Brian Ruffles (ruff0498@fredonia.edu)
Richard Michael (mich1230@fredonia.edu)
John Hamilton (hami4699@fredonia.edu)

Geometer's Sketchpad Reference Guide

Introduction:

This lesson is a technology reference guide on the computer software Geometer's Sketchpad. This program can be used at all age levels depending on the lesson you are teaching. It is intended to be used for middle school through the college level where the students can it to manipulate and prove geometric shapes and theorems. The only materials needed is the program which you must buy and install on your computer or have a class set that is installed on school computers.

Relevant Professional Standards:

NTCM:

Geometric Strand:

Analyze characters and properties of shapes: Students will explore relationships among geometric objects.

Apply transformations and use symmetry for analysis: Students will be able to represent and analyze translations, reflections, rotations, and dilations.

NYS MST:

8.PS.1 Use a variety of strategies to understand new mathematical content and to develop more efficient methods

8.G.12 Identify the properties preserved and not preserved under a reflection, rotation, translation and dilation.

8.R.1 Use physical objects, drawings, charts, tables, graphs, symbols, equations, or objects created using technology as representations

Objectives:

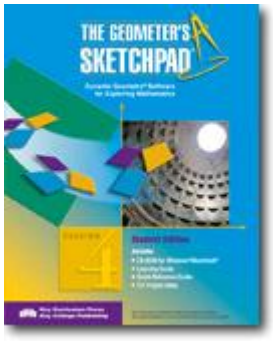
After reviewing this reference guide teachers should be able to:

- Understand how to use Geometer's Sketchpad when creating shapes and various mathematical ideas with those shapes
- Create a lesson and be able to incorporate this program in their classroom
- Have students work on Geometer's Sketchpad individually or in a group setting so they can formulate mathematical ideas

Instructional Protocol/Itinerary:

This guide will illustrate how to use Geometer's Sketchpad and the various activities that can be done using this program. It will cover topics such as how to construct a circle, find the circumference, area, and radius. It will also cover how to construct a triangle and how to find the angle bisector, create perpendicular and parallel lines and so on. There will also be a lesson included on how area of a triangle is preserved to help teachers see how it can be utilized in the classroom.

What is Geometer's Sketchpad?



The Geometer's Sketchpad is a dynamic construction, demonstration, and exploration tool that adds a powerful dimension to the study of mathematics. You and your students can use this software program to build and investigate mathematical models, objects, figures, diagrams, and graphs. With Sketchpad, you can give your students a tangible, visual way to explore and understand abstract concepts in algebra, geometry, trigonometry, precalculus, and calculus. Concepts that may be initially difficult for your students to understand become very clear when they see visual representations on the screen and interact with them using Sketchpad.

How do you get it?

A student or home edition of the software can be purchased online for as low as $27.25 used or $39.95 new. It can also be purchased for in an unlimited quantity for a school for $1499.95 and in other quantities at the following website:

http://www.keypress.com/x4752.xml

How do you use it?

Geometer's Sketchpad can be used on your computer at home or anywhere including school as long as the program is installed on that computer. It is a very useful tool in your classroom when doing your lessons as it is easier to show your students simple proofs and understand concepts regarding different shapes and properties of those shapes. It is also easy to make copies of the shapes you make and use them in your handouts and to incorporate it into a power point presentation. The following pages will explain the basics behind using Geometer's Sketchpad in your classroom.

Simple Constructions

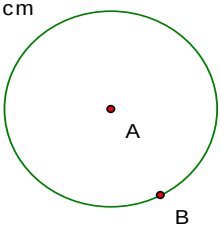
How to construct a circle

- On the left side of the screen, click on  .
- On the screen with your mouse click and move your mouse to the size you want your circle. The point you start at is the center of your circle.

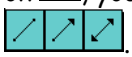
What a circle can give you

- Once the circle is constructed, you can use the selection arrow  to highlight the circle.
- Once the circle is highlighted, go to the toolbar up top and select measure.
- You can now measure the circumference, radius and area of the circle

Circumference ⊙AB = 9.59 cm
Area ⊙AB = 7.32 cm²
Radius ⊙AB = 1.53 cm

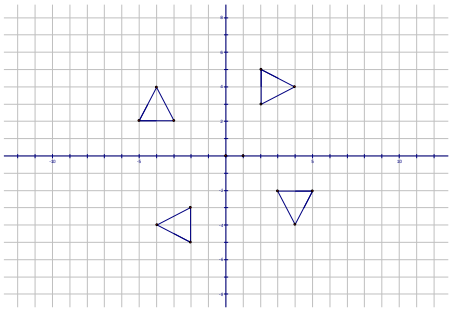


How to construct a triangle

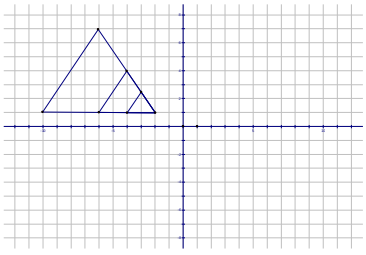
- On the left side of screen, click on  , you will see the following,  .
- To construct a triangle you will want to use the line segment button  .
- On the screen with your mouse create a line. This line will have a dot on each end
- To create another line, move your mouse to one of the dots. The dot will become highlighted once you in the right spot, then construct the second line
- The third line should be drawn by using the previous step and drawing the line until it gets highlighted by the dot it will intersect with.
- To label the points use the selection arrow and highlight the points.
- Go to the toolbar, select display and click on label points.

What a triangle can give you

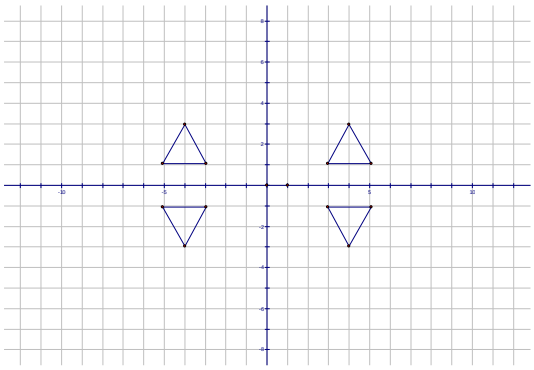
- Use the selection arrow  to highlight the segments and points on the segments of the triangle.
- After highlighted use toolbar, go to transform and select rotate. A box will pop up, rotate about a fixed point a certain number of degrees you choose.
- Press **Rotate.**
- To label the points by hand, use the  to label points as you want them.



- Highlight all points and segments of triangle.
- Go to toolbar, select transform and click dilate.
- A box will pop up giving you an option of what ratio to dilate.
- Press **Dilate**.



- Highlight the x-axis, select transform, and select mark mirror.
- Highlight all points and segments of triangle.
- Go to toolbar, select transform.
- Then highlight the y-axis, select transform, and select mark mirror.
- Press **Reflect.**



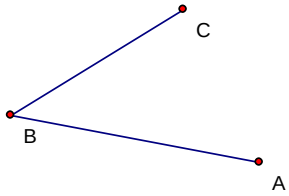
Measurements

- Draw a line segment using the button on the left hand side
- Highlight the line.
- Go to the toolbar select measure.
- Click **length**, a box will show up with the measure of the segment.

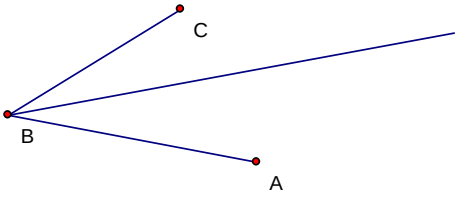
$m\overline{CD} = 2.16$ cm

How to construct an Angle bisector

- Click on the icon first
- Create three non-linear points
- Highlight the three points in the order that you want to look at the angle. (You can label the points if you want)
- Connect the points that you want the angle of (let's connect A to B and B to C) using the line segment icon .



- Say we want the angle bisector of ABC, first click A, then B, then C. Now go to construct and click angle bisector.



- You can do this for a triangle for all three angles to see some interesting results.

Construct a Circle using three points

- Use the icon to create three non-linear points.
- Highlight the points in any order you want.
- Go to construct and click Arc through three points.
- Click the points in a different order and do this again. Move one of the points around to see the different sized circles you can create.

How Can I use Geometer's Sketchpad in My Classroom?

Geometer's Sketchpad can be used as a supplement to a lot of different lessons. It helps to show visuals for things that student's may be having trouble with. It also shows the process of how certain things are done. It can pique interest in certain topics that may otherwise seem boring. It can also be used to create overheads or pictures that look a lot more professional than hand-drawn ones.

Parametric Color and the Sketchpad

Here is an activity that you can do to really impress your students and let the know what this software is capable of.

1. Draw a point (A) on the sketch
2. Draw a segment (approximately 1 cm)
3. Highlight (select using the arrow tool) the point (a) and the segment
4. Click *Construct/Circle by Center + Radius*
5. Click (with the circle still highlighted) *Construct/Circle Interior*
6. Click (with the circle interior highlighted) *Display/Trace Circle Interior*

You have just constructed The Sketchpad Paintbrush. Now lets really blow there minds

7. Draw a vertical line segment down the left hand side of the sketch.
8. Click *Construct/Point on Segment*
9. Highlight both point and that segment
10. Click *Construct/Perpendicular Line*
11. Highlight the Paintbrush center and the perpendicular line
12. Click *Edit/Merge Point to Perpendicular Line*
13. Highlight the circle interior and the center point
14. Click *Construct/Locus*
15. Right click the locus and click *Properties/Plot*, set the number of samples to 250. Click Ok.
16. Click *Display/Trace Locus*. (Deselect the trace of the locus.)
17. Highlight the point on the intersection of the vertical line and the perpendicular line
18. Click *Edit/Action Buttons/Animation*. Click the *Animate* tab and change the Direction to *forward* and the speed to *fast*.
19. Reduce the size of the paintbrush by making the segment that controls the radius of the paintbrush very small
20. Click *Animate*

You can move around the center point to change where the rainbow centers around.