

3D Design Modeling and Mathematics

Copyright © aspexSoftware

All rights reserved. Neither the whole or part of the information contained in this manual may be adapted or reproduced without written approval from aspexSoftware. The products in this manual are subject to continuous development and improvement and all information of a technical nature and particulars of the products and their use, including the information and particulars in this manual, are given by aspexSoftware in good faith. However this information is provided on the understanding that aspexSoftware cannot accept any responsibility for any loss or damage arising from the use of any information or particulars in this manual.

ISBN 1-894170-02-4

Windows is a trademark of Microsoft Corporation.

USA/Canada www.knowledgetree.ca
tabs@knowledgetree.ca

UK/R.o.W www.aspexsoftware.com
tabs@aspexsoftware.com

Contents

aspex Tabs ^{MST}	Preamble	4
	Overview	5
	Edit Window	6
	View Window	7
	Output Window	8
Toolbar Buttons		10
Creating Shapes Manually		14
	<i>Cuboid</i>	
	<i>Cylinder</i>	
	<i>Cone</i>	
	<i>Regular Prism</i>	
	<i>Pyramid</i>	
	<i>Sphere</i>	
	<i>Wedge</i>	
	<i>Torus</i>	
	<i>Platonic</i>	
Creating Shapes Manually		16
	<i>Irregular Prism</i>	
	<i>Solid of Rotation</i>	
Creating Shapes Automatically		18
	QuickShapes	
	Shape Assistant	

Quick Start Manual

The Quick Start Manual provides a basic overview of aspexTabs and contains information to enable the new user to draw simple 3D shapes on the screen and to display their Nets and Projections.

Expanded and updated versions of the aspexTabs manual will from time to time be made available in pdf format for download from:

www.aspexsoftware.com

www.knowledgetree.ca

aspex**Tabs**

Preamble

Geometry is all around us, very many structures both natural and man-made comprise combinations of 3D and 2D geometrical shapes. Look around and try to recognise how many cuboids, spheres, pyramids, prisms there are in the objects that you can see, touch and use everyday.

You might notice that your computer is made up of different sized cuboids and prisms. How about the table or chair you are sitting on, the door to the room, or the filing cabinet?

The Saturn V Rocket for example can be visualised as a structure consisting mainly of cylinders and cones.

aspex**Tabs** enables you to investigate a whole variety of 3D shapes. Create 3D shapes, change their properties, make them long and thin, or short and fat, and combine them with other shapes to make complex 3D shapes or models;

aspex**Tabs** provides a variety of ways to investigate 3D objects and space; making computer models which can be rotated as if in space (ie, in virtual space), transforming 3D shapes, generating projections and nets, and physically folding paper or card shapes.

aspex**Tabs** provides a medium to apply traditional geometrical concepts practically and improves the student's ability to recognize, visualize, represent and transform geometric shapes.

aspex**Tabs** helps students to become more spatially aware. Students will learn to apply their awareness and knowledge of the properties of shapes in the real world.

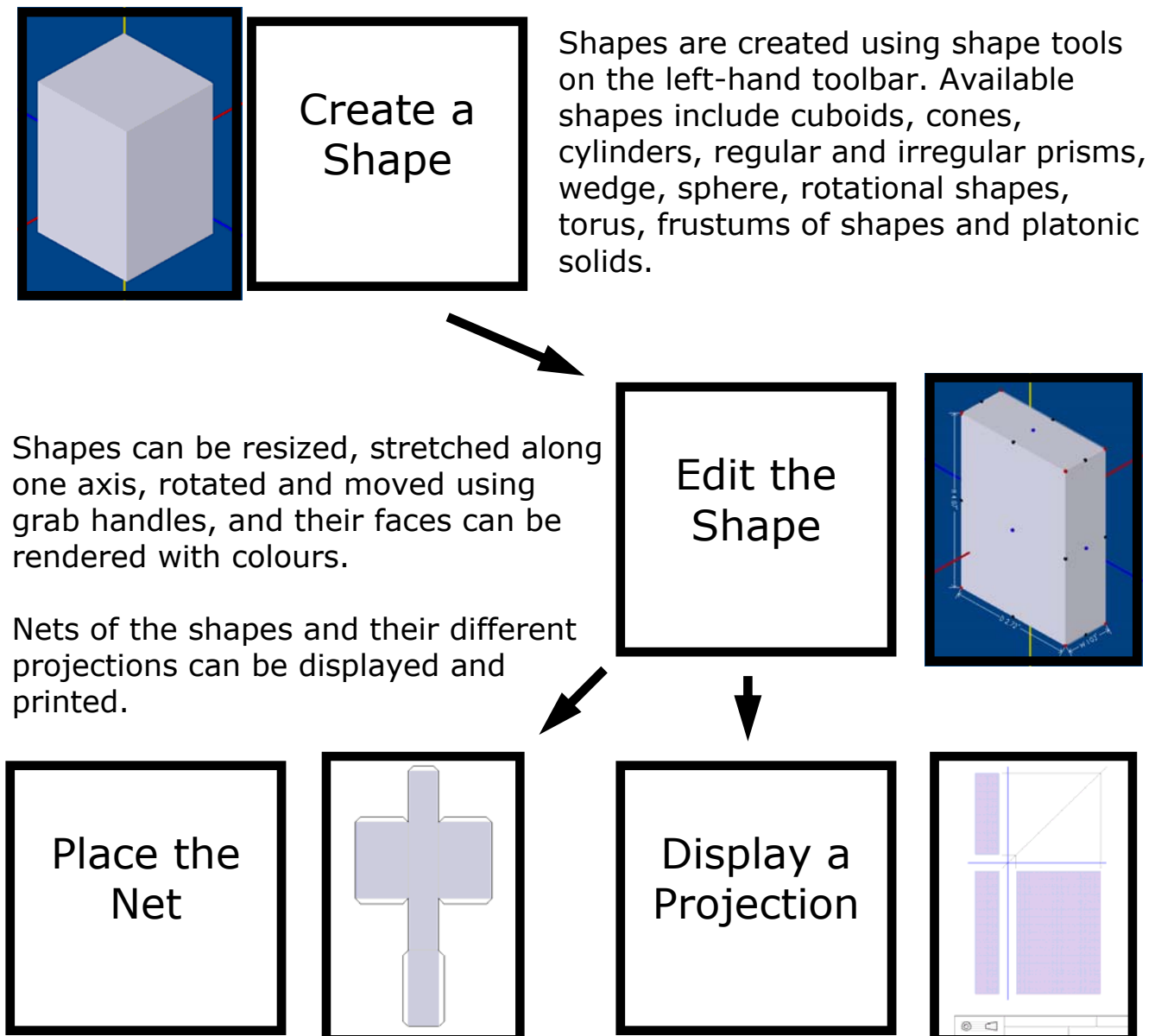
aspex**Tabs** provides the easiest method of creating 3D shapes.

Overview

aspex**Tabs** is a tool for drawing and manipulating 3D shapes, enabling students to understand geometric shapes, their properties and to learn simple 3D Computer Aided Design. Models are constructed from combinations of cuboids, cones, prisms and other mathematical shapes and can be displayed on the screen in the following ways :

1. As a 3D solid or wireframe image of the whole model.
2. As Nets of the individual shapes.
3. Mathematical projections; 3rd Angle for example.

The diagram below shows the basic aspex**Tabs** design flow.



aspeXTabs

Edit Window

Shapes are drawn in the Edit Window and displayed there in **orthographic** view, which means that all dimensions, near or far, appear at the same scale. In the Edit Window shapes can be edited, manipulated and combined to make more complex 3D models. Shapes can be resized, stretched and rendered with colours.

Shapes can be:

- Grouped together
- Duplicated
- Scaled
- Cloned
- Locked
- Rendered with colours
- Dimensioned

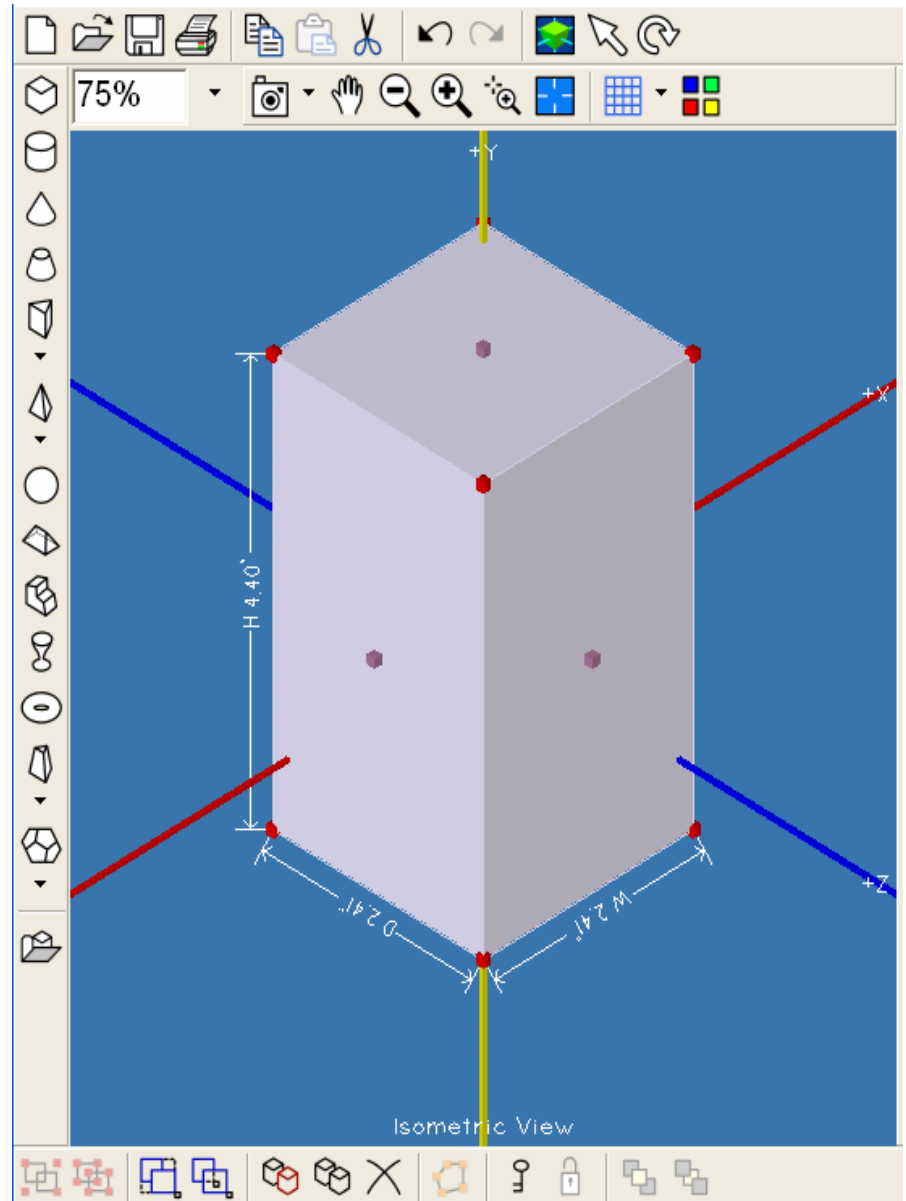
Grab handles:

- Resize the whole shape.
- Stretch one face only.
- Rotate in X, Y or Z axis

Display shapes in different view modes:

- Left
- Right
- Front
- Back
- Top
- Bottom
- Isometric

Perspective views of the shapes are displayed in the View Window.



Shapes are drawn using the mouse and shape tools. They can also be created using a **Create Shape Assistant**. To use this feature, ensure that nothing is selected, and select 'Create Shape Assistant...' in the context sensitive menu of the Edit window. You may then select the required shape type from a list and enter size parameters and X,Y,Z coordinates.

View Window

When the View Window is displayed, the 3D model is shown in **perspective** view. In perspective view dimensions which are further away are shown smaller than nearer dimensions, giving the appearance of a real life scene. In this window the individual faces of each shape can be selected and rendered with colours as can whole shapes.

The 3D scene can be:

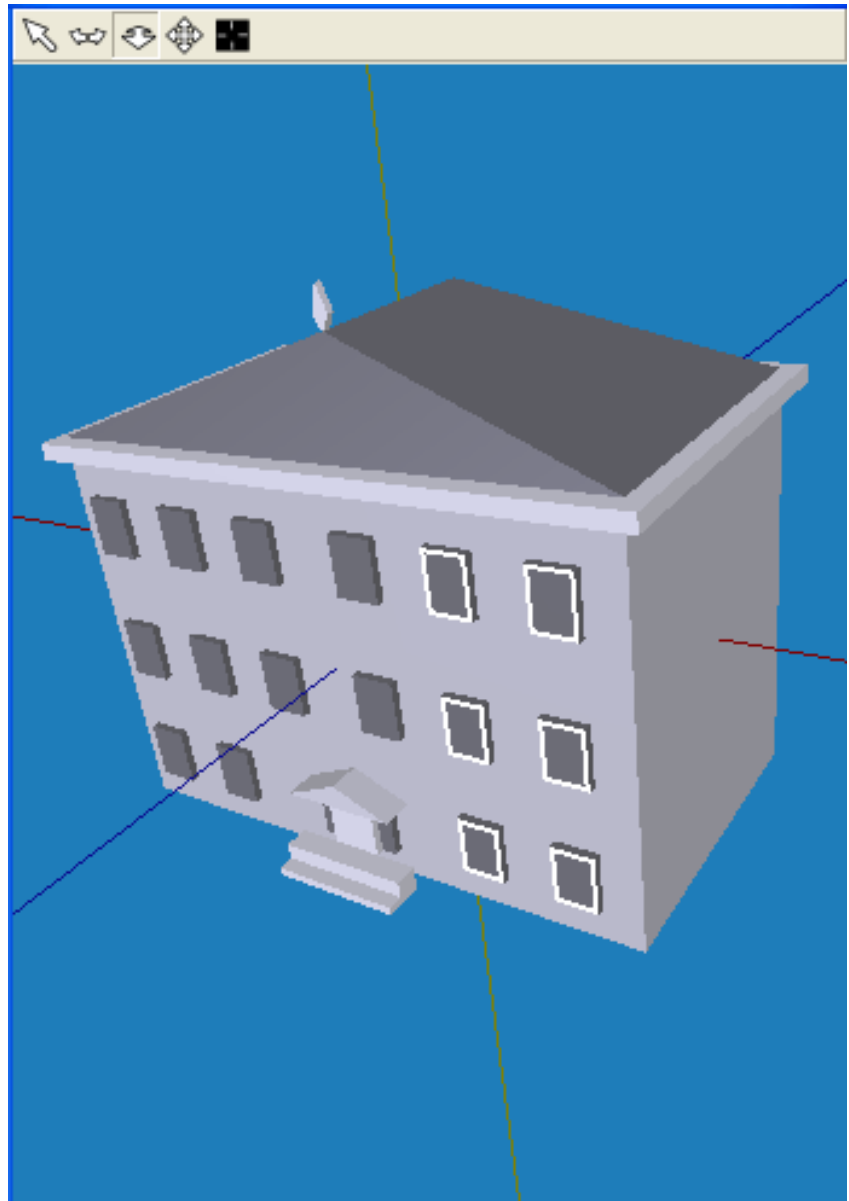
- Moved around (Panned)
- Rotated in all axes
- Zoomed close and far
- Tumbled in X,Y or Z axis
- Reset to centre
- Set to the position of the scene as displayed in the Edit Window

Shapes:

- Select shapes and render with colours or images:
 - Grouped shapes
 - Single shapes
 - Single faces

Perspective / Orthographic views:

The View Window displays the **perspective** view of the shapes. Orthographic views of the 3D scene are displayed in the Edit Window.



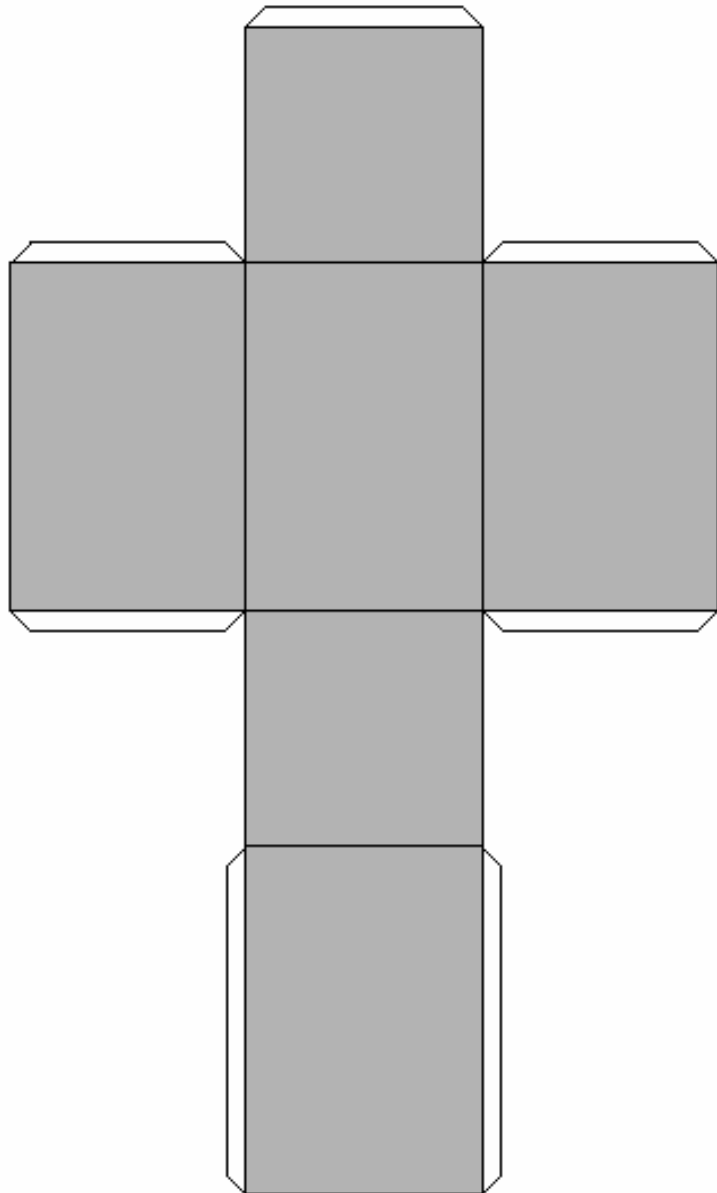
The View Window is handy when you want to see the whole model from any angle. In the View Window it is quick and easy to rotate and move the model using the mouse, and you can easily compare the orthographic and perspective views.

Output Window—Nets

The Output Window on the right of the screen has a white background. It's function is to display Nets of shapes which aspex**T**abs can output, and also to display the 3D model in different projections, third-angle projection for example (see page 9).

Nets can be:

- Moved around.
- Resized.
- Scaled.
- Rotated.
- Ordered front / back
- Zoomed near / far
- Displayed with or without their 'tabs'.
- Some nets can be displayed in different permutations. For example, a cuboid net can be displayed in 16 different ways.



To display a net, select a shape in the Edit window and click 'Place Nets' in the Edit window context sensitive menu. Multiple nets of the same shape can be placed. Once a net has been placed it will not be affected by any subsequent editing of the original shape. If the 3D shape is edited further, a new net can be placed alongside the previous one. Nets can be printed out and built into real world models.

Output Window—Projections

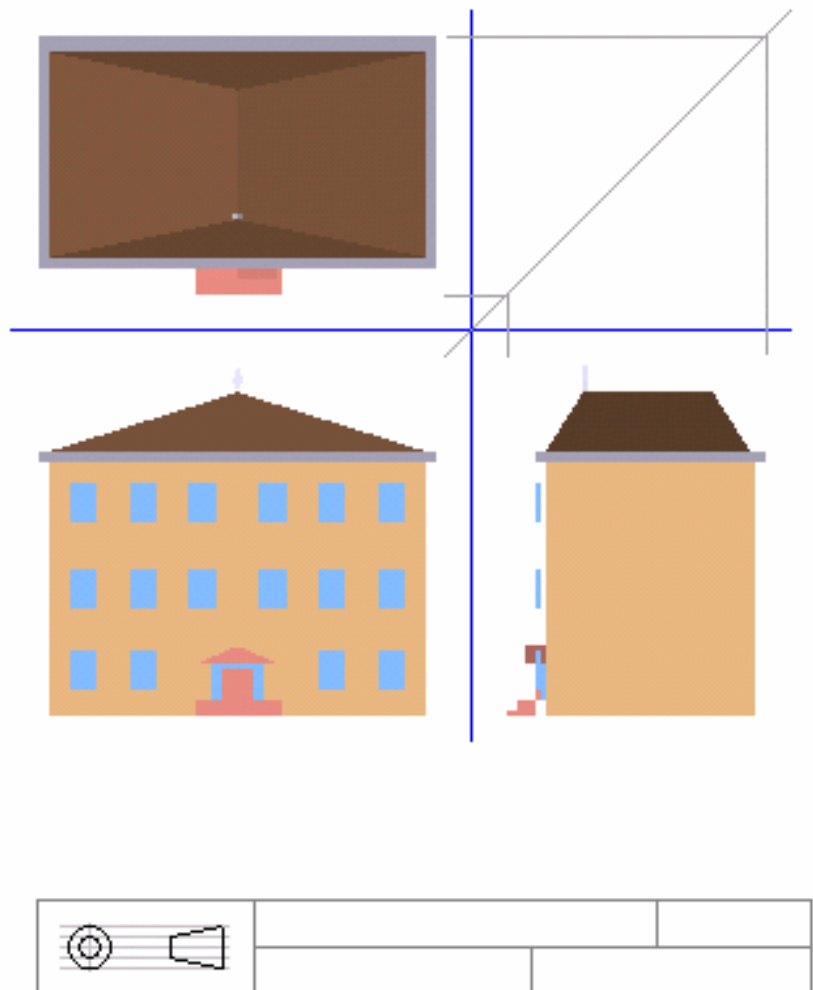
The Output Window is the one with the white background and on the right of the screen. Its function is to display the 3D model in different projections, for example third-angle projection. The Output Window is also used to display the nets/projections of all the shapes that aspex**T**abs can generate, or output (see page 8).

Projections can be:

- Moved around (Panned)
- Zoomed close and far
- Resized
- Scaled
- Displayed with construction lines and info box
- Displayed as:
 - Solid
 - Outline
 - With hidden lines

Projection types:

- 3rdAngle
- 1stAngle
- Left-Right views or both
- Single projections
 - Top / Bottom
 - Front / Back
 - Left / Right
 - Isometric



The illustration above is a 3rdAngle projection of the model of a house showing the front, plan and right-side elevations. The type of projection is changed using the context sensitive menu of the Output window. The image can be displayed in colour or with a black outline only, with hidden lines, and it can also be printed out.

aspex**Tabs**

Toolbar Buttons



Select

The **select** button enables you to resize a shape or stretch individual faces using grab handles on the selected shape.



Rotate

The **rotate** button enables you to rotate a shape in the X, Y and Z axis using grab handles. The axis of rotation is determined by clicking the axis button at the centre of a face.

Below are the toolbar buttons for the different shapes one can draw in **aspexTabs**. Some of the buttons have a drop down menu associated with them providing access to variations on the selected shape button. For example the drop down menu for the Regular Prism will allow the selection of triangular based, rectangular based, pentagonal based prisms etc.



Cuboid



Cylinder



Cone



**Frustum of
Cone**



Regular Prism



Pyramid



Sphere



Wedge



**Frustum of
Pyramid**



Torus



Irregular

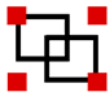


Rotational



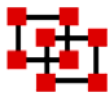
Platonic

Toolbar Buttons



Group

The **Group** button is used to group selected shapes. The grouped shape can be move about, re-sized and rotated like a single shape.



Ungroup

Use the **Ungroup** button to ungroup a selected grouped shape.



Select All

Click **Select All** to select all the shapes in the Edit Window. This action might precede a group action for example.



De-select All

The **De-select All** button is used to remove any selections that may be active at the time.



Duplicate

Use the **Duplicate** button to duplicate a selected shape. The effect is the same as copy / paste.



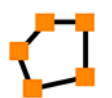
Clone

Clone is similar to duplicate but the copied shape is placed in exactly the same place as the original.



Delete

Delete the selected shape; note that the shape will not be placed on the clipboard.



Edit

In **aspexTabs**, irregular prisms and rotational shapes can be path edited.



Lock

Locks the selected shape and makes it transparent. This is very useful for placing or editing shapes in the background.



Unlock

Unlocks all currently locked shapes.

aspex**T**abs

Toolbar Buttons



Bring to Front Bring a NET to the front of all the other NETs.



Put to Back Put a NET to the back of all the other NETs.



View Window Display the View Window.



Camera Orientation

The display in the Edit Window can be changed to show the top, front, bottom, left, right and isometric views.



Pan

Move the entire display around on the screen.



Zoom Out

Make the entire display smaller by zooming it further away.



Zoom In

Make the entire display larger by zooming it closer.



Drag Zoom

Only the part of the display bounded by the drag-zoom box will zoom closer. The object of interest will zoom to the centre of the view.



Centre

Reset the entire display so that the axes return to the central position.



Grid

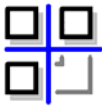
Switch the grid on or off.

Toolbar Buttons



Colours

Opens the palette window so that colours can be rendered on to shapes.



Projections

Display different projections of the shape or model in the Output Window. The Output Window can either display Nets or Projections.



Nets

Display Nets of the shape in the Output Window. The Output Window can either display Nets or Projections.



Fit to screen

The Output Window will shrink or expand to fit the available space.



Edit Window

Display the Edit Window and not the Output Window.



Edit / Output Windows

Display both the Edit and the Output Windows.



Output Window

Display the Output Window but not the Edit Window.

Creating Shapes

Shapes are created in the Edit Window. Shapes can be drawn in whatever view is already set by the camera button ie, **front, bottom, left, right, top, bottom** or **isometric view**.

At first it is best to create a shape with the Edit Window set to **isometric** view. In this case the user sees the 3D view of the shape at the outset, rather than only the front or the side view, etc.

There are different methods of creating shapes in aspex**T**abs:

Creating a shape manually:

1. **Simple:** Create a shape in one mouse movement. Select the desired shape tool by clicking the relevant button on the left hand toolbar. Then either 'click-drag-click' or 'press-move-release' with the mouse in the Edit window.

Once the shape is drawn, you can look at it in different views, **top, side** etc by selecting a view position with the camera button, and you can move the shape around to position it precisely in 3D space.

The simple method enables the user to create a shape quickly and easily, and then move the shape in different planes or views to position it in 3D space.

2. **Advanced:** To use the Advanced method, select 'Preferences...' from the File menu. In the Preferences window, set the 'Place Shapes In Z' option to ticked.

The advanced method allows the user to draw the **front view** of the shape only, which can then be positioned in the Z (depth) plane before the **side view** is drawn. This method therefore enables the user to create a shape and place it accurately in 3D space in one operation.

As you progress you will find this method makes constructing more complex models much easier.

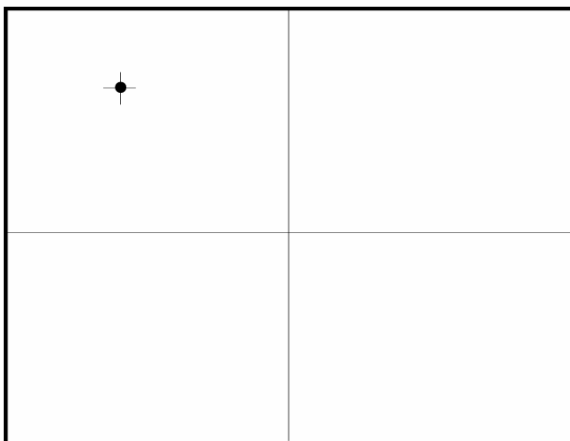
Creating Shapes

Creating a shape manually

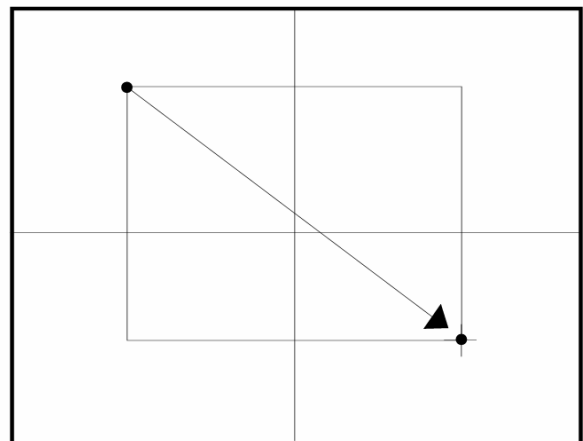
1. To create the following shapes:

Cuboid	Sphere
Cylinder	Wedge
Cone Regular	Torus
Prism Pyramid	Platonic

Select the desired shape tool, click in the Edit-Window, move the mouse to draw the shape and click to finish. Alternatively, select the shape button, press the mouse in the Edit Window, drag the mouse and release the button.



Click the mouse in the Edit Window.



Drag the mouse and click to finish.

To create the following shapes:

Frustum of a Cone
Frustum of a Regular Pyramid

Draw these shapes exactly as described above but instead of the 'finishing', aspex**T**abs will wait for the user to move the mouse to set the top width of the shape.

Select the shape button then click-move-click in the Edit Window to draw the basic shape then move the mouse to set the top width and click to finish.

aspex**T**abs

Creating Shapes

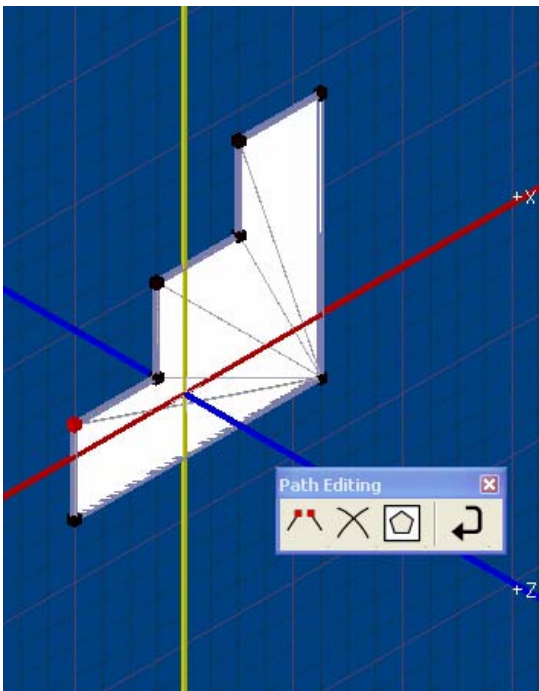
To create the following shapes:

Irregular Prism
Solid of Rotation

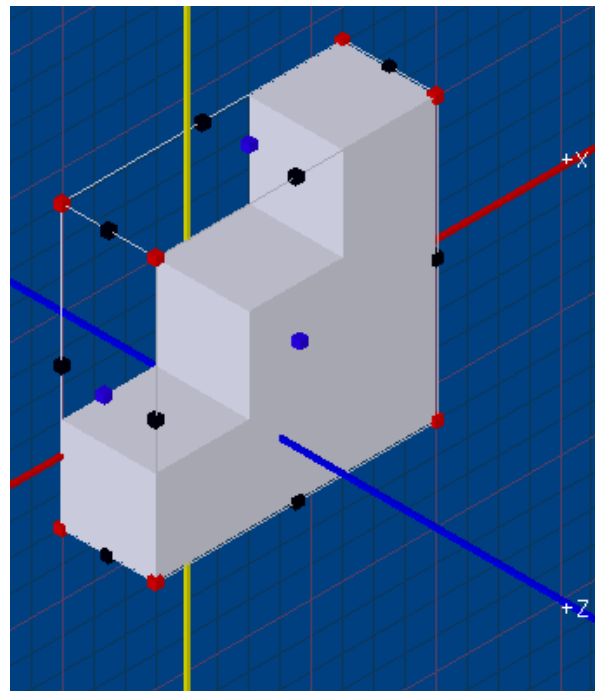
Irregular Prism

An irregular Prism is made by drawing a cross-sectional shape on a 2 Dimensional plane and then 'extruding' the shape, stretching it so that all cross sections cut parallel to one of the ends will be identical.

Select the Irregular Prism tool and draw the 2 Dimensional shape in the Edit Window using mouse clicks; this shape represents the cross-section. To finish drawing the cross section, double-click, or drag the last point close to the first point, or click the 'Finish' button. aspex**T**abs will then add height to the shape which can be edited by mouse using the grab handles.



The cross section shape is defined by points clicked on to the Edit Window. When the shape forms a closed shape it is filled with white.



When the cross section is 'finished' aspex**T**abs will automatically provide some depth to the shape which can be changed using the grab handles.

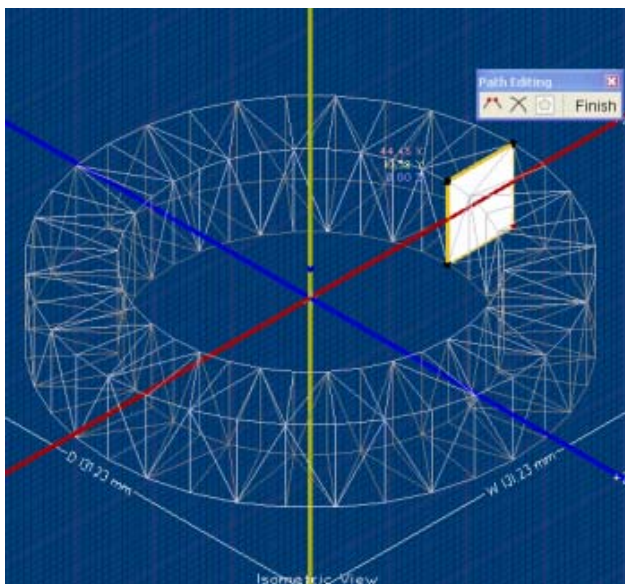
Creating Shapes

Solid of Rotation

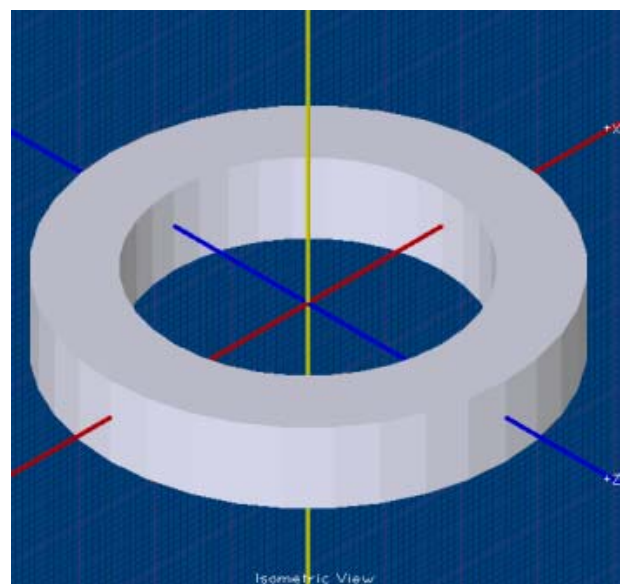
A solid of rotation can be described as a cross-sectional shape drawn on a 2-Dimensional plane which is rotated or swept around an axis. A circular shaped cross section for example, when rotated or swept around an axis will form a doughnut, or torus shape.

Select the Solid of Rotation tool, click on the Edit Window to fix the position of the axis of rotation, move the mouse to the desired position and click the first point, then with subsequent clicks, draw the cross sectional shape.

To finish drawing the cross section, double-click, or drag the last point close to the first point, or click the 'Finish' button, aspex**T**abs will then automatically sweep the shape around the axis to complete a solid shape of rotation.



The cross section shape is drawn by clicking points on the screen— a square cross section is outlined above. When the last point is clicked near to the first point, the shape will closed and be filled with white.



Once the cross section has been drawn, it can be edited by adding points and moving them. Click the Finish button to display the solid shape.


Creating Shapes

Creating a shape automatically

1. **QuickShapes**

aspex**T**abs has a Quickshape facility allowing the student to choose from a range of common shapes for rendering automatically in the Edit Window.



Click the Quickshapes button,  to display the QuickShapes Window. Click and drag a shape from the QuickShapes window to the Edit window and place it. The shape can be positioned in 3D space by moving it in the front, side and top views.

2. **Create Shape Assistant**

A more advanced method allows the student to specify the parameter and position of a shape using the keyboard.

The Create Shape Assistant is found in the right-click menu on the Edit Window. The student specifies the size and coordinates of the shape which is then automatically placed in the Edit Window.

Installing aspex**Tab**s

PC:

Double-Click Setup.exe on the CD.

The application and its associated folders and files will install by default into C:\Program Files. The destination may be changed during the install process.

Shortcuts are placed into start-menu-programs by default and the computer registry is updated with aspex**Tab**s file icon information.

MacOS 9

Double-Click the aspex**Tab**s installer file on the CD.

The application and its associated folders and files will install to a folder on the HD. The default destination folder is 'Applications'. Another folder can be specified during the install process.

MacOS X

Double-Click the aspex**Tab**s installer file on the CD.

The application and its associated folders and files will install to a default folder on the HD. The default destination folder is 'Applications'. Another folder can be specified during the install process.

Network

Network administrators may find it useful to copy the contents of the CD on to the server, then access the installer from each workstation.

A textfile in the application folder, TabsAdminSetup.txt can be edited to change the pathname where aspex**Tab**s will look for particular files or folders. The default paths are relative to the application folder. Absolute paths can be supplied, ie: LicenseFilePath=\\server\Tabs Resources \AspexTabLicense so that all the network stations refer to a single licence file stored in a global location.