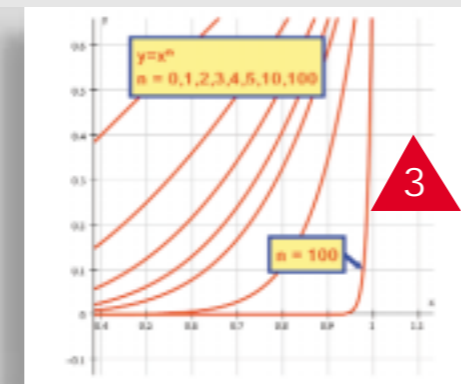
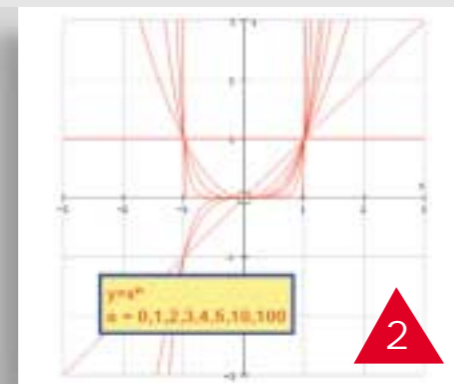
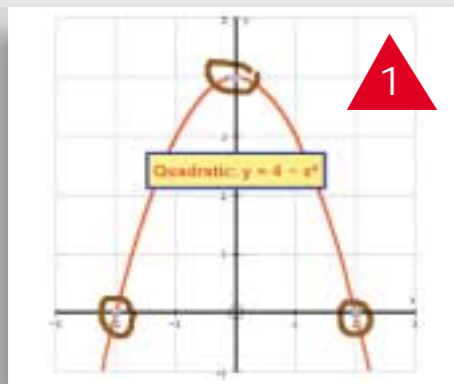


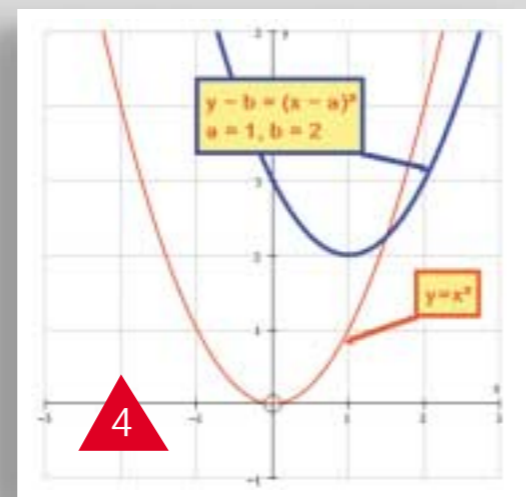
The Dynamic Classroom, using Autograph (11-16)



Dynamic Functions

There are many ways to generate functions in *Autograph*:

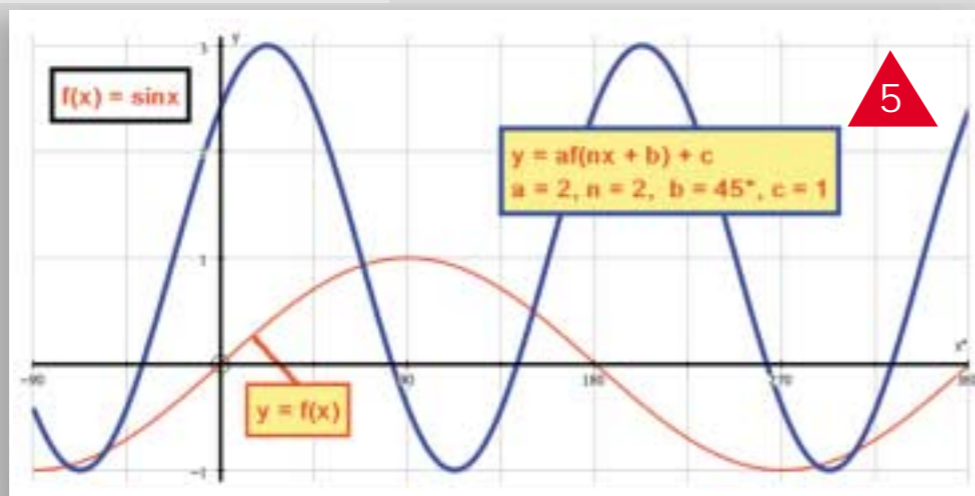
1. Selecting a number of points on the screen: here 3 points to create a quadratic. The points can be dragged around, eg to explore what happens when two of the points are coincident on the x-axis
2. and 3. Entering the equation $y = x^n$. When an entry includes constants, these can be varied dynamically, or a family plotted. In this case, a comma-separated list is used to generate the family, and 'zooming in' allows an exploration of the behaviour of x^n for large n.
4. A look at the transformation of $y = x^2$ in the form $y - b = (x - a)^2$, when the constants 'a' and 'b' can be varied.



5. Functions can be defined as $f(x) = \dots$, and $g(x) = \dots$ giving, for example, an opportunity to explore transformations of $\sin x$ and the same transformations on, say, $y = x^2$.

Equation entry is easy, eg to enter $y = x^3 - 4x$ you enter "y = xxx - 4x".

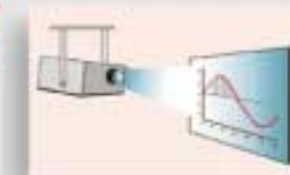
Plotting can also be set to SLOW, with 'pause and replay' control for maximum impact.



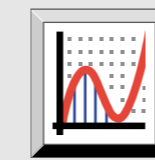
THE DYNAMIC CLASSROOM

Lesson ideas with Autograph v 2.10

* free upgrade now available, from: www.chartwellyorke.com



No. 1 January 2003



Using Autograph for ages 11-16

e.g. UK: K.S. 3-4, International: O-level, IGCSE, MYP (IB)

WHY AUTOGRAPH?

Dynamic software can add spectacular moving interactive images in the classroom, especially when a data-projector is installed. Autograph offers a dynamic approach to both coordinate geometry and probability/statistics, and is the perfect complement to Dynamic Geometry (real space) software.

There have been highly favourable reviews of Autograph in many countries and a selection is included on the Autograph web site. A recent TEEM assessment by UK classroom teachers concluded:

"This package is an extremely practical and useful mathematical tool and is an essential part of any Mathematics teacher's kit."

Also in this issue:

- Pg 2 - Data Handling - Histograms
- Pg 3 - Dynamic Transformations
- Pg 4 - Dynamic Functions

In issue 2: Ideas for ages 16-19

All these lesson ideas, and many others, have been recorded and can be viewed on chartwellyorke.com

New angles on Simultaneous Equations:

1. A chance encounter with a recurring decimal

$y + 14x = 7$ and $3y - 7x = 7$ solves to $(\frac{2}{7}, 3)$. First discuss and construct the 2 lines manually on the white board, noting the large negative slope (-14). THEN have Autograph plot them. Next, select the 2 lines and solve for the intersection, first at 4 d.p. (the default setting), then at 10 d.p. (in the 'Page' => 'Settings' menu), and discuss the recurring nature of $\frac{2}{7}$ in decimal form.

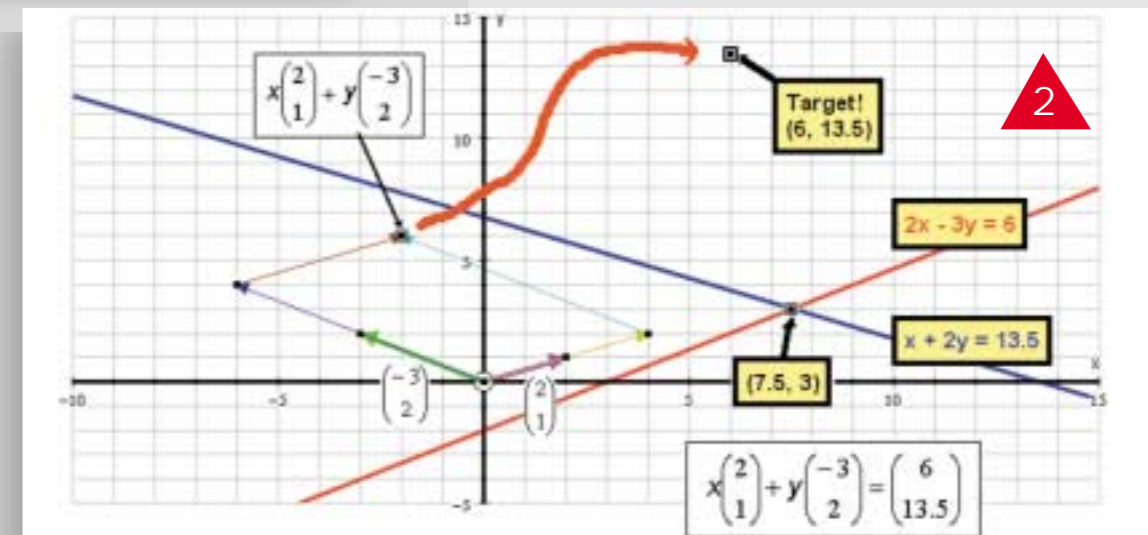
2. Turn it into a game of battleships!

The equations $2x - 3y = 6$ and $x + 2y = 13.5$ can be written as a linear combination of 2 vectors (see below).



Using Autograph, plot the two straight lines, then add the two vectors at (0, 0).

Add multiple vectors of each with the default factor 2: these are 'x' and 'y'. Copy these vectors to complete the parallelogram. The challenge is to vary the factors 'x' and 'y' until you hit the target ($x=7.5, y=3$)!



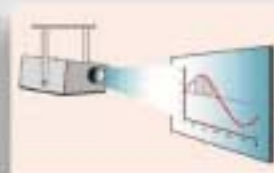
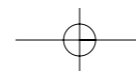
Single User £50 + vat, 50-User £250 + vat, Site £400 + vat.

For further details of *Autograph*, and order details, contact:

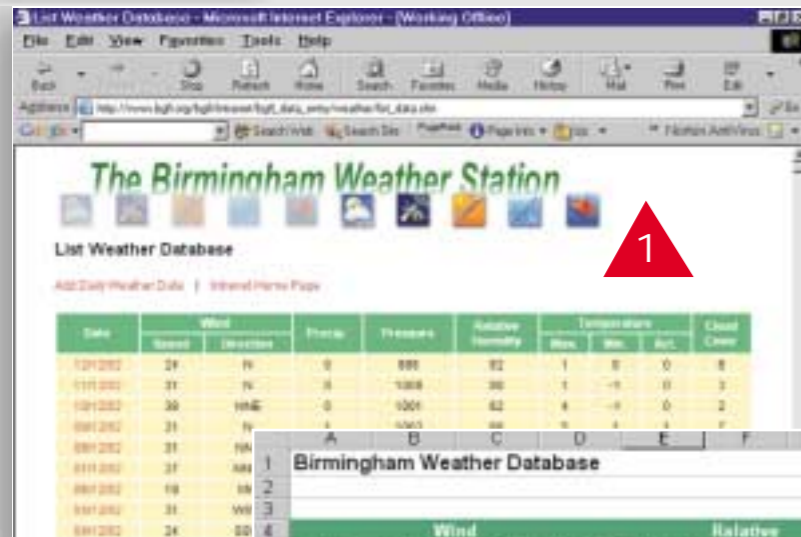
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The Dynamic Classroom, using Autograph (11-16)



Data Handling in Autograph

As well as offering full analysis of bivariate data (scatter diagrams and line of best fit), Autograph has a significant section for **single variable statistics and probability**. Data can be entered directly or copied from a spreadsheet.

In this example, data is found on the web from the Birmingham Weather Station (one of many useful data sites available off the Autograph home page).

1. Click anywhere on the web site table and 'Select all' (Ctrl-A).

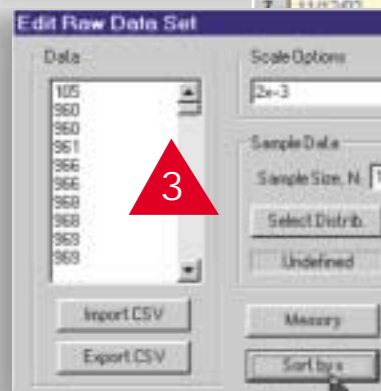
2. In Excel, paste (Ctrl-V). [Excel XP has a useful facility for downloading web-data directly].

Use the split-screen facility to view the top and bottom of the data. To construct a histogram of the pressure variation over Birmingham, select the 'Pressure' data (click on the top value, then Shift-click on the last.)

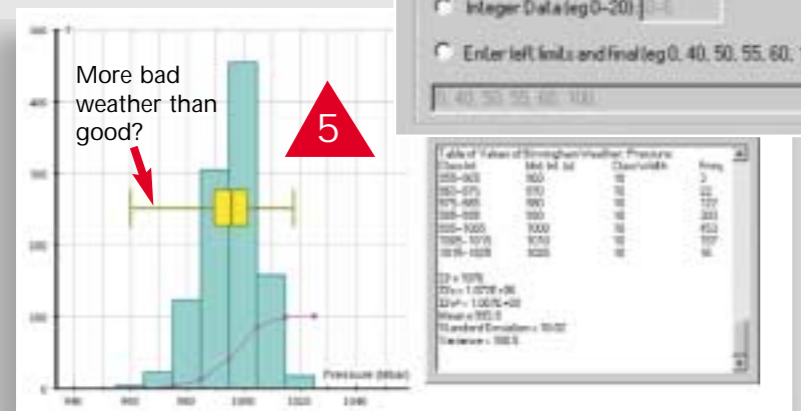
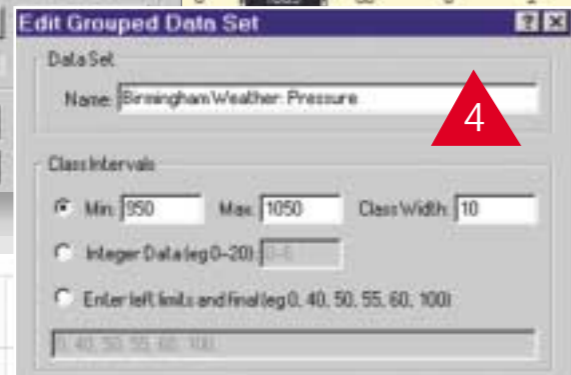
3. Paste into the Raw Data entry box in Autograph. Sort. Notice a rogue value at the start. Discuss, and delete. Before plotting anything, note the range and variation and discuss the likely distribution.

4. Set up appropriate 'Min', 'Max' and 'Width' for the class intervals, and enter a name for the data set.

5. Plot the **Histogram**, (use 'autoscale' and 'horizontal zoom' to obtain a good fit on the page).



Date	Speed	Direction	Precip.	Pressure	Humidity	Max.	Min.	Act.	Cloud Cover
12/12/02	24	N	0	998	82	1	0	0	8
12/12/02	31	N	0	1000	80	1	-1	0	3
12/12/02	30	NNE	0	1001	62	4	-1	0	2
08/12/02	31	N	0	1002	68	5	1	1	7
08/12/02	31	N	0	1004	75	7	5	6	8
08/12/02	19	NE	0	1007	81	8	5	8	8
08/12/02	31	NE	0	1011	87	8	6	8	8
08/12/02	31	NE	0	1004	84	9	3	4	0
08/12/02	31	N	0	1000	86	9	2	3	3
08/12/02	24	SE	0	1003	86	8	2	4	1
08/12/02	24	SE	0	1003	86	8	2	5	2



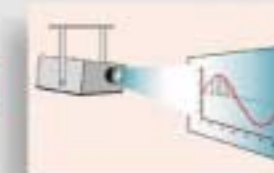
6. Use the 'Table of Statistics' option in Autograph to create a summary in the 'Results Box'. This can be copied directly into Word - you will however need to select it all and change the font to 'Autograph' for the symbols.

To tidy up the columns, select the tabular text and use the option 'Table' => 'Text to columns' and finally the default 'Table Autofomat' option to obtain the layout illustrated. Any Autograph screen can also be copied and pasted to Word.

Class Int	Mid Int (x)	Class Width	Freq	Cum. Freq
950-965	958	15	3	3
965-975	970	10	22	25
975-985	980	10	122	147
985-995	990	10	303	450
995-1005	1000	10	483	933
1005-1015	1010	10	157	1090
1015-1025	1020	10	15	1105

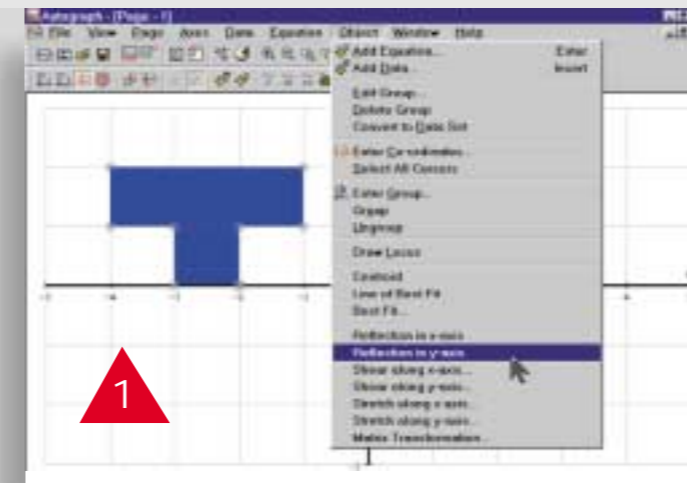
$\bar{x} = 1016$
 $\bar{y} = 1.012E+03$
 $\bar{z} = 1.067E+03$
 Mean = 985.3
 Standard Deviation = 10.02
 Variance = 100.5

The Dynamic Classroom, using Autograph (11-16)



Transformations in Autograph

The object-based environment of Autograph is ideal for the study of **transformations**. It is exceptionally easy to enter **shapes, lines or points**, and to create dependent transformations, which can be animated dynamically.

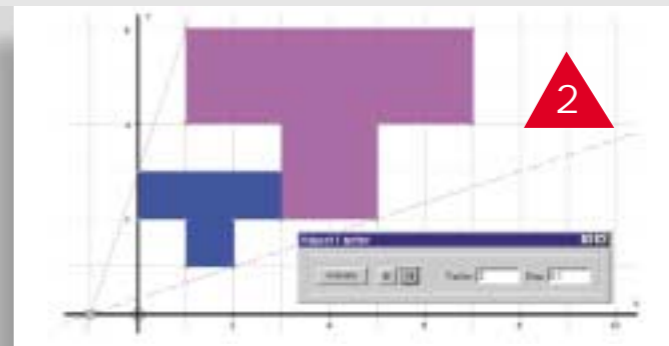
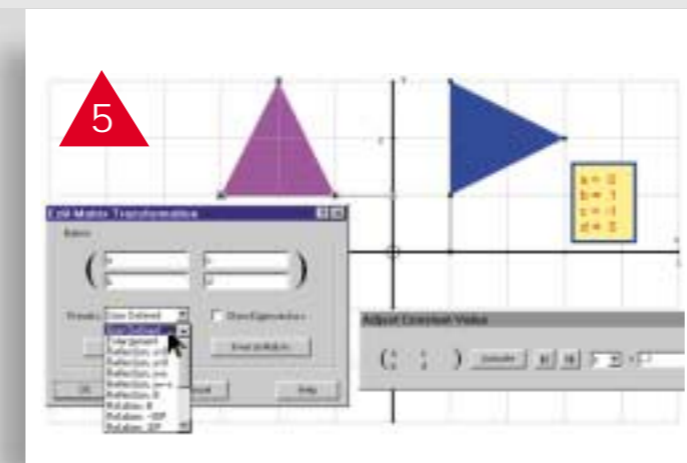


1. Here a shape has been created by **Grouping** a number of points. This shape can now be dragged around as required.

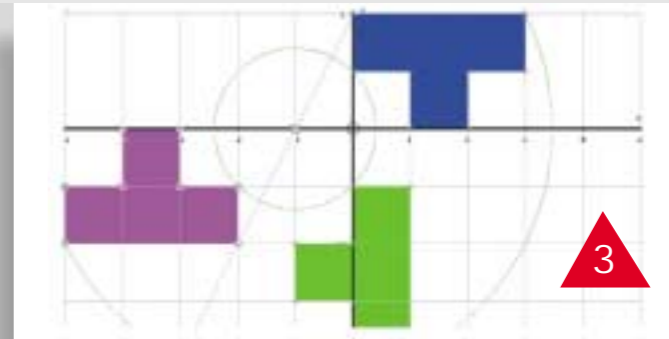
With the shape selected the right-click menu lists all the transformations that are possible without the additional selection of other objects. Of those listed, **Shear** and **stretch** can be animated by varying the appropriate factor.

To set up **Enlargement**, **Rotation** or **Reflection**, it is important to create and select the appropriate objects first. Then the desired transformation will appear in the right-click menu. See examples 2, 3, 4 opposite.

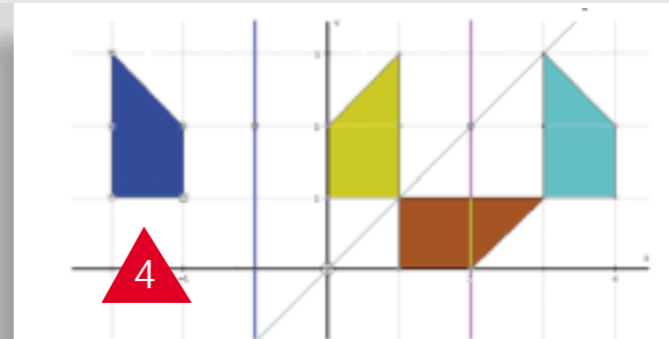
Not illustrated here is **Translation**: this is achieved by creating a **Vector** and selecting both the vector and the grouped object. All transformations can be 'chained' indefinitely in Autograph.



2. **Enlargement**: need first to select a grouped object AND the centre of enlargement. Factor can be animated.



3. **Rotation**: need first to select a grouped object AND the centre of rotation. Angle of rotation can be animated.



4. **Reflection**: reflection line can be constructed from coordinate points, or entered as an equation.

5. Transformations can also be defined in Autograph by **Matrices** (eg for the IGCSE). There is a long list of preset matrices for standard transformations.

Matrix elements can include constant which can be varied dynamically. This is a great way to visualise the association of each element.

