE AND PAPER FORMAT FOR NEW DOCUMENTS BY DEFAULT

Cabri 3D chooses the natural perspective. To change the default perspective or paper format, choose Edit-Preferences (on a Macintosh, choose Cabri 3D-Preferences), then use the Template menu to choose the format desired. In North America, for example, you might choose US Letter paper, either blank or with a specific perspective.

6.6 DISPLAY OPTIONS

The Display menu lets you change the display scale from 1:4 (reduction) to 4:1 (enlargement).

In addition, the Adjust to page command fits the whole page to the current window while the Adjust to view command fits the selected view to the current window.

The Vertical Layout, Horizontal Layout and Two Page Layout commands let you change the arrangement of pages. These commands are only available if a document has two or more pages.

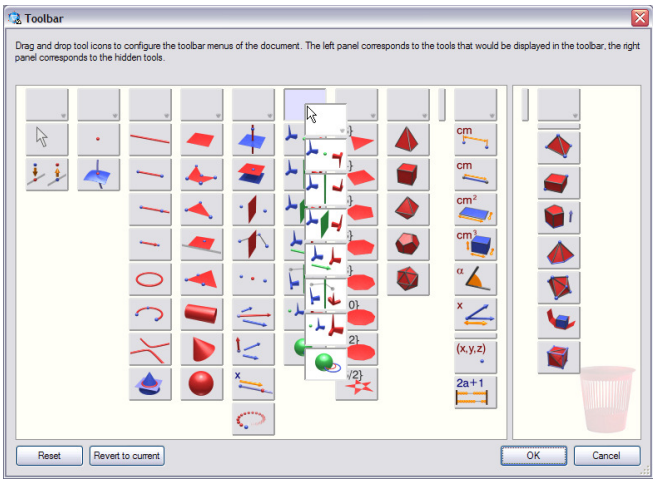
6.7 PERSONALIZING THE TOOLBAR

For each document, Cabri 3D enables you to create a customised toolbar, adapted to your needs, and to use both this toolbar and the initial default toolbar.

Elimination of tools or of a group of tools
It might be useful, particularly for teachers, to remove some tools from the toolbar to enhance the learning and understanding of specific geometrical concepts. For example, you could remove the Perpendicular tool and ask students to construct a line that is perpendicular to a given segment by using the properties of objects created with other tools.

To personalise the toolbar, select Edit-Toolbar…. In the dialog box which appears, drag all the tools that you do not want used into the right

part of the screen.



As shown above, you can also move an entire toolbox at a time. Click OK when you are finished and your customised toolbar will appear.

To move between the normal toolbar and your customised toolbar, right-click on the toolbar (Ctrl-click on a Mac) and select Full toolbar or Customized toolbar.

Changing the location of tools

The toolbar personalisation function also enables you to reorganize the order and location of tools. For example, if you construct a figure that requires the Segment tool to be used frequently, you could move this tool from its initial place in a toolbox to a position on the toolbar itself, so that you don't have to use a pull-down menu when you want to activate it.

To change the location of tools, click on Edit-Toolbar…, and simply drag the tool or toolbox to another position inside the left part of the window. As you move them, you'll see a little black stick (vertical or horizontal)

between the icons. This stick indicates where your tool or toolbox will be dropped.

Note: The toolbar in the active document is the only one which will modified.

6.8 INSERTING DYNAMIC AND STATIC CABRI 3D IMAGES IN OTHER PROGRAMS

Cabri 3D allows you to insert static bitmap images in other applications.

You can also insert dynamic images, which the user can then manipulate, in most Internet browsers (on both PC and Macintosh) as well as in Microsoft Office applications (on PCs only).

6.8.1 Exporting a bitmap image

To export a Cabri 3D image to another program you must first copy the image to the Clipboard in bitmap format. First click in a work area to activate it, then choose Edit-Copy Selected View As Bitmap and choose the desired image resolution from the sub-menu. (Note that creating a high-resolution image may take 30 seconds or more.) Paste the resulting image into the program of your choice (word processor, presentation software, etc.).

6.8.2 Inserting a dynamic image in a web page

In order to view a dynamic Cabri 3D image, it is necessary to install a free plug-in.

• **On a PC**, the plug-in is installed automatically when Cabri 3D v2 is installed. This plug-in is compatible with Internet Explorer, as well as with Netscape-based browsers (Mozilla, Firefox, etc.).

• **On a Macintosh**, the plug-in must be installed manually. To install the plug-in from the CD-ROM, open the Cabri3D Internet Plug-In folder, double-click on the Install Cabri3D Plug-In icon, then follow the instructions. The plug-in is compatible with Safari, as well as with

Netscape-based browsers (Mozilla, Firefox, etc.). It does not work with Internet Explorer.

It is also possible to download the plug-in installers from the *www.cabri.com* web site. The plug-in does not require that Cabri 3D be installed.

Once you have the plug-in installed, insert the following HTML code in a web page:

```
<object type="application/cabri3d"
     data="document_name.cg3"
     width="700" height="700">
     <param name="src" value=" document_name.cg3">

     <center>
          <a HREF="http://www.cabri.com/direct/cabri3d-
plugin">
          Download the <i>Cabri 3D</i> plug-in
          </a>
     </center>
</object>
```

The `data` and `value` parameters correspond to the name of the file to be displayed (you'll type that name again on the fourth line, after the expression « value= »); the parameters width and height correspond to the dimensions of the document in pixels.

The last two lines (before « `</object>`») give a link to the website from which the Cabri 3D plug-in may be downloaded. This will be displayed if the plug-in has not been installed.

Simpler HTML code, which does not refer to the plug-in, is as follows. Note that in this case, a visitor to your website will receive no help if they have not downloaded the plug-in.

```
<embed src=" document_name.cg3" width="500"
height="600"></embed>
```

Here, the `src` parameter is the name of the file to be displayed (including the relative path from the page), while the `width` and the `height` are its dimensions in pixels.

The use of spaces or special characters (accents particularly) in file

names is not recommended and may prevent the web page from being displayed correctly.

6.8.3 Displaying a dynamic image in a web browser

Once the Cabri 3D plug-in is installed, the image will be visible when the webpage opens. Once you press Space Bar or Enter you can both drag objects and change the view angle.

6.8.4 Inserting a dynamic image in a Microsoft Office application

On PCs only.

If you have Office 2007, go directly to section [6.8.5].

• A plug-in that enables you to view dynamic images is installed automatically when Cabri 3D is installed.

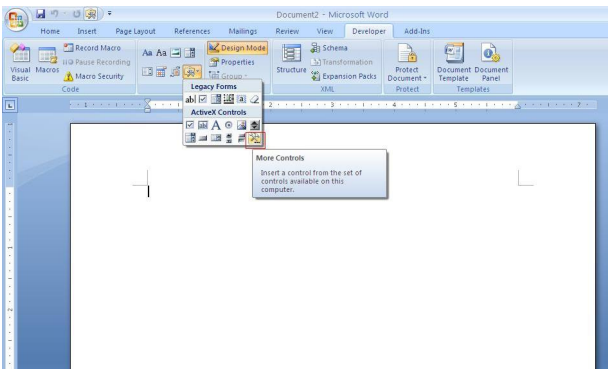
To insert a dynamic image in a Microsoft Office document (Word, PowerPoint), choose Insert-Object…-Cabri 3D. Then, using the contextual menu on the icon which will appear, choose Cabri3ActiveDoc-Import… and select the file to display. Next right-click on the static image of the file which will appear and select Cabri3ActiveDoc-Manipulate from the contextual menu. You can now drag objects and change the view angle.

The plug-in installer can also be downloaded from the *www.cabri.com* web site.

6.8.5 Inserting a dynamic image in a Microsoft Office 2007 application

On PCs only.

Show Developer Tab in the Ribbon by ticking the Show Developer tab in the Ribbon check box in the application options Popular section. Click Legacy Tools on Controls Group and then select More Controls under the ActiveX Controls category.



A pop-up dialog will appear: select Cabri 3D.

Using the contextual menu of the new object which has been inserted (right-click on the object), choose Cabri 3D Object > Import…. Select the file to display and open it. Your figure will appear.

To manipulate your figure, choose Cabri 3D Object > Manipulate, in the figure's contextual menu: your figure appears, and you can operate on it as you please.

6.9 CREATING AN HTML DOCUMENT OR A PNG IMAGE

To export your Cabri 3D constructions in an HTML or a PNG format, select Export… in the File menu. Name your figure and select the format and the quality that you want (HTML, PNG 72 dpi, PNG 300 dpi) in the pull-down menu of the window. Click on Export.

If you have created an HTML file, you'll have access to a « .cg3 » file (which opens with Cabri 3D), a PNG image of your construction, and an HTML file. You can modify many parameters of your HTML file, such as title or comments, etc. if you open the Web page with an appropriate text editor (for example Notepad on a PC).

If you have created a PNG image, you'll have access to an image that you cannot manipulate, with a low (72 dpi) or a high (300 dpi) resolution.