

CABRI® 3D



Innovative Math Tools

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**USER MANUAL**

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## INTRODUCTION

Welcome to Cabri 3D's world of spatial and solid geometry!

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 30 million people are using Cabri Geometry II and Cabri Geometry II Plus on computers and Texas Instruments graphing calculators.

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

Using Cabri 3D, 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, and you can freely manipulate, change and redefine objects as needed. With Cabri 3D, you will discover a remarkable tool to help you study and solve geometry problems.

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

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

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## 1.1 INSTALLING AND ACTIVATING THE PROGRAM

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### 1.1.1 System requirements

#### **Supported operating systems:**

**PC:** Windows 98 IE5, Me, NT4, 2000 & XP

**Macintosh:** Mac OS X, version 10.3 or higher

#### **Minimum configuration for PC:**

800 MHz or greater CPU, 256 MB or greater RAM, OpenGL compatible graphic card with 64 MB or greater RAM

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### 1.1.2 Installation

#### **Using the CD-ROM from the box version:**

**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 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](http://www.cabri.com)) or from your local distributor. You will be emailed a "license.cg3" that you must open with Cabri 3D to activate.

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### 1.1.3 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.

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.



## BASIC PRINCIPLES

## CREATING YOUR FIRST CABRI 3D DOCUMENT

2.1

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

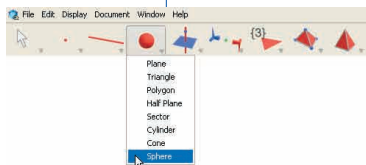
## YOUR FIRST 3D CONSTRUCTION

2.2

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 (fourth button from the left) and choose **Sphere** from the dropdown menu.



The mouse pointer changes into a pencil.

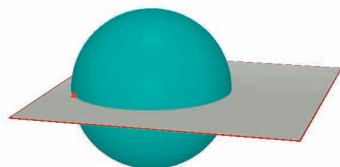
Click once about 1 cm to the left of the base plane's center point, then click again about 2 cm to the left of the first point.

You have constructed a sphere!

To modify the sphere, click and hold the **Manipulation** toolbox (the first button in the toolbar) and choose the **Manipulation** tool.

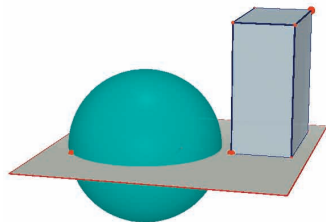
To change the size of the sphere, use the mouse to click and drag either the first or second point that you constructed.

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 next to last button in the toolbar) and choose the **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  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 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 **[5] ADVANCED FUNCTIONS**.

## 2.4

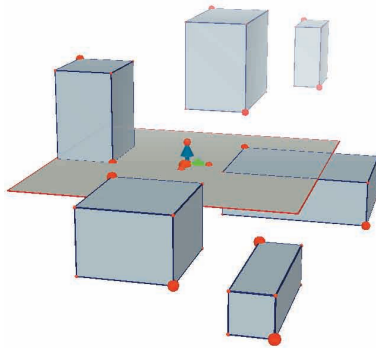
### THE CONCEPT OF PLANES

To really understand how Cabri 3D works, you need to grasp the concept 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 center 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\*.

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



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.

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

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).

## CHANGING THE VIEW ANGLE

2.5

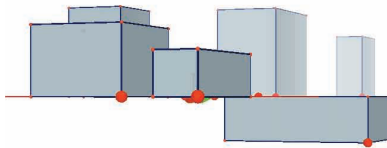
You can view your construction from various angles, as if it were contained in a glass ball that you can rotate in any direction. To change the view angle of the scene, put the mouse pointer anywhere in the work area, hold down the right mouse button, and move the mouse. Begin by moving the mouse up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

By changing the view angle, you can see that all the boxes you constructed earlier really are 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 **⌘** 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

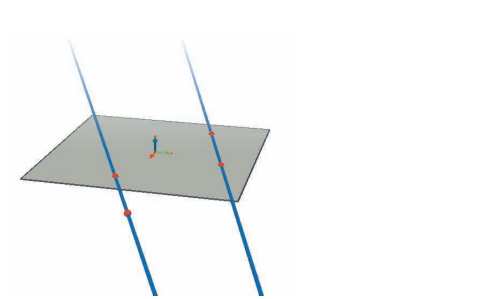
Points that are not constructed on an existing object or plane are points in space. As we saw in section [\[2.4\]](#), by default these points in space are constructed on the invisible extension of the **VP** of the base plane.


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.

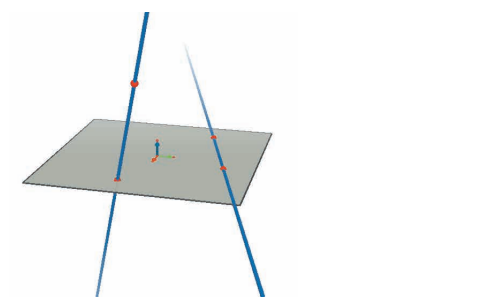
First open a new document.

Click and hold the **Curves** toolbox (third button from the left) 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  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 them 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 [4], however, this chapter can 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 colored 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](#).

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### 3.1 MANIPULATION

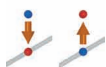
#### Manipulation



- Lets you select points and objects.
- Lets you move points and objects, and as a consequence, all objects that depend on them.

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#### Redefinition



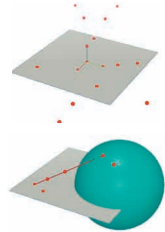
The Redefinition tool lets you change the way points can be moved. See sections [3.10] and [3.11] for an explanation of how it functions.

### 3.2 POINTS




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

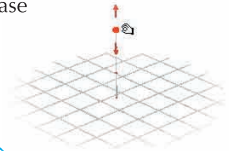
Lets you construct points in different ways. These points can then be used to anchor the construction of various objects (segments, planes, polyhedrons, etc.).

- 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 anywhere on objects. Polyhedrons, as well as polygons with 4 sides or more, are an exception: points can only be constructed on their vertices.



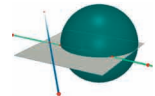
#### Point in space (above or below the base plane)

- Lets you construct points in space above or below the base plane:
  - Hold down the  key.
  - Use the mouse to move the point up or down to the desired position.
  - Click to confirm.
- To again move vertically a point constructed using the  key, use the **Manipulation** tool, again hold down the  key, and move the point.



#### Intersection point(s)

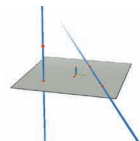
Lets you construct the intersection point or points of 2 objects (2 lines, a line and a sphere, etc.).



### 3.3 CURVES

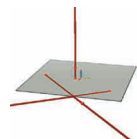
#### Line

- Lets you construct a line passing through 2 points.
- Lets you construct the line of intersection of 2 planes:
  - move the mouse pointer near the intersection between 2 planes to display the line
  - click to confirm.



#### Ray

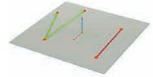
Lets you construct a ray passing through 2 points. The first point is the origin of the ray.





## Segment

Lets you construct a segment bounded by 2 points.



## Vector

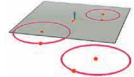
Lets you construct a vector bounded by 2 points. The first point is the origin of the vector.



## Circle

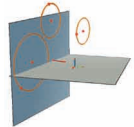
Lets you construct circles in various ways:

- A circle defined by 2 points (center and radius) on the base plane:
  - click on the **VP** to select the plane
  - construct the circle on the **VP** or the **NVP**.

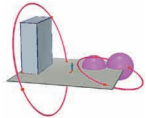


- A circle defined by 2 points (center and radius) on another plane:
  - click on the **VP** to select the plane
  - construct the center point of the circle on the **VP**
  - construct the point defining the radius, also on the **VP** (or on an existing object on the **NVP** of this plane).

Note: once constructed, the circle can be moved onto the **NVP** using the **Manipulation** tool.

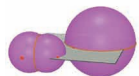
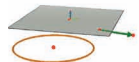
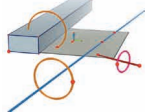


- A circle defined by 3 existing points:
  - construct the circle passing through the three points.
- A circle defined by 3 points, some of which have not yet been constructed:
  - construct the circle by selecting the existing points and then constructing the others as needed by clicking on the desired objects.



- Note: you cannot construct the first point on the **VP** of a plane (in this case select an existing point).
- A circle around a line:
    - 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 center point of the circle
    - select the vector or segment that defines the radius.

Note: the vector or segment may be situated anywhere.
  - Circle of intersection of 2 spheres or of a sphere and a plane:
    - move the mouse close to the area of intersection until the circle appears
    - click to confirm.

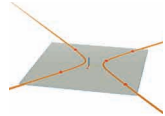


\* ray, segment, vector, edge of a polyhedron



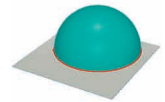
## Conic

- Lets you construct a conic passing through 5 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 5 coplanar points.
- Lets you construct a conic tangent to 5 coplanar lines.
  - select 5 lines on the same plane.
- Lets you construct the conic of intersection of a plane and a cone, sphere or cylinder:
  - move the mouse close to the area of intersection until the conic appears
  - click to confirm.




## Intersection curve



- Lets you construct the line of intersection of 2 planes.
- Lets you construct the conic of intersection of a plane and a cone, sphere or cylinder.
- Lets you construct the circle of intersection of 2 spheres.

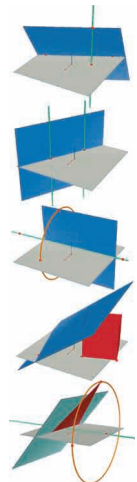


## 3.4 SURFACES

### Plane

Lets you construct new planes in various ways. To use this tool, you must construct at least one point situated above or below the base plane (this point may be situated on an object or constructed using the  key.

- A plane passing through 3 points, one of which is constructed using the  key:
  - construct (or select) 2 points on the **VP** of the base plane
  - hold down the  key and move the mouse upwards (without clicking)
  - click to confirm.
- A plane passing through 3 points.
- A plane passing through 2 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 confirm.

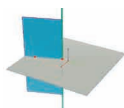


\* ray, segment, vector, edge of a polyhedron



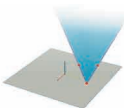
## Half-plane

Lets you construct a half-plane delimited by a line (or part of a line\*) and passing through a point.



## Sector

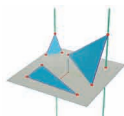
Lets you construct a sector defined by a point of origin and 2 other points.



## Triangle

Lets you construct a triangle defined by 3 points.

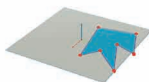
- On the base plane:
  - construct (or select) the points on the **VP** or **NVP**.
- On another plane:
  - construct (or select) the points on the **VP** (or on an object already constructed on the **NVP** of this plane)
  - once the triangle has been constructed you can move it onto the **NVP**.
- You can also construct a triangle by constructing (or selecting) any 3 points.



## Polygon

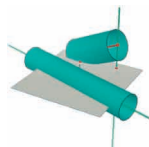
Lets you construct a polygon defined by 3 or more points. To finish a polygon, click a second time on the last point constructed (or some other point of the polygon) or press the **Enter** key (**Return** key on Macintosh).

- 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)
  - once the polygon has been constructed you can move it onto the **NVP**.
- You can also construct a polygon by constructing (or selecting) any coplanar points.



## Cylinder

- Lets you construct a cylinder around a line or a ray, which becomes the axis, and passing through a point.
- Lets you construct a cylinder around a part of a line (segment, vector or edge of a polyhedron), which becomes the axis, and passing through a point. In this case the height of the cylinder is limited by the length of the part of the line in question.

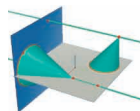


\* ray, segment, vector, edge of a polyhedron



## Cone

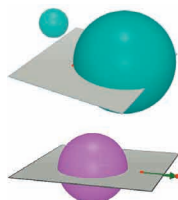
Lets you construct a cone defined by a point (the vertex) and by a circle (constructed using the **Conic** tool).



## Sphere

- Lets you construct a sphere from its center point and another point determining its radius.
- Lets you construct a sphere whose radius is determined by the length of a vector or a segment. To use this method you must:
  - construct a vector or a segment (or use an existing vector or segment)
  - construct (or select) the center point of the sphere
  - select the vector or the segment that will determine the radius.

Note: the vector or segment may be situated anywhere.



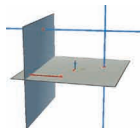
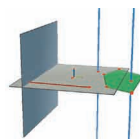
## 3.5 RELATIVE CONSTRUCTIONS



### Perpendicular (perpendicular line or plane)

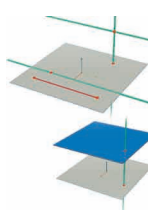
- Lets you construct a line perpendicular to a plane (or part of a plane) or a polygon.
- Lets you construct a plane perpendicular to a line (or part of a line\*).
- Lets you construct a line perpendicular to a line (or part of a line\*). To use this function you must:
  - first press and hold the **Ctrl** key (**Option** on Macintosh) during the following steps
  - select the reference line
  - select or construct a point somewhere other than on the reference line.

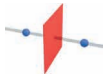
Note: to construct a point on the reference line, you must click once in the **VP** after selecting the reference line.



### 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 (or part of a plane) 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 somewhere other than on this reference plane.

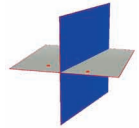




### Perpendicular bisector

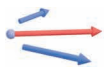
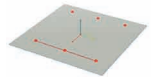
- Lets you construct a plane midway between 2 existing points, or 2 points constructed for the purpose.
- Lets you construct a plane in the middle of a segment, a vector, or the edge of a polyhedron.

Note: the plane constructed will be perpendicular to the selected part of the line or to the line defined by the 2 selected points.



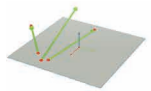
### Midpoint

- Lets you construct the midpoint between 2 points.
- Lets you construct the midpoint of a segment, a vector, or the edge of a polyhedron.



### Vector sum

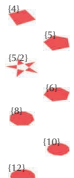
From a selected point of origin, lets you construct the vector resulting from the addition of 2 other vectors.



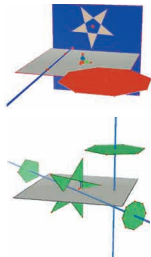
## TRANSFORMATIONS

The Transformation tools are presented in section [\[3.9\]](#)

### 3.6 REGULAR POLYGONS



- Lets you construct regular polygons on a given plane:
  - select a plane
  - construct the polygon by defining the center 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 line:
  - select a line (or part of a line\*)
  - select (or construct) a point.



### 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 the other points. This point may be constructed on an existing object or constructed by holding down the key.

\* ray, segment, vector, edge of a polyhedron




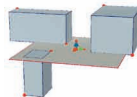
### Tetrahedron (defined by 4 points)

- Construct the first 3 points.
- To construct a three-dimensional tetrahedron, construct the 4<sup>th</sup> point on another plane, either on an existing object or using the  key.



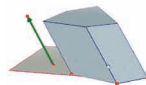
### XYZ Box (defined by a diagonal)

- 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 this second point on a different plane from the first, on an existing object, or using the  key.




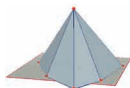
### Prism (defined by a polygon and a vector)

- 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 a polygon and a vector.




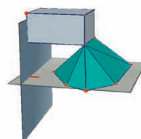
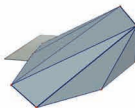
### Pyramid (defined by a polygon and a point)

- 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  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 3 or more points, then add one or more points on another plane (using an existing object or the  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 Macintosh).
- Lets you construct a polyhedron that incorporates existing objects:
  - Use the **Convex Polyhedron** tool to select one or more of the following objects: polygons, segments, edges of polyhedrons, 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.

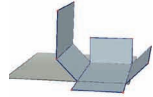
- To finish the construction, click a second time on the last point constructed (or some other point of the construction) or press the **Enter** key (**Return** key on Macintosh).



### Open Polyhedron

- Lets you open the faces of a polyhedron (and then lay them flat in order to create a pattern).
- 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 **↑** key.
- To open the face(s) in multiples of 15°, hold down the **Ctrl** key (**Option** on Macintosh).

Once you have created a polyhedron pattern, you can print it and use it to create a real model. See Section [\[4.7\]](#) **CREATING PRINTABLE PATTERNS (NETS)**.



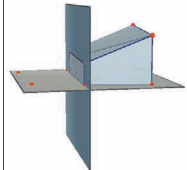
### Cut polyhedron

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 Changing the View Angle function (section [\[2.5\]](#)) to rotate the construction.

To show the hidden part of the polyhedron, use the Mask/Show function (section [\[4.3\]](#)).

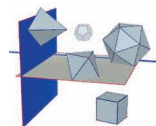


## 3.8 REGULAR POLYHEDRA

### Regular Polyhedra (Platonic solids)

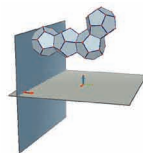
- Lets you construct a polyhedron directly:
  - Select a plane.
  - Construct a first point.
  - Construct a second point. The second point must be placed on the **VP** of the selected plane (or on an existing object on the **NVP** of this plane).

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 of the same type as the polyhedron to be constructed.
- Or, use the appropriate **regular polyhedron** tool to select a face of a polyhedron (i.e., a polygon) of the same type as 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** key on Macintosh).



### 3.9 TRANSFORMATIONS



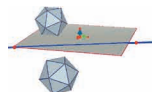
#### Central symmetry (defined around a point)

- Select the object (or part of an object) to be transformed.
- Select (or construct) a point as the center of symmetry.



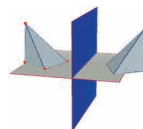
#### Half-turn (defined around a line or part of a line\*)

- Select the object (or part of an object) to be transformed.
- Select a line (or part of a line\*) as the axis of symmetry.



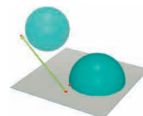
#### Reflection

- Select the object (or part of an object) to be transformed.
- Select a plane (or part of a plane\*\*) as the plane of symmetry.



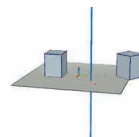
#### Translation (defined by a vector or 2 points)

- First select a vector or 2 points (or construct the points directly).
- Select the object (or part of an object) to be transformed.



#### Rotation (around an axis and points)

- Select the object (or part of an object) to be transformed.
- Select a line (or part of a line) as axis of rotation.
- Select (or construct) 2 points.



\* ray, segment, vector, edge of a polyhedron

\*\* half-plane, sector, polygon

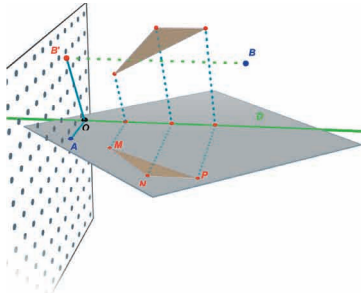
### Example of advanced use of Rotation around an axis and points

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

The angle of the rotation is the angle between the 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  $(\overrightarrow{OA}, \overrightarrow{OB'})$ ,  $B'$  being the orthogonal projection of  $B$  on the plane perpendicular to  $D$  and passing through  $A$ .



### IMPORTANT INFORMATION ABOUT POINTS AND THE REDEFINITION TOOL

3.10


#### Points are linked to the objects on which they are constructed

Normally points are "attached" to the objects on which they were constructed. A point constructed on a sphere, for example, cannot be moved onto another object or onto a plane.

Points constructed on the **VP** of a plan may be moved, but only onto the **NVP** of the plane, and not onto other objects.

To "free" these points you must use the **Redefinition** tool. See section [3.11] for an explanation of how it functions.

#### Moving points in space above or below the base plane

Points that were originally constructed in space or on the **NVP** of the base plane may be moved vertically above or below the base plane (by using the **Manipulation** tool and holding down the  key).

However, points that were originally constructed on an object or on the **VP** of the base plane cannot normally be moved vertically in space. To "free" these points you must use the **Redefinition** tool. See section [3.11] for an explanation of how it functions.


**Note:** if you wish to construct points on the **VP** of the base plane that can be moved vertically without using the **Redefinition** tool, you must first construct them on the **NVP** and then move them onto the **VP**.

### 3.11 USING THE REDEFINITION TOOL


To “free” a point, in order to then move it from one object to another (from a sphere to a plane, or from a plane to a vertex of a polyhedron, for example), you must use the **Redefinition** tool, which is found in the **Manipulation** toolbox (the first button in the toolbar). To use the **Redefinition** tool:

- click once to select the point to be redefined (then release the mouse button)
- move the mouse towards the new object (without clicking)
- 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 the **VP** of a plane or on an object into a point in space (which can then be moved vertically above or below the base plane). To do this:

- click once to select the point to be redefined (then release the mouse button)
- move the mouse towards a new destination (without clicking)
- to move the point vertically hold down the  key
- click a second time to confirm.

### 3.12 KEYBOARD-CONTROLLED SHORTCUTS AND FUNCTIONS

Function	PC	Macintosh
Selecting more than one object using the <b>Manipulation</b> tool	Hold down the <b>Ctrl</b> key and select all required objects	Hold down the  key and select all required objects
Delete selected objects	Press <b>Delete</b>	Press <b>Delete</b>
Stop construction of an unfinished object (e.g., stop constructing a triangle after creating 2 of its 3 points)	Press <b>Esc</b>	Press <b>Esc</b>
Cancel the selected tool and choose the <b>Manipulation</b> tool	Press <b>Esc</b>	Press <b>Esc</b>

Function	PC	Macintosh
Deselect a selected object	Press <b>Ctrl</b> +clíc	Press <b>⌘</b> +clíc
Construct a point or an object above or below the base plane	Hold down the <b>⌘</b> key, move the point vertically, then click	Hold down the <b>⌘</b> key, move the point vertically, then click
Move vertically an existing point or object constructed above or below the base plane	Hold down the <b>⌘</b> key, then move the object vertically	Hold down the <b>⌘</b> 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 <b>Ctrl</b> + <b>⌘</b> keys, then move the object vertically	Hold down the <b>Option</b> + <b>⌘</b> 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 <b>Ctrl</b> key, then move the object horizontally	Hold down the <b>Option</b> key, then move the object horizontally

### A USEFUL TECHNIQUE FOR MANIPULATING OBJECTS

3.13

#### 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 orientation of a line, etc. Simply select a point or an object, hold down the mouse button and move 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 temporarily grow bigger, while the others will stay their normal size.



## COMPLEMENTARY FUNCTIONS

## CREATING TEXT LABELS FOR OBJECTS

4.1

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

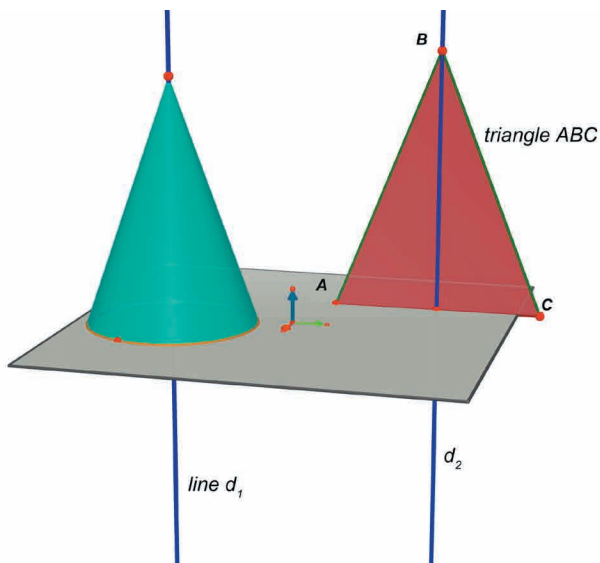
To create a label, select an object (point, sphere, line, plane, etc.) with the **Manipulation** tool, then enter the desired text.

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 Macintosh) to use the contextual menu. See Section [4.8] **CONTEXTUAL MENUS**.



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

To create an independent text area, choose **Document-Add Text Area**.

To change the size of the text box, first click 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 outside the text box to hide the resize handles, then click in the box to type.

To move the text box, again click the border to show the resize handles. Next click inside the box and move it using the cross pointer that appears.

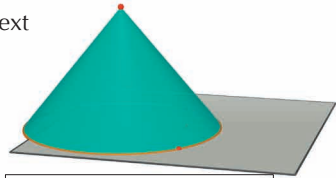


Figure # 24 - Cone - date of realisation, etc.

To change the label font or other attributes, click the right mouse button (**Ctrl**-click on Macintosh) to use the contextual menu. See Section **[4.8] CONTEXTUAL MENUS**.

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-Mask/Show** to hide it. To select several items, hold down the **Ctrl** key (**⌘** on Macintosh).

To show an hidden object, you must first display all hidden objects to choose it. Make sure the Active View window is open (**Window-Active View**), then click the **Show Masked Objects** check box. Outlines of all hidden objects will appear.

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

Please note that the outline display of masked objects only applies to the currently selected work area ("view"). To learn more about creating multiple work areas, see Chapter [5] **ADVANCED FUNCTIONS**.

## ANIMATION

4.4

Cabri 3D enables you to create automatic animations of your objects. By creating a moving point on a circle or a segment, 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 on the right. Then construct a new point on the circle and a new point on the segment as shown.

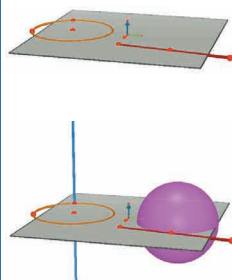
Use the **Perpendicular** tool to construct a line passing through the last point you added to the circle. Next use the **Sphere** tool to construct the center of a sphere about 1 cm behind the last point you constructed on the segment. Then use this same point to define the radius of the sphere. Your construction should look like the illustration on the right.

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 greater 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 AUTO ROTATE

Cabri 3D lets you watch your construction rotate on its axis. 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 Macintosh) to activate the view angle control (see Chapter [\[2\] BASIC PRINCIPLES](#)). Change the view angle with a quick movement of the mouse left or right, then release the mouse button. Rotation will start. To stop the rotation, click on the right mouse button again.

---

## 4.6 MODIFYING OBJECTS' GRAPHIC ATTRIBUTES

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 color of an object, click the color box to the left to display the color palette.

You can also change objects' attributes using the contextual menu, see Section [\[4.8\] 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 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 color of an object, click on the color box to the left to display the color 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 attributes you can choose to select the [Render Object Hidden Parts](#) check box.

If this option is NOT selected, objects in the selected family 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 color, etc.

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

## **CREATING PRINTABLE PATTERNS (NETS)**

4.7

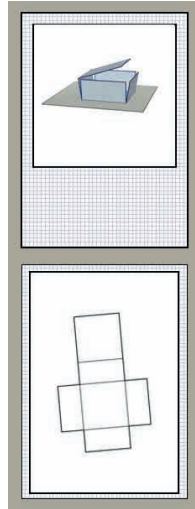
### **Creating and printing patterns**

Cabri 3D lets you create patterns ("polyhedral nets") from the polyhedra you construct. You can then print these patterns 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.
3. With the [Manipulation](#) tool, select the polyhedron.
4. Choose [Document-Add Net Page](#).

You can now print the pattern.



### Changing the graphic attributes of patterns

To change the default graphic attributes of patterns (color, line width, etc.) choose [Edit-Preferences-Default Visible Styles](#) (on 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 [\[4.8\] CONTEXTUAL MENUS](#).

## 4.8

### 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 [⌘](#) or [Ctrl](#) key, then click **briefly**.

Environment	Examples of functions provided by the contextual menu
Object	<ul style="list-style-type: none"> <li>- Change graphic attributes</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>
Text label	<ul style="list-style-type: none"> <li>- Text color and font</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>
Independent text box	<ul style="list-style-type: none"> <li>- Text box background color</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>
Text selected in an independent text box	<ul style="list-style-type: none"> <li>- Text color and font, alignment, etc.</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>
Blank portion of a work area	<ul style="list-style-type: none"> <li>- Background color</li> <li>- Auto rotate</li> <li>- Show masked objects</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>
Page	<ul style="list-style-type: none"> <li>- <a href="#">Document</a> menu commands (Add Page, etc.)</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>
Pattern (on a net page)	<ul style="list-style-type: none"> <li>- Change graphic attributes</li> <li>- Some <a href="#">Edit</a> menu commands</li> </ul>



## ADVANCED FUNCTIONS

## THE CONCEPT OF WORK AREAS

5.1

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 your group of constructions from various perspectives.

## CREATING NEW WORK AREAS

5.2

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

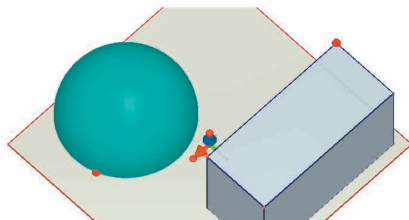
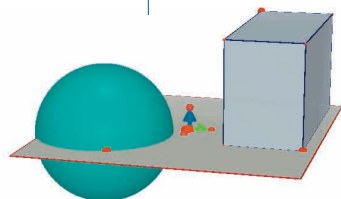
**To create a new work area** with a different perspective choose **Document-Add View...-Dimetric  $k=1/2$** .

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.

## 5.3

### CREATING NEW PAGES WITHIN A DOCUMENT

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

#### New page with pre-selected perspectives

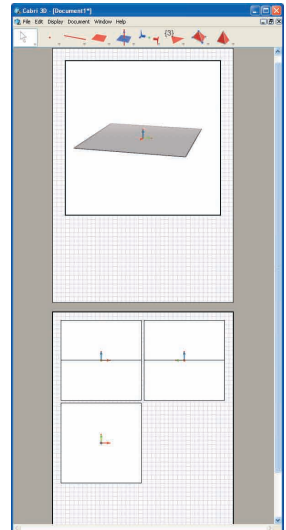
To add a page to your document, choose **Document-Add Page...** Cabri 3D will present several choices. You can choose from a number of pre-selected perspectives for your page, as well as several paper sizes (US letter, A4, etc.). As an example, choose **Technical Drawing US Layout**.

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.



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## CREATING A NEW DOCUMENT WITH A CHOICE OF PERSPECTIVES

5.4

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.

---

## CHANGING THE DEFAULT PERSPECTIVE AND PAPER FORMAT FOR NEW DOCUMENTS

5.5

By default, Cabri 3D chooses the natural perspective. To change the default perspective or paper format, choose [Edit-Preferences](#) (on 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.

---

## DISPLAY OPTIONS

5.6

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

As well, the [Adjust to page](#) command fits the whole page in 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.

---

## EXPORTING DYNAMIC AND STATIC CABRI 3D IMAGES

5.7

Cabri 3D allows you to export dynamic images, which the user can then manipulate, to Microsoft Office applications (on PC only) and to most Internet browsers (on both PC and Macintosh). You can also export static bitmap images to other applications.

---

### 5.7.1 Inserting a dynamic image in a Microsoft Office application

**Instructions for PC:** In Windows, an ActiveX control is used to view Cabri 3D documents. In a Microsoft Office document (Word, PowerPoint), choose [Insert-Object...-Cabri 3D](#). Then, using the contextual menu, choose [Object Cabri3ActiveDoc-Import...](#) and select the file to display. Next choose [Object Cabri3ActiveDoc-Manipulate](#) in the contextual menu.

To view a dynamic image in a Microsoft Office application, Cabri 3D must be installed on the computer (either the demo or the full version).

**Instructions for Macintosh:** This function is not available.

---

### 5.7.2 Inserting a dynamic image in a web page

In a web page, insert the following HTML code:

```
<embed src="document-name.cg3" width="500"
height="600"></embed>
```

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.

---

### 5.7.3 Displaying a dynamic image in a web browser

**Instructions for PC:** The plug-in that enables you to view a dynamic image is compatible with Internet Explorer, as well as with Netscape-based browsers (Mozilla, Firefox).

To view a dynamic image in a web browser, Cabri 3D must be installed on the computer (either the demo or the full version).

**Instructions for Macintosh:** To view a dynamic image on Macintosh you must first install a plug-in. To install it from the Cabri3D CD-ROM, open the Cabri 3D Internet Plug-in folder, then double-click the Install Cabri 3D Plug-In icon and follow the instructions. The plug-in installer can also be downloaded from the [www.cabri.com](http://www.cabri.com) web site.

The dynamic image plug-in for Macintosh is compatible with Safari, as well as with Netscape-based browsers (Mozilla,

Firefox). It does not work with Internet Explorer.

## Exporting a bitmap image

5.7.4

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.).