Appendix 1: Using *The Geometer's Sketchpad*

There are many occasions in *Nelson Mathematics 11* where students may wish to use dynamic geometry software (DGS) if it is available. This appendix shows how to use the DGS program the Geometer's Sketchpad. This appendix can be used either as transparencies or as blackline masters.

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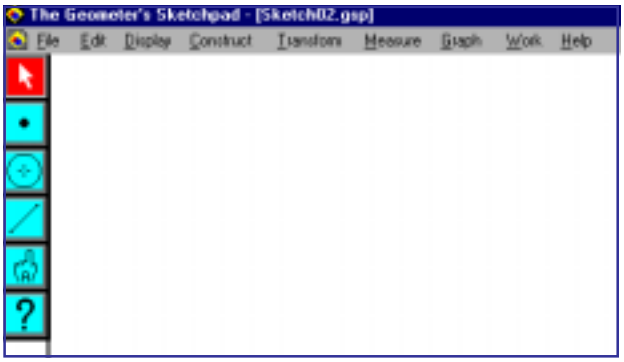
Quick Tips for Use with *The Geometer's Sketchpad*

Tool Bar **Workspace Area**



Use the **selection tool** to select and move objects in a sketch. To select one object, click on the object using this tool. To select several objects at the same time, hold down the shift key while clicking on each object.

To deselect several objects, hold down the shift key while clicking on each object. To deselect all objects, click on a blank area of the sketch.

deselected point	selected point	de-selected line segment	selected line segment

Use the **point tool** to draw and plot points in a sketch.

Use the **circle tool** to create circles/

Use the **line tool** to create line segments, lines, and rays.

Drag the selection tool right to choose the ray tool or line tool . Press and hold down the mouse button in a sketch and drag in the desired direction . Releasing the mouse button completes the drawing.

Use the **labelling tool** label points and lines in a sketch. Once this tool is selected, moving the hand to an object will cause it to turn black. Click the object and a label will appear. Click the object again and the label will disappear. The label can be changed when the object is selected by choosing relabel (Point/Segment/Ray/Line) from the Display menu.

Commands on the Menu Bar

File Menu

New Sketch	Starts a new workspace for a new sketch.
New Script	Creates a new set of steps that leads to a sketch.
Open	Opens an existing sketch or script.
Save	Saves the sketch or script you are working on
Save As …	Saves the sketch or script under a new name.
Close	Closes the sketch or script.
Print Preview …	Shows you what your sketch will look like before you print it.
Print	Prints the sketch you are working on.
Exit	Exits *The Geometer's Sketchpad.*

Edit Menu

Undo	Undoes the last step in your sketch.
Redo	Redoes the last step that was undone.
Cut	Removes selected objects from your sketch.
Copy	Copies selected objects to the clipboard.
Paste	Pastes objects from the clipboard to your sketch.
Paste Link	
Clear	Clears objects that have been selected from your sketch.
Action Button	
Select All	Select all objects in sketch(Selection tool must be activated).
Select Parents	Selects the original objects used to create a construction.
Select Children	Selects the secondary objects used to create a construction.
Links…	
Insert Object…	Inserts an object created in another application
Hide Toolbox	Remove the toolbox from view. Select it again to reactivate.
Show Clipboard	Displays contents of the clipboard.

Clearing the Workspace

To eliminate all objects in a sketch, choose the Selection tool, then **Select All** from the **Edit** menu. Then choose **Clear** from the Edit menu.

Display Menu

Line Style >	Allows you to change the appearance of selected lines.
Colour >	Allows you to change the colour of selected objects.
Text Style >	Allows you to change the style and size of text used for labels
Text Font >	Used to change the font of captions and labels.
Hide Objects	Hides all selected objects.
Show All Hidden	Displays all objects that have been hidden.
Show Labels	Shows all labels that have been hidden.
Relabel Objects	Allows you to change the label of an object.
Trace Objects	Shows the path of objects that have been moved
Animate…	
Preferences	Allows you to change the units used to measure and adjust the precision with which measurements are made. You can also adjust how objects are labelled among other things.

Objects That Must Be Selected for Each Construction

Construct Menu

Point On Object	One or more objects.
Point At Intersection	Two paths (lines, rays, line segments).
Point At Midpoint	One or more line segments.
Segment/Ray/Line	Two or more points (changes with the line tool selected).
Perpendicular Line	One straight object and at least one point.
Parallel Line	One straight object and at least one point.
Angle Bisector	Three points in order (point, vertex, point)
Circle By Centre and Point	Two points in order (centre and radius endpoint on circle)
Circle By Centre and Radius	One point (centre) and one segment (radius)
Arc On Circle	Circle and two points on it **or** centre of circle and two points on it.
Arc By Three Points	Three points on the circle.
Interior	The vertices of the polygon **or** the circle **or** an arc
Locus	An object and a point on a path
Construction Help…	This will give you a list of selections for each Construct command.

Objects That Must Be Selected for Each Measurement

Measure Menu

Distance	Two point or one point and a straight object.
Length	One or more segments.
Slope	One or more straight objects (segment, ray, or line)
Radius	One or more circles, circle interiors, arcs, or sectors.
Circumference	One or more circles or circle interiors.
Area	One or more polygon interiors, circles (or interior), sectors, or arc segments.
Perimeter	One or more polygon interiors, sectors, or arc segments.
Angle	Three points where the vertex of the angle is the second point selected.
ArcAngle	One or more arcs, sectors or arc segments or a circle with 2 or 3 points selected.
ArcLength	One or more arcs, sectors or arc segments or a circle with 2 or 3 points selected.
Ratio	Two line segments.
Coordinates	One or more points.
Equation	One or more lines or circles.
Calculate…	Calls up the calculator. Selected measurements will appear in values window
Tabulate	Creates a table of selected measurements. One or measure must be selected.
Add Entry	Adds an entry to the table. Table must be selected.

Transform Menu

Translate…	Translates an object by a specified amount.
Rotate…	Rotates an object through a specified angle around a chosen centre.
Dilate…	Reduces or enlarges an object by a specified amount about a chosen point.
Reflect…	Reflects an object across a line, segment, ray, or axis.
Mark Centre "G"	Marks a point as the centre for a rotation or dilatation.
Mark Mirror "k"	Marks a line, ray or segment as a mirror for a reflection.
Mark Vector	
Mark Distance	
Mark Angle	
Mark Ratio	
Define Transform	Allows you to define multi-step transformations.

Graph Menu

Create Axis	Creates a Cartesian plane with the origin in the centre of the workspace using the specified unit for measuring distances as the basis for the scale.
Show Grid	Displays or hides a grid on the graph using the specified scale.
Snap to Grid	Causes points to be moved only to locations on the grid. Click again and points can move anywhere.
Grid Form >	You can choose between a rectangular or polar grid system.
Plot Measurement	Plot selected measurements.
Plot Points …	Plot points by entering their coordinates.
Coordinate Form>	Choose between rectangular or polar coordinates.
Equation Form >	Choose the way that a selected line or circles equation will be displayed.

Using the Calculator

The calculator is obtained by choosing **Calculate** from the **Measure** menu.

The **Values** window displays all selected measurements in the workspace. These measurements can be used in calculations. Select the desired measurement and the operations you wish to use like any other calculator.

The **Functions** window displays all the functions the calculator can do. Choose the desired function and close the function with "\)". Choose the desired units if necessary. Select **OK** to perform the function.

Function	What It Does
sin[, cos[, tan[	trigonometric functions
arcsin[, arccos[, arctan[	inverse trigonometric functions
abs[	absolute value
sqrt[	square root
ln[	natural logarithm
log[	log base 10
round[	round to the nearest integer
trunc[	round to the nearest integer to 0
sgn[	signum

You can display the results in the calculator's window and in the workspace in either **Text Format** or **Math Format**, by selecting the desired format at the bottom of the calculator.

How To Build Conics as Loci

How to Draw a Parabola as a Locus

1. Construct line AB for the directrix.
2. Construct point C, not on the line, for the focus.
3. Construct point D on line AB.
4. Select line AB and point D, and then construct a perpendicular line (Construct menu).
5. Construct point E on this line, above line AB.
6. Select points E, D, and C, in that order, and Mark the Angle (Transform menu).
7. Select point C and Mark Center (Transform menu).
8. Select point D and Rotate by Marked Angle (Transform menu)
9. Draw line CD′.
10. Draw point F at the intersection of lines DE and CD′ (Construct Menu) .
11. Trace point F (Display menu).
12. Select point D and line AB, and then Animate (Display menu).

How to Draw an Ellipse as a Locus

1. Construct two points A and B for the foci.
2. Construct a segment CD and a point E on it.
3. Mark Vector CE and Translate point A by it (Transform menu).
4. Select points A and A′. Draw circle AA′ (Construct menu).
5. Mark Vector ED and Translate point B by it (Transform menu).
6. Select points B and B′. Draw circle BB′ (Construct menu).
7. Construct points F and G at the intersections of circles AA′ and BB′ (Construct menu).
8. Trace points F and G (Display menu).
9. Select point E, then line CD. Animate point E along segment CD. (Display menu).

How to Draw a Hyperbola as a Locus

1. Construct two points A and B.
2. Select the two points and construct a circle by center and point (Construct menu).
3. Construct a third point C outside the circle. A and C represent the foci.
4. Select the circle and construct point D on the object (Construct menu).
5. Select points A and D and construct a line (Ensure that the line tool is on line , not segment .)

6. Select points C and D and construct a line segment between them.
7. Select line segment CD and construct the midpoint E.
8. Select line segment CD and the midpoint E and construct a perpendicular line.
9. Select line AD and the perpendicular line through E and construct the point at intersection, F.
10. Select C and F and construct a line segment.
11. Select point F and trace (Display menu)
12. Select point D, the circle and animate from the display menu.

How To Build Conics As Envelopes

How to Draw a Parabola as an Envelope

1. Construct a horizontal line AB for the directrix.
2. Construct a point C not on the line for the focus.
3. Construct a point D on the line AB.
4. Construct segment CD.
5. Construct E, the midpoint of segment CD.
6. Construct the perpendicular to CD through E.
7. Trace the perpendicular line from the Display menu.
8. Select point D, then line AB.
9. Go to **Display - Animate** and click **OK**.

How to Draw an Ellipse as an Envelope

1. Construct a circle AB.
2. Construct a point C inside the circle.
3. Construct a point D on the circle.
4. Construct segment CD.
5. Construct the perpendicular to CD through D.
6. Trace the perpendicular line from the Display menu.
7. Select point D, then circle AB.
8. Choose **Display - Animate** and click **OK**.

How to Draw a Hyperbola as an Envelope

Repeat the directions for the ellipse, except in step 2, place point C outside the circle.

Appendix 2: Internet Sites for Teachers

Description	Internet Address
Texas Instuments Graphing Calculator Activities for High School Teachers	www.ti.com/calc/start/teachers-math-high.htm#act
Draft of Grade 11 and 12 Curriculum	www.ecoo.org/projects/deliverables/secondary.html
Course Profiles	www.curriculum.org/9prof.htm
The Geometer's Sketchpad Resource Center	www.keypress.com/sketchpad/index.html
Statistics Canada	www.statcan.ca/start.html
The History of Mathematics Archive	www-history.mcs.st-and.ac.uk/history/
Women in Mathematics	www.math.ca/Women/
General Math Resources	www.math.ca/General/
Math and Spreadsheets	forum.swarthmore.edu/sum95/math_and/spreadsheets/intro.html
Ask Dr. Math	forum.swarthmore.edu/dr.math/dr-math.html
Careers in Mathematics	www.coolmath.com/careers.htm
OAME	www.oame.on.ca/