# Virginia Department of Education 2018 Mathematics Institutes

# Facilitator’s Guide – Grade Band Algebra I/Geometry/Algebra II

## 2018 Mathematics Institutes

The purpose of the 2018 Mathematics Institute is to provide teachers with professional development grounded in the implementation of the [2016 *Mathematics Standards of Learning*](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/index.shtml) to strengthen the teaching and learning of mathematics through facilitating meaningful mathematical discourse, to include: posing purposeful questions; eliciting and using evidence of student thinking; using and connecting mathematical representations; and supporting productive struggle in learning mathematics; as well as supporting equitable learning opportunities for all students.

## Professional Development Instructions

A product of the 2018 Mathematics Institutes is a set of online professional development modules designed to be used by a group of teachers of a specific grade level or course, facilitated by a member of the team. Modifications could be made to adapt the professional development for more than one grade level/course or for large groups. Facilitators should review the activities and handouts in this guide prior to facilitating this professional development.

| **Approximate Time** | **Facilitator Instructions** | **Materials** |
| --- | --- | --- |
| **50 minutes total** | **Module I: Teaching Practice: Facilitate Mathematical Discourse in the Algebra 1/Geometry/Algebra 2 Classroom**  **Essential Questions: What elements must be in place to support meaningful mathematical discourse? In what ways can teachers promote equitable teaching practices in mathematics classrooms?** | * [**Algebra and Geometry Grade Band Session Powerpoint**](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/2018-institute-ppt-a1-geom-a2.pptx) |
| 1) Community Builder/Introduction- 5 minutes  2) Logistics - 4 minutes  3) Revisit WODB -- 5 minutes  4-7) Connect the Process Goals to the Mathematics -- Practices - 8 minutes  8) Equity image – 10 minutes  9) Card sort – 15 minutes  10) Reflection -3 minutes | 1. Community Builder Activity – [Which One Doesn’t Belong](http://wodb.ca/) (WODB)? **(Slide 2)**    1. Round Robin -- Introduce yourself and explain your WOBD choice    2. Facilitator will ask participants to think about how activities, such as these, can build a sense of community within a classroom. 2. Review the agenda, parking lot, strategy catcher and norms. Solicit ideas for additional norms from the group. **(Slides 3 – 6)** 3. Revisit the Community Builder Activity    1. Discuss why this type of activity is valuable to facilitate discourse. If not discussed, facilitators should point out that activities that can provide all students with an entry point, even if they are uncertain of the mathematics involved, can facilitate mathematical discourse and build classroom community. **(Slide 8)**    2. Introduce other online resources that may serve as possible community builder activities **(Slide 9)**    3. Discuss the Essential Questions for Module I. Have the reflection sheet handouts available and explain that they can be used to reflect after each module of the professional development session. **(Slide 10)** 4. Review the Eight Effective Mathematics Teaching Practices from NCTM *Principles to Action* book and connect to the chapters in the *Taking Action* book. Allow participants a few minutes to read the descriptions in the *Taking Action* book onpage 5. **(Slide 11)** 5. Turn and talk – Which of these practices are you using effectively? For which ones do you feel you need more support? 6. Review the VDOE Mathematics Process Goals for Students that are included in the *Mathematics Standards of Learning* document. **(Slide 12)**   Each person at a table will select one of the Eight Effective Mathematics Teaching Practices and tell how it relates to at least one VDOE Mathematics Process Goal for Students. Ask participants to give an example of an activity or routine that they have used in a classroom that relates back to that one practice and/or process goal.   1. The Teaching Framework for Mathematics highlights the relationships between and among the Eight Effective Mathematics Teaching Practices (found on page 215 of the *Taking Action* book). Explain that this professional develop will focus on two of these practices, pose purposeful questions and elicit and use evidence of student thinking, but acknowledge that they are all connected. Note that these practices also reflect similar information found in other educational research. **(Slide 13)** 2. Have participants view the Equality, Equity, and Reality image. Ask participants to Stand up/hand up/pair up (preferably with someone at another table) to discuss any connections that can be made to this image. The facilitator is encouraged to have a whole group share-out, being sure to discuss key concepts such as student agency and identity, particularly as it relates to students building a sense of mathematical competency as a learner. **(Slide 14)** 3. Discuss the purpose of the Mathematics Discourse Card Sort. Ask participants to sort the cards into the appropriate levels (0-3) and categories. Distribute a “clean” copy of the completed rubric and have participants compare their results. Advise participants to refer to these levels of discourse throughout the day. **(Slides 14-15)** 4. Reflection – Module I. Take time to reflect on the learning from this section, using the reflection sheet provided. Include ideas for your own classroom and ideas to share with others during this professional development session. **(Slide 16)**   **Strategy Catcher:** Round Robin (Which One Doesn’t Belong); Stand Up, Hand Up, Pair Up (Equality, Equity and Reality Image); Pre-Assessment and Using Technology to Capture Initial Thinking (Sorting Activity – Math Talk) | * **Chart paper posted -- titled “Strategy Catcher”** * ***Taking Action* book** * [**Cut up Classroom Discourse Card Sorts, 3-4 per table**](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/clssrm-discourse-sort.docx) * [**Clean copies of Levels of Classroom Discourse Rubric for each person**](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/levels-of-class-discour.docx) * [**Reflection sheet**](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/reflection-sheet.docx) |

| **Approximate Time** | **Facilitator Instructions** | **Materials** |
| --- | --- | --- |
| **Approximately 130 minutes total**  **(90 minutes before lunch and 40 minutes after)** | **Module II: Teaching Practice: Pose Purposeful Questions**  **Essential Question: How can posing purposeful questions be used to inform instruction and assess student understanding?** |  |
| 1) Intro to Module II - 1 minute  2a) Solve Playground Task -12 minutes  2b) Watch Classroom Video - 5 minutes  2c-e) Sort Questions and Share Purposes; Connect to 4 types of Questions from *Taking Action* - 20 minutes  2f) Monitoring tool -- 5 minutes  3a-c) Burger Task, complete task and monitoring tool -- 30 minutes  3d) Chart Questions from the Monitoring Tool -- 20 minutes  **LUNCH**  3e) Desmos Polygraph Activity - 10 minutes  3f) Desmos Teacher Dashboard - 5 minutes  3g) Use Desmos for Burger task - 20 minutes  4-6) Summarize Module II: Pose Purposeful Questions and reflect -- 5 minutes | 1. Review Module II essential questions and definition of “posing purposeful questions” **(Slides 17 – 19)** 2. Playground Task from *Taking Action* book, page 91    1. Solve the Playground task with a shoulder partner. Provide the participants with tools such as graph paper, rulers, protractors, compasses, when available. Suggest that participants also use the Desmos graphing calculator. Encourage participants to discuss the strategies used to solve the task and what other student strategies that they might see in a classroom. **(Slide 20)**    2. Have participants watch Playground Task classroom video. The video is available at [www.nctm.org/more4u](http://www.nctm.org/more4u) using the code found in the *Taking Action* book provided by VDOE. Ask participants to jot down the questions that the teacher asks on post-it notes – one question per note. **(Slide 21)**    3. As a table group, have participants sort the questions on their post-it notes by the purpose. A written transcript of the classroom video is available through the [www.nctm.org/more4u](http://www.nctm.org/more4u) link. Have each table share out the purposes of the questions that were obtained. Facilitators will chart the categories/types of questions and post at the front of the room.  **(Slide 22)**    4. Facilitators will then summarize the two main question purposes and the four types (gathering information, probing thinking, making the mathematics visible, and encouraging reflection and justification, as found in the *Taking Action* book. **(Slide 23)**    5. Distribute the Task Monitoring Tool handout - see page 239 in the *Taking Action* book. Using the Playground Task, facilitators will help identify the anticipated solutions. Discuss solution strategies and predict other solution strategies that students might use. Include the questions (assessing and advancing) recorded from the classroom video activity. The facilitator can discuss how the monitoring tool might be used as preparation for planning an instructional lesson. **(Slides 24-25)**    6. Discuss the Standards of Learning and Essential Knowledge and Skills addressed in the Playground Task by referencing the [Geometry Standards of Learning Curriculum Framework.](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/cf/geometry-cf.pdf) **(Slide 26)** 3. Taking Action in your Classroom - Burger Task (adapted from [VDOE Mathematics Instructional Plans](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/mip/index.shtml#a1), Algebra I, Graphing Systems of Linear Inequalities in Two Variables) 4. Revisit the Essential Questions for Module II. **(Slide 27)** 5. Have participants complete the Burger Task independently. Allow time to discuss possible solutions/strategies with the table group. **(Slides 28-29)** 6. Provide a blank copy of the Task Monitoring Tool. Ask each participant to complete the tool, but encourage working as a table group to share ideas. Ask each table group to share out potential questions (one assessing and one advancing). The facilitator will record them on chart paper at the front of the room. Ask participants to note how the various questions were sorted and to make connections among the questions. **(Slide 30)** 7. As participants return from lunch ask them use an electronic device to log into student.desmos.com and play one of the Desmos Polygraph Activities (Algebra I, Geometry or Algebra II) using the log-in code provided. Encourage participants to play one game at each course level. Allow participants time to play for a few minutes and circulate around the room encouraging participation. **(Slides 31-32)** 8. Show the “student” responses briefly via the [Desmos Teacher Dashboard](https://teacher.desmos.com/) from the Polygraph Activities in which the participants are engaging. Encourage participants to pause their game (or show them how to do so from the Teacher Dashboard) so that they can give attention to the Desmos screen that the facilitator displays to the whole group. **(Slide 33)** 9. How can you use Desmos to illustrate the ideas in the Burger Task? Open the Desmos graphing calculator and ask for participant feedback of how we might use the graphing utility to solve or illustrate this problem. Anticipate student thinking and ask purposeful questions. Provide participants with a copy of the Desmos User Guide. Facilitators may wish to demonstrate the following and ask the following questions, using the Desmos graphing calculator: **(Slide 34)**    * 1. Graphing lines (don’t need to solve for y)      2. Graphing window in Desmos – use wrench icon/drag screen      3. Label the axes in Desmos      4. Find points of intersection of the lines graphed      5. Shaded region -- change linear equations to inequalities      6. Type coordinates and label points in the shaded area, points on each line, and points on the axes      7. Discuss limitations on the domain and range given the context of the Burger Task problem 10. Discuss the Standards of Learning and Essential Knowledge and Skills addressed in the Burger Task by referencing the [Algebra I Standards of Learning Curriculum Framework.](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/cf/algebra1-cf.pdf) **(Slide 35)**   5) Encourage a whole group discussion about how the practice of posing purposeful questions promotes equity for all students. **(Slide 36)**  6) Ask the participants to use their reflection sheet and record their thoughts regarding the essential questions from Module II. **(Slide 37)**  **Strategy Catcher:** Build in time to allow for discourse (Playground Task Classroom Video); Open Sorting/Categorizing (Playground Task Classroom Video Post-It Note Questions); Popcorn – Calling out Answers by Table (Charting Questions from Playground Task Video); Turn and Talk (Reviewing the Monitoring Tool) | * [Playground task copies](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/playground-task.docx) * Post-It notes * Task Monitoring Tool copies ([Playground Task on one side](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/monitor-tool-playground.docx), [Burger Task on the other](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/monitor-tool-burger-task.docx)) * Graph Paper * Rulers * Compasses * Protractors * [Geometry Curriculum Framework](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/cf/geometry-cf.pdf)  * [Burger Task copies](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/monitor-tool-burger-task.docx) * Chart paper - set up as task monitoring tool * [Burger Task MIP Systems of Linear Inequalities Desmos](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/burger-task-mip-sys-lin-ineq-desmos.docx) * [Desmos User Guide handout](https://support.desmos.com/hc/en-us/articles/202529279-English-Desmos-User-Guide) |

| **Approximate Time** | **Facilitator Instructions** | **Materials** |
| --- | --- | --- |
| **85 minutes total** | **Module III: Teaching Practice: Elicit and Use Evidence of Student Thinking**  **Essential Questions: What can teachers do to elicit and use evidence of student thinking? How does eliciting and using evidence of student thinking promote student agency and identity?** |  |
| 1-2) Doing the Desmos activity -- 20 mins  3a) Jigsaw -- 20 min  3b) Planning -- 20 min  3c) Gallery walk -- 20 min  4-6) Summarize and reflect -- 5 min | 1. Review Module III essential questions and definition of the teaching practice “elicit and use evidence of student thinking.” **(Slides 38-40)** 2. Desmos Activity – [Exponential Regression](https://teacher.desmos.com/activitybuilder/custom/5b2956c3749f46344b36f9de) – Facilitators can access and copy the activity linked here. **(Slide 41)**    1. Ask the participants to log into student.desmos.com and participate in the regression activity as a student by answering all questions and completing all of the graphs.    2. Facilitator will monitor the activity. Pause as needed to show features of Desmos or talk about responses – modeling what to do with what the students say.    3. For participants who complete the activity quickly, recommend that they go to teacher.desmos.com and explore other pre-made activities. 3. Pass out the sample student/participant responses to the Desmos Exponential Regression Activity. Have participants consider the questions: What mathematical understanding do these response reveal? What misconceptions do these responses reveal? **(Slide 42)** 4. Jigsaw - Ask each participant at the table to consider a different student response. Participants will group themselves at tables where all share the same student’s response. In these groups, discuss the two questions. Ask participants to return to their original table and share each student’s response with the group to create an instructional plan for the entire class. **(Slide 43)** 5. Each table group will then need to consider an instructional plan of what to do next. Make a plan on chart paper labeling 2 columns (Understandings/Misconceptions and Instructional Decision). **(Slide 44)** 6. Have participants conduct a gallery walk to see other groups’ responses. Ask them to look for at least one idea that they did not have on their plan. 7. Discuss the Standards of Learning and Essential Knowledge and Skills addressed in the Desmos Activity – Exponential Regression by referencing the [Algebra II Standards of Learning Curriculum Framework.](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/cf/algebra2-cf.pdf) **(Slide 46)**   5) Encourage a whole group discussion about how the practice of eliciting and using evidence of student thinking promotes equity for all students. **(Slide 47)**  6) Ask the participants to use their reflection sheet and record their thoughts regarding the essential questions from Module III. **(Slide 48)**  **Strategy Catcher:** Jigsaw (Desmos Activity – Exponential Regression Reviewing Student Responses); Gallery walk (reviewing instructional plan to respond to student understandings/miconceptions) | * [Copies of student responses to Exponential Regression task](http://www.doe.virginia.gov/instruction/mathematics/professional_development/institutes/2018/alg-geo-alg2/desmos-output-stud-work.docx) * Chart Paper |

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| --- | --- | --- |
| **20 minutes total (Q&A as time allows)** | **Module IV: Taking Action – Next Steps**  **Essential Question: How will you plan to implement tasks to facilitate meaningful mathematical discourse? How will you share this information with others?** |  |
| 1) Discussion rubric reflection -- 10 min  2) Summary, etc. -- 5 min  3) Final q&a -- as time allows  4) Final reflection -- 5 min | 1. At their tables, ask participants to reflect on the classroom discussion rubric. Have them share places where they saw explicit use of higher levels of discourse throughout the day – either in the structure of the Professional Development session or in the activities to be used with students. Have them start with the person whose birthday is coming up next. **(Slides 49 – 51)** 2. Summarize the learning from the session by discussing the climate needed in a classroom to promote discourse, the use of technology, using the lens of equity in all of our work with students, planning for purposeful questioning, eliciting and using evidence of student thinking, and being deliberate about the instructional strategies that we use in our classrooms to ensure that the teaching practices being implemented connect to the larger framework for teaching. **(Slide 52-53)** 3. Remind participants of the VDOE Instructional Resources that are available. **(Slide 54)** 4. Discuss any questions from the parking lot that have not yet been addressed, along with any other questions that participants may have. **(Slide 55)** 5. Leave time for a final reflection using the reflection sheet. Participants should address the questions: How will you plan to facilitate meaningful mathematical discourse? How will you share this information with others? **(Slide 56)** 6. Share the VDOE contact email: [mathematics@doe.virginia.gov](mailto:mathematics@doe.virginia.gov) **(Slide 57)**   **Strategy Catcher:** Start with the person who \_\_\_\_\_\_\_ (Sharing places where high level discourse was noted) | Handout: Levels of Classroom Discourse rubric (already provided in Module I) |