Multi-User GeoGebra
For Virtual Math Teams

supporting collaborative online math

Presented by The Math Forum
Gerry Stahl, Drexel U., USA
Arthur Powell, Rutgers U., USA
Multi-User GeoGebra

- GeoGebra for small groups of students
- Engage in dynamic geometry together
- Drag and explore together
- Chat about actions and noticings
- Construct and investigate collaboratively
- Share and test each other’s hypotheses
- Explain and prove to each other
- Build on each other’s custom tools and constructions
Exploration & Discourse: VMT-with-GeoGebra
Construction & Chat

Chat (0):

- **vmt** 6:03:26 PM EST: Interesting ... I dragged corner A around and watched how the areas of poly 1 and e changed
- **Gerry** 6:04:05 PM EST: yeah, I c
- **Gerry** 6:04:30 PM EST: poly2 seems to always be about half of poly1
- **vmt** 6:05:14 PM EST: I bet that is always true because it is built from the midpoints of poly1
- **vmt** 6:08:11 PM EST: Look! I connected A and C -- that forms two sets of similar triangles. I bet that if we made triangles DEH and DAC that DEH would be 1/4 the area of DAC because its b and h are 1/2
- **Gerry** 6:10:00 PM EST: Cool! That proves it. If we draw BD, we will have 4 triangles each with a quarter the area of half the quadrilateral! Very elegant

- **Gerry**

Nice work, partner! Thanks for explaining it to me.
Virtual Math Teams Environment

• An integrated online environment for small teams of students to do math together
• Combines text chat with drawing spaces and spaces for storing ideas and findings
• Teachers can configure chat rooms for different topics and tools
• Lobby, wiki, multiple tabs for constructions, activity topic, help pages
The VMT Lobby

Virtual Math Teams 3.0–Dev.03

Welcome Professor

View Chat Rooms as
Math Subject Tree       Tabular List

Filter Chat Rooms By...
Project: iSchool

Apply filters   Use default filters

Geometry (2 Topics)
- Activity1 (9 Rooms, 3 Active)
- Activity2 (No Rooms, 0 Active)
  - Lucky Numbers 1
  - Team Bee 1

Table:

<table>
<thead>
<tr>
<th>Username</th>
<th># of Messages</th>
<th>Last Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>at373</td>
<td>10</td>
<td>Jan 31, 2012 19:50</td>
</tr>
<tr>
<td>chartizek</td>
<td>25</td>
<td>Feb 1, 2012 19:56</td>
</tr>
<tr>
<td>charlie_mcmichael</td>
<td>141</td>
<td>Feb 1, 2012 19:50</td>
</tr>
<tr>
<td>gerry</td>
<td>12</td>
<td>Jan 31, 2012 23:19</td>
</tr>
<tr>
<td>professor</td>
<td>8</td>
<td>Feb 1, 2012 19:57</td>
</tr>
</tbody>
</table>

Add to Favorites  Save as JSON  View Chat Log

Students find chat rooms with activities
Teachers overview student work
Researchers, teachers, students access chat logs
The VMT Chat Room

GeoGebra

- poly1
- poly2
- poly3
- poly4

Current users:
- Professor

Chat (1):
- Professor leaves the room 2/6/12 11:03:57 PM EST
- Professor joins the room 2/6/12 11:24:03 PM EST
- Professor leaves the room 2/6/12 11:25:12 PM EST
- Professor joins the room 9:14:50 PM EST
- Professor 9:18:40 PM EST: I moved the blue triangle
- Professor 9:18:52 PM EST: So it seems to be generic
- Professor 9:19:00 PM EST: or scalene
- Professor 9:19:18 PM EST: I think there is an equilateral
- Professor 9:19:27 PM EST: and a right triangle
- Professor 9:19:38 PM EST: and probably an isosceles
- Professor 9:20:03 PM EST: Does everyone else agree with my conclusion?

Message:
How do you think these were constructed?
Turn Taking for Multi-User Control
Shared & Personal Spaces; Synch/Asynch

GeoGebra Summary A B C D Shared Whiteboard Topic Wiki

Professor leaves the room 2/6/12 11:03:57 PM EST
Professor joins the room 2/6/12 11:24:03 PM EST
Professor leaves the room 2/6/12 11:25:12 PM EST
Professor joins the room 9:14:50 PM EST

Professor 9:18:40 PM EST: I moved the blue triangle
Professor 9:18:52 PM EST: So it seems to be generic
Professor 9:19:00 PM EST: or scalene

Professor 9:19:18 PM EST: I think there is an equalateral
Professor 9:19:27 PM EST: and a right triangle
Professor 9:19:38 PM EST: and probably an isosceles
Professor 9:20:03 PM EST: Does everyone else agree with my conclusion?

Message:
How do you think these were constructed?
# Probability

Here are a set of challenges related to probability problems. **You can contribute** by adding your ideas about applying a strategy to a problem (adding content to a P#S# page), proposing a new strategy (adding a new column) or adding a new challenge (row).

## Probability Strategies & Problems

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P1. The sock drawer</td>
<td>P1S1</td>
<td>P1S2</td>
<td>P1S3</td>
<td>P1S4</td>
<td>P1S5</td>
</tr>
<tr>
<td>P2. Box with three cards</td>
<td>P2S1</td>
<td>P2S2</td>
<td>P2S3</td>
<td>P2S4</td>
<td>P2S5</td>
</tr>
<tr>
<td>P3. Seating arrangements</td>
<td>P3S1</td>
<td>P3S2</td>
<td>P3S3</td>
<td>P3S4</td>
<td>P3S5</td>
</tr>
<tr>
<td>P4. Baseball_World_Series</td>
<td>(P4-S1 Example)</td>
<td>(P4-S2 Example)</td>
<td>(P4-S3 Example)</td>
<td>(P4-S4 Example)</td>
<td>P4S5</td>
</tr>
<tr>
<td>P5. Duck hunters</td>
<td>P5S1</td>
<td>P5S2</td>
<td>P5S3</td>
<td>P5S4</td>
<td>P5S5</td>
</tr>
<tr>
<td>P6. Clock hands</td>
<td>P6S1</td>
<td>P6S2</td>
<td>P6S3</td>
<td>P6S4</td>
<td>P6S5</td>
</tr>
<tr>
<td>P7. Length of Random Chords</td>
<td>P7S1</td>
<td>P7S2</td>
<td>P7S3</td>
<td>P7S4</td>
<td>P7S5</td>
</tr>
<tr>
<td>P8. New Problem</td>
<td>P8S1</td>
<td>P8S2</td>
<td>P8S3</td>
<td>P8S4</td>
<td>P8S5</td>
</tr>
</tbody>
</table>

If you need them, here are some resources for probability

*Categories: ProblemSolving | VMT*
Curricular Activities

- Based on US Common Core Standards
- Stress noticings and conjectures
- Promote math discourse
- Encourage collaboration
- Include individual reflection and group discussion
- Structured, guided collaborative learning, leading to open-ended creative exploration
More Exploration, Less Instruction
Reflection on Math Discourse

• Access to VMT Chat logs in convenient formats
• VMT Wiki pages for sharing findings
• VMT Replayer to review action in detail: drawing and chat coordinated in playback mode
The VMT Re-Player

Here is point D on the circle and on line segment CD. Try to drag this point and watch the circle.
<table>
<thead>
<tr>
<th>Time of Posting</th>
<th>andicat</th>
<th>Annie</th>
<th>jr6g</th>
<th>loretta</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:45:03</td>
<td></td>
<td></td>
<td>i don't know how to do a perpendicular</td>
<td></td>
</tr>
<tr>
<td>14:45:16</td>
<td></td>
<td></td>
<td></td>
<td>should we do</td>
</tr>
<tr>
<td>14:45:20</td>
<td>i need my tool!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:45:24</td>
<td></td>
<td>So, Jen, what do you think would go into a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:45:37</td>
<td></td>
<td></td>
<td>a 90degree angle and</td>
<td></td>
</tr>
<tr>
<td>14:45:40</td>
<td>i created a tool to make a perpendicular</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:46:01</td>
<td></td>
<td></td>
<td>can we use the built in tool to do</td>
<td></td>
</tr>
<tr>
<td>14:46:13</td>
<td></td>
<td>I'm thinking that we can use the built-in tool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:46:39</td>
<td>oh - didn't know that</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:46:42</td>
<td></td>
<td></td>
<td>its under the intersect point</td>
<td></td>
</tr>
<tr>
<td>14:46:47</td>
<td></td>
<td></td>
<td>the perpendicular tool is under the fourth</td>
<td></td>
</tr>
<tr>
<td>14:46:48</td>
<td>i thought it was only something we created</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Professional Development

- Special courses for math teachers
- Full credit toward degree and certification
- Flexible online offering
- Includes synchronous contact with other teachers in small groups
- Prepares for use of technology and curriculum in classrooms
- Teachers try VMT-with-GeoGebra and plan for its use by their students
For further information

- Gerry@MathForum.org
- PowellAB@rutgers.edu
- http://vmt.mathforum.org/vmt/courses.html