Application of Research to Practice

A Right to Education – Teaching Maryland's Detained and Committed Youth

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https://doi.org/10.65517/25V37N113

Abstract

In 2022, the Maryland Juvenile Services Education Program (JSEP) became its own state local education agency. This education program ensures justice involve youth receive the same level of rigorous education and access to the same state standards as the other twenty-four counties in Maryland. In order to see this come to fruition, the JSEP Coordinator of Mathematics built a mathematics program that ensured every student has access to course appropriate mathematics instruction every day, with just in time supports to advance mathematical understanding.

Who is JSEP?

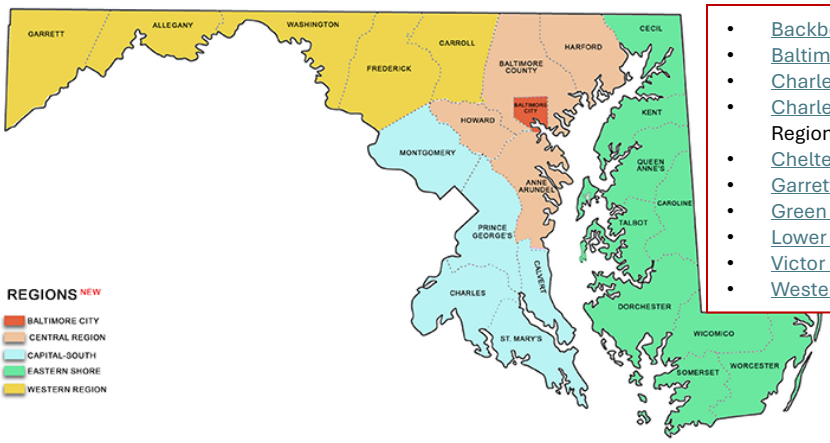
Who deserves a high quality, rigorous education? Is there anything a student can do that would result in denying them access to grade appropriate, affirming, and meaningful education? Absolutely not. Established by the 14th Amendment of the United States Constitution, "...No U.S. state can deny equal educational opportunity to any person on the basis of gender, race, color, or nationality through intentional segregation by an educational institution." Furthermore, a free appropriate public education (FAPE) must be available to all students in Maryland, even if they are incarcerated, including students with disabilities who have been suspended or expelled from school (MSDE, 2022). According to the Maryland Department of Juvenile Services (2024), in just the month of October 2024, 1,288 juveniles were referred to the Maryland Department of Juvenile Services: 174 felonies, 805 misdemeanors, 168 crimes of violence, 27 citations, and 114 other offenses. While a little over 300 of these juveniles are enrolled into the Department of Juvenile Services (DJS), everyone is a student of mathematics regardless of the reason for entry into DJS.

During the 2021 Legislative session, the Maryland General Assembly passed and Governor Lawrence J. Hogan Jr., signed into law SB 497, Chapter 145 "Juvenile Services Education Board and Program." The legislation transitioned the responsibility of implementing a juvenile services education program from the Maryland State Department of Education (MSDE) to the Juvenile Services Education Program (JSEP) and Board. As of July 1, 2022, the responsibility of implementing educational programming again transferred from MSDE to DJS,

who worked collaboratively ensure a successful transfer of educational responsibilities. The Juvenile Services Education Program (JSEP) became an independent education program housed in Maryland's Department of Juvenile Services. JSEP provides comprehensive educational services to all students in DJS detention and/or residential facilities (see Figure 1).

Figure 1

Map of JSEP Centers



- Backbone Mountain Youth Center (Western Region)
- Baltimore City Juvenile Justice Center (Baltimore City Region)
- Charles H. Hickey, Jr. School (Central Region)
- Charles H. Hickey, Jr. Structured Shelter Care Program (Central Region)
- Cheltenham Youth Detention Center (Capital-South)
- Garrett Children's Center (temporarily closed) (Western Region)
- Green Ridge Youth Center (Western Region)
- Lower Eastern Shore Children's Center (Eastern Shore)
- Victor Cullen Center (Western Region)
- Western Maryland Children's Center (Western Region)

Note. From Maryland Department of Juvenile Services (n.d.).

The Myth

In June 2022, the JSEP mathematics program consisted of the Savvas enVision textbook series and the list of the Maryland College and Career Ready Mathematics Standards. Despite the textbook being a highly qualified resource according to EdReports (2024), the delivery of instruction was largely teacher lead, lecture style, teacher centered, with teachers under intense pressure to pass students over developing their mathematical understanding. Compounding the issue are education complications many justice-involved youth bring (see Figure 2).

While JSEP teachers believe in their students, an unfortunate narrative of "these kids can't" permeated JSEP. The transient nature of the students compounded with the broken educational backgrounds and complicated socio-emotional chemistry gave a false lens that the students were incapable of achieving course-appropriate work. Instruction shifted to focus on mathematics concepts significantly below grade level. A history of poor student behaviors led to a misconception that they could not engage in hands-on experiential activities. Compliance and complacency were rewarded with passing grades.

Figure 2

Education Complications

Note. From Office of Juvenile Justice and Delinquency Prevention (2019).

JSEP had unintentionally become the embodiment of The Opportunity Myth. In 2018, The New Teacher Project (TNTP) studied a large, diverse group of students to learn reasons, despite earning course credits and advancing in their course trajectories, that they were unsuccessful on high stakes assessments and failing to reach their career goals. According to TNTP (2018), "While students succeeded on more than two-thirds of their assignments, they only demonstrated success against the grade-level standards 17 percent of the time on those exact same assignments. That gap exists because so few assignments actually gave students a chance to demonstrate grade-level mastery" (p. 21). Learning walks and classroom observations showed JSEP students were experiencing this same narrative. JSEP students were earning credits in high school courses, but completing worksheets drilling elementary level mathematics skills. In these classroom observations, students showed a drive to learn. They displayed an anxious energy to be challenged, with this need not being met. TNTP researchers found when students were given grade appropriate materials:

> *"...students met the bar on those assignments more often than not, even though the bar was higher. When students were tasked with assignments that were appropriate for their grade, they met the demands of those assignments a little more than half the time. That was true of students in nearly all groups—regardless of race or language background. It was also true in nearly all types of classrooms, including those that are often identified as "high-need." In all of these classrooms, students were more likely*

> *than not to have success on assignments that were grade-appropriate—when they were given the opportunity to try" (TNTP, 2018, p. 24).*

It became clear it was time to change the trajectory of mathematics education in the JSEP schools.

Changing the Trajectory

When given grade-appropriate assignments, students rose to the challenge. Students are more likely to meet the rigor of assignments appropriate for their grade when given the opportunity to try. This statement has a direct connection to Maryland's justice involved youth. JSEP students are capable of mastering course-appropriate material if given the opportunity. TNTP (2018) assert that "Every student should have access to grade-appropriate assignments, strong instruction, deep engagement, and teachers with high expectations, every day, in every class—regardless of their race, ethnicity, or any other part of their identity" (p. 56). This includes JSEP students.

The JSEP Coordinator of Mathematics struggled with how to make this happen. How can the JSEP students be provided with meaningful and engaging opportunities? How can such a deeply diverse student body be provided access to course-appropriate instruction while addressing learning gaps? How can teachers be provided with the professional development needed?

The first consideration was remediation and intervention. However, the instructional issues and learning gaps JSEP students experienced were too vast to be overcome with remediation and intervention. Limited staffing, with oftentimes only one mathematics teacher per school, meant intervention and remediation would happen at the cost of Tier I instruction. As Kyles-Smith (2023) argues, "...Overuse of academic-remediation interventions may offer temporary gains but impede long-term progress and ultimately lead to regression...deeper instruction and a focus on high-quality student work must be the primary strategies for addressing and closing achievement gaps." It became important to build a mathematics program that went deeper for all JSEP students. Remediation and intervention had to be embedded within Tier I instruction.

> *"Targeted remediation interventions may be useful in certain situations, but there is profound power in learning experiences that are complex, authentic, and that foster knowledge development and craftsmanship. Schools can provide a pathway to mitigating widening achievement gaps by emphasizing the production of high-quality work,...tasks that reflect real-world contexts, challenge students to think critically, and connect learning to practical applications" (Kyles-Smith, 2023).*

JSEP needed a mathematics program that engages students in research-based Standards of Mathematical Practice, focused on adaptive reasoning, strategic competence, conceptual

understanding, procedural fluency, and productive disposition. JSEP students needed to experience the same levels of cognitive complexity and aspects of rigor all students in Maryland had access to.

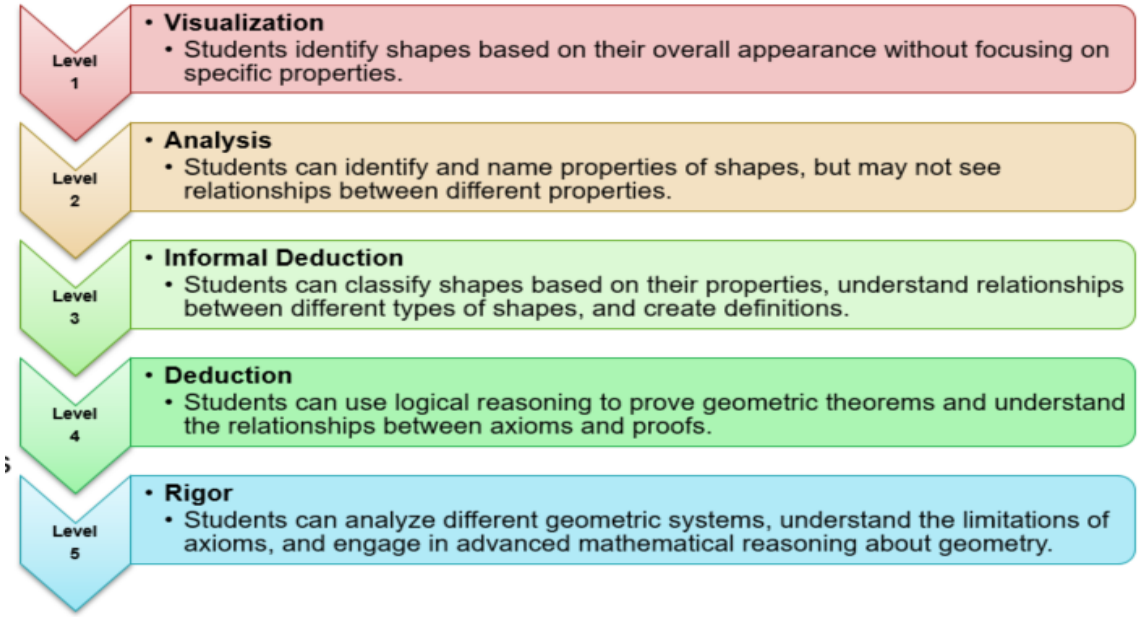
The van Hiele Model

The vision of JSEPs Mathematics curricula is to build on students' procedural skills and conceptual understandings, and strengthen their ability to apply their understandings to solve real world problems. These aspects of rigor build students' mathematical proficiency, providing students with the problem-solving skills needed to be successful in the future they aspire to realize. The solution came by way of the van Hiele Model of Geometric Thinking, a tiered approach built around how students learn geometric concepts.

The JSEP high school geometry course is based on the van Hiele model of geometric thinking. This research-based model structures learning on a five-level hierarchy. Each level of learning focuses on the characteristics of the thinking process. As shown in Figure 3, the van Hiele model asserts that the learner moves sequentially from visual learning to analysis to informal deduction to formal deduction, and lastly, to rigor.

Figure 3

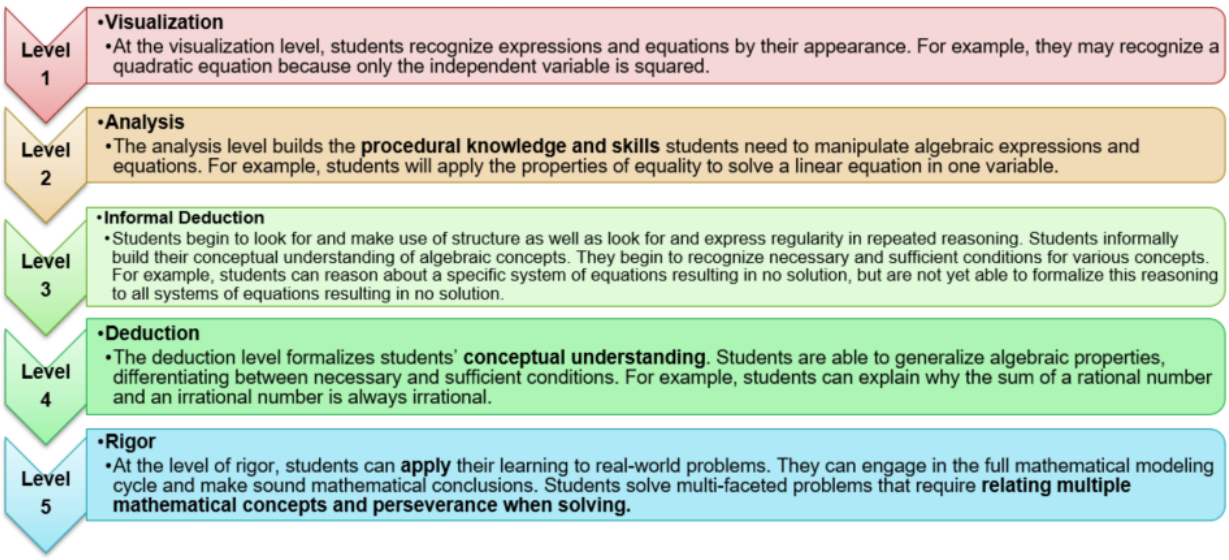
van Hiele Model of Geometric Thinking



Inspired by this method for teaching geometry, the JSEP Algebra I curriculum and the JSEP Algebra II curriculum were developed following the same tiered instructional process (see Figure 4).

Figure 4

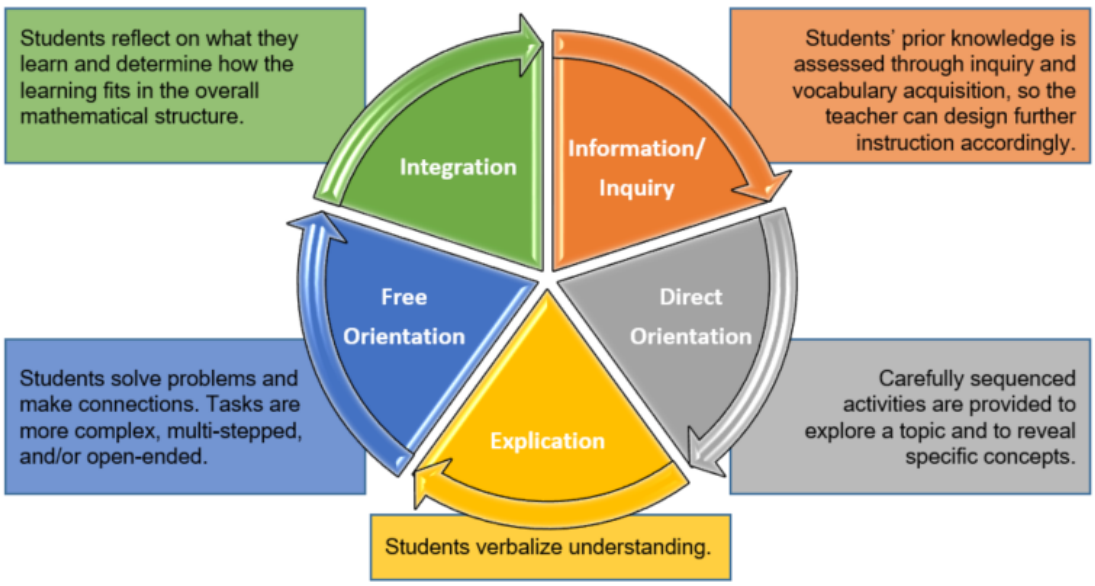
JSEP van Hiele Model of Mathematical Thinking



This design assures that every student will have an entry point into the day's mathematics lesson, and every student's learning will be taken to a new level every day. Through the van Hiele model there is a focus on student-centered classrooms, where teachers support students to engage in mathematics through inquiry and problem solving in order to learn mathematics.

Figure 5

JSEP van Hiele Phases of Learning



The JSEP Mathematics Curricula

Through the JSEP Mathematics curricula, the van Hiele Model became the van Hiele Model for Mathematical Thinking. By adhering strictly to the van Hiele Levels, the JSEP curricula uses the van Hiele Phases of Learning to move students through the Levels of Understanding (see Figure 5). To ensure the written curricula would become the taught curricula, lesson suggestions for every van Hiele Level for every day for every section were embedded into the curricula. Each suggested learning activity in the curricula needed to purposefully further the mathematics knowledge of the students. To build out the van Hiele Levels, curriculum writers answered the following questions.

Level 1: Visualization

- How do we have the students 'see' the mathematics?
- What activity can allow every student to access the mathematics?
- What can we have the students discover to peek their interest and move the learning forward?

Level 2: Analysis

- What procedural knowledge, skills, definitions, properties, etc., do the students need?
- What activity can allow every student to access the mathematics?
- Which key questions are essential for teachers to ask students to build knowledge and move learning forward?

Level 3: Informal Deduction

- What understandings and connections do students need to make between and across concepts?
- What activity can allow every student to access the mathematics?
- Which connections and conclusions are essential for students to make to move learning forward?

Level 4: Deduction

- What generalizations do students need to make between and across the concepts?
- What activity can allow every student to access the mathematics?
- Which formal conceptual understandings do students need to make that are essential for moving learning forward?

These questions were answered for every day of every section of every unit for the JSEP Algebra I, Geometry, and Algebra 2 courses. The result is a coherent guide that supports teachers as they navigate students through their learning. The guide helps teachers understand not only the 'what' students need to learn, but the "why" and the "how."

Connections to high quality instructional materials (HQIM) are provided to ensure research-based activities are implemented. A variety of low-tech tools, such as patty paper and pattern block, as well as a variety of high-tech tools, such as virtual graphing tools and applets, are provided to engage students in the learning. Refer to Appendix A for sample curricular pages.

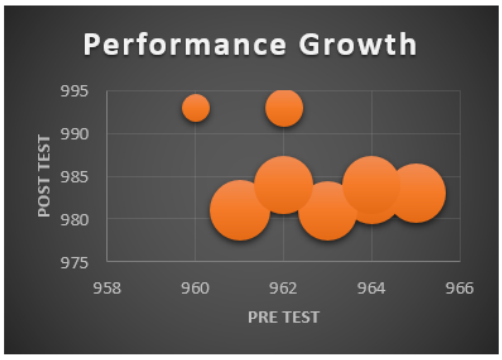
Successes and Continued Challenges

The term "curriculum" has a multitude of definitions and interpretations. By creating a curriculum *guide* for JSEP teachers, with guiding scaffolds, guiding questions, guiding activities, guiding instruction, and guiding assessments, JSEP teachers have flipped the script in the juvenile detention and treatment centers in Maryland. Students have access to high quality education and take ownership of their learning. The Standards for Mathematical Practice are evident in instruction, and worksheets no longer drive instruction. Interviews with students showed students value the more active learning, with one student stating they appreciate the opportunities to show what they know, the respect shown to them when given on-grade level work, and the "…break from the boredom of worksheets and laptops." Biweekly check-ins with teachers provide further anecdotal data, revealing teachers value the focused pacing of the curriculum guides, with one teacher stating, "The coherence in the presentation of the content has helped me to not only know what I need to teach, but more importantly *why* I am teaching it. The curriculum has also provided me with different ways on *how* to teach the mathematics, which has helped me to better reach the students and be a more effective teacher" (C.L., JSEP Mathematics Teacher).

Figure 6

JSEP STAR Renaissance Mathematics Data SY23-24

STAR Renaissance Mathematics Data, SY23-24 Winter to Spring Growth



Total # Positive Growth	230
Total # Tested	352
% Positive Growth	65.34%

JSEP uses the Renaissance STAR assessment to monitor student growth. This assessment is given to students within three days of enrollment at a JSEP facility, and every 90 days thereafter. Performance growth is tracked. Figure 6 shows the performance growth in the eight JSEP facilities for the 2023-2024 school year, which was the first year the van Hiele

model curriculums were implemented. With over half of the students showing growth on the assessment, and a positive trend in the correlation between pre-test and post-test scores, there is evidence the JSEP curriculum is effective. Success can also be seen by student performance across the unit assessments embedded in the curriculum. Figure 7 shows the improvement in student performance in the first unit assessments for each curriculum.

Figure 7

JSEP Unit Assessment Data

Successes – Unit 1 Data from Common Assessments

Algebra I Unit 1 Assessment			Algebra 2 Unit 1 Assessment			Geometry Unit 1 Assessment		
	Sp 24	F 24		Sp 24	F 24		Sp 24	F 24
A	2	10	A	1	1	A	3	5
B	2	15	B	0	7	B	7	6
C	3	22	C	6	6	C	10	9
D	6	10	D	8	7	D	12	9
E	19	32	E	23	16	E	23	19

Despite the success, there are still many challenges to overcome when strengthening the mathematics instruction JSEP students receive. JSEP currently works with a one room schoolhouse design, where teachers are teaching multiple subjects in one class period. This divides instructional time, making it difficult for teachers to teach lessons seamlessly and to focus on students' individual needs. Safety and security are always considerations and concerns, which makes some hands-on activities and exploratory lessons difficult as the simplest of manipulatives can be weaponized.

Teacher vacancies have hit JSEP harder than any other LEA, with several schools lacking a certified mathematics teacher. With facilities across Maryland from western Maryland to the Eastern Shore, face-to-face professional development is difficult if not impossible to arrange. Lastly, despite the success of the curricula, there are still challenges with full fidelity to and full implementation of the curricula. Despite the challenges, JSEP continues to grow and student performance maintains a positive trajectory. By improving and strengthening teacher capacity, increasing collaboration, building a supportive culture, and strengthening coherence, JSEP can bust the opportunity myth.

References

EdReports. (2024, October 16). *enVisionMath A/G/A*. *https://www.edreports.org/reports/overview/envisionmath-aga-2024*.

Kyles-Smith, K. (2023, September 1). *To address learning gaps, go deeper.* ASCD Educational Leadership. https://ascd.org/el/articles/to-address-learning-gaps-go-deeper

Maryland Department of Juvenile Services. (2024). *Data resource guide fiscal year 2024*. https://djs.maryland.gov/Documents/DRG/Data_Resource_Guide_FY2024.pdf

Maryland Department of Juvenile Services. (n.d.). *Facilities and offices*. https://djs.maryland.gov/Pages/facilities/index.aspx

Maryland State Department of Education. (2022, July 26). *Maryland's teacher workforce: Supply, demand, and diversity* [Data brief]. https://www.marylandpublicschools.org/stateboard/Documents/2022/0726/TabGBlueprintAndDataDeepDiveTeacherPipelineAndDiversity.pdf

Office of Juvenile Justice and Delinquency Prevention. (2019). *Education for youth under formal supervision of the juvenile justice system: Literature review* (NCJ 252926). U.S. Department of Justice. https://ojjdp.ojp.gov/model-programs-guide/literature-reviews/education_for_youth_under_formal_supervision_of_the_juvenile_justice_system.pdf

Ohio Department of Education. (2024). *van Hiele Model of Geometric Thinking*. https://education.ohio.gov/getattachment/Topics/Learning-in-Ohio/Mathematics/Model-Curricula-in-Mathematics/Van-Hiele-Model-of-Geometric-Thinking.pdf.aspx?lang=en-US

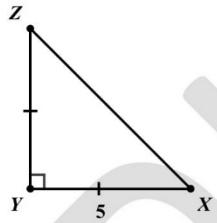
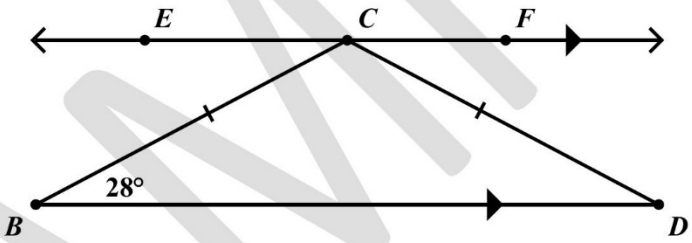
TNTP (2018). *The opportunity myth: What students can show us about how school is letting them down—and how to fix it.* https://tntp.org/publication/the-opportunity-myth/

Nina Riggs is the immediate-past Academic Coordinator for Mathematics and Science with the Maryland Juvenile Education Program. Prior to this role, she worked as a Secondary Mathematics Specialist in the Maryland State Department of Education, as well as a Secondary Mathematics Resource Teacher in the Baltimore County Office of Mathematics.

Appendix A
Geometry Curriculum Sample

Chapter 4 Lesson 2

Section(s)
4-2: Isosceles and Equilateral Triangles

Assessment
Lesson Opener
Find $m\overline{XZ}$    [Key: $\sqrt{50} = 5\sqrt{2} \approx 7.071$]
Exit Ticket
Find $m\angle BCF$.    [Key: 152°]

Lesson Materials
enVision Geometry Common Core. SAVVAS (Pearson) Technology – Desmos Geometry Tool (https://www.desmos.com/geometry) Curriculum Resources – *Isosceles Triangle Proof Pieces* – *Equilateral Triangles are Isosceles Triangles* Patty paper Rulers

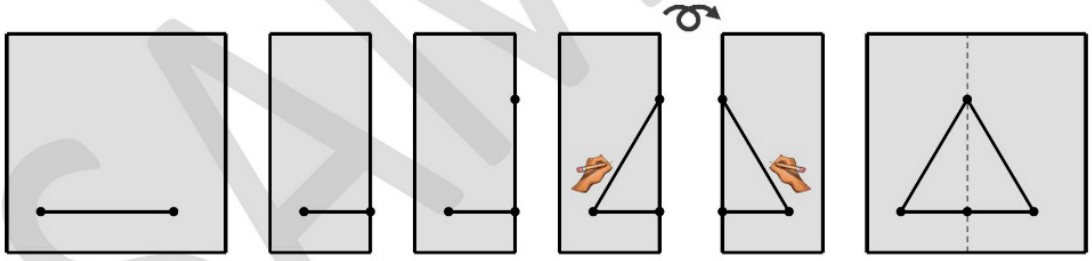
Lesson Suggestions

Level 1: Visualization

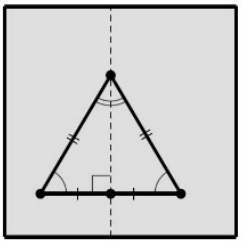
- Have the students open a blank Desmos Geometry Tool. Direct the students to construct a horizontal segment. Rotate the segment 60° about its left endpoint. Rotate the resulting segment 60° about its left endpoint. Ask, "What type of triangle have we constructed? What properties does this triangle appear have?"
- Use this construction and conversation to refresh student's knowledge of equilateral triangles. Discuss the properties of equilateral triangles that appear to be true visually, such as congruent sides, congruent angles, always an acute triangle, etc.
- Open a new Desmos Geometry Tool. Instruct the students to construct a circle. Use the segment tool to draw two radii of the circle. Refresh student knowledge of the properties of circles, i.e. all radii are congruent. Connect the endpoints of the segments on the circle with a third segment. Ask, "What type of triangle have we constructed? What properties does this triangle appear have?"
- Use this construction and conversation to refresh student's knowledge of isosceles triangles. Discuss the properties of isosceles triangles that appear to be true visually, such as at least two congruent sides, could be an acute or obtuse triangle, etc. Translate the endpoints of the segments to hypothesize other properties about isosceles triangle that appear to be true.

Level 2: Analysis

- Give each student a piece of patty paper and a ruler. Have the students draw a segment on the patty paper. Direct the students to fold the perpendicular bisector of the segment. Keep the patty paper folded, and place a point along the perpendicular bisector above the segment drawn. Connect the point to one endpoint of the segment with a segment. Flip over the patty paper, and connect the point to the other endpoint of the segment with a segment. Unfold the patty paper to reveal an isosceles triangle.



- Use the patty paper construction of the isosceles triangle to find all the properties of an isosceles triangle. Use the folding techniques to map parts of the triangle onto itself to show congruency. Mark the triangle with the appropriate markings to indicate these congruencies.



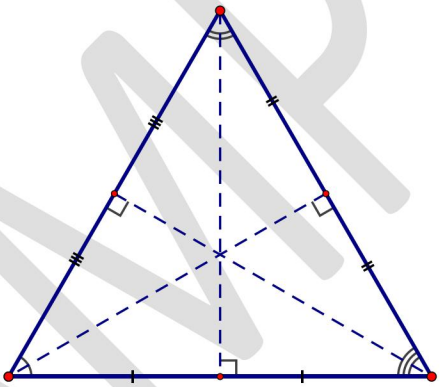
Lesson Suggestions

Level 3: Informal Deduction

- Apply the properties of isosceles triangles to solve algebraic problems such as pp. 158-160, Examples 2-4 and corresponding Try It! 2-4. Support visual learners by having the students label the isosceles triangle from the patty paper construction with the measurements and expressions given in the problem. Erase the measurements and relabel with new measurements for each problem.
- Create the Proof Pieces for each of the properties of the isosceles triangle. Refer to *Isosceles Triangle Proof Pieces* for reference, or simply cut these out for the students and add them to their Proof Piece set.

Level 4: Deduction

- Refer to the formal definition of an isosceles triangle using the glossary of the textbook. Ask the students what is meant by 'at least two congruent sides'. Conclude that an equilateral triangle is a special type of isosceles triangle.
- Cut out the equilateral triangle from *Equilateral Triangles are Isosceles Triangles*. Give each student a triangle. Have the students use folding techniques to discover and verify the properties of an equilateral triangle. Mark the equilateral triangle with the appropriate congruency marks and angle markings to indicate the properties.



- Apply the properties of isosceles triangles and equilateral triangles to solve algebraic problems such as pp. 161-162, Examples 5-6 and corresponding Try It! 5-6. Support visual learners by having the students trace the given triangles given in each problem using patty paper, labeling the triangle with the given measurements. Prompt students to use folding techniques to identify relationships and form algebraic equations to solve the problems. Encourage students to redraw overlapping or adjacent triangles as separate triangles to better visualize the triangle measurements.

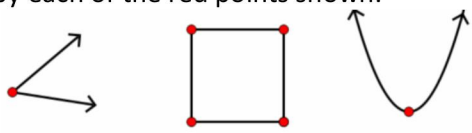
Level 5: Rigor

- (This level of geometric understanding is not applicable at this time.)

Appendix B
Algebra II Curriculum Sample

Unit 2 Lesson 1

Section(s)
2-1: Vertex Form of a Quadratic Function

Assessment
Lesson Opener
Identify the term represented by each of the red points shown.  [Key: Each point indicates a *vertex*.]
Exit Ticket
The parabola $f(x) = -(x-6)^2 - 2$ is graphed in the coordinate plane. Select from the drop-down menus to correctly complete the sentence. The vertex of the parabola is 6 units [Choose... / left of / right of / up from / down from] the origin and 2 units [Choose... / left of / right of / up from / down from] the orig [Key: right of; up from]

Lesson Materials
enVision Algebra II SAVVAS (Pearson) Technology – Desmos Graphing Calculator (https://www.desmos.com/calculator) Curriculum Resources – *Which is Which?* – *Slide to the Left! Slide to the Right!*

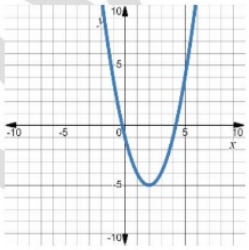
Lesson Suggestions

Level 1: Visualization

- Cut out the cards from *Which is Which*, prior to the start of class. Provide each student with a set of cards, and have the students sort the cards by the function type shown on each card. Use this card sort to formatively assess student knowledge of recognizing linear, quadratic, and exponential functions given different representations.
- Focus on the quadratic functions from *Which is Which*. Graph the function $y = x^2 + 6x + 9$ in the Desmos graphing calculator. Identify the graph of the function as a parabola. Explain that quadratic functions are polynomial functions with the variable's highest exponent is two.
- Graph the function $y = (x - 3)^2 + 2$. Point out this function is also quadratic and forms a parabola, but the equation is in a different structure. Assign the activity, *Slide to the Left! Slide to the Right!*, to have students discover and explore vertex form of a quadratic function.

Level 2: Analysis

- Ask the students, "What is the significance of writing a quadratic equation in this vertex form?" Make connections between the structure of the equation $y = a(x - h)^2 + k$, the vertex (h, k), and the axis of symmetry $x = h$ of the parabola. Use the *Slide to the Left! Slide to the Right!* activity for students to record these connections.
- Present the equation $y = -3(x - 1)^2 + 4$. Prompt students to identify the vertex, axis of symmetry, and direction of the parabola by asking, "What can you tell me about the parabola of this quadratic equation without graphing it?" Follow up by graphing the quadratic equation to verify the responses. Repeat the prompt with the equation $f(x) = 2(x + 4)^2 - 5$, cautioning students to use the correct sign for the value of *h*.
- Provide additional practice identifying the vertex of a parabola given the quadratic equation. Have the students determine if the vertex is a maximum or minimum.
- Display the graph shown. Ask the students to identify a potential quadratic equation, justifying their reasoning.

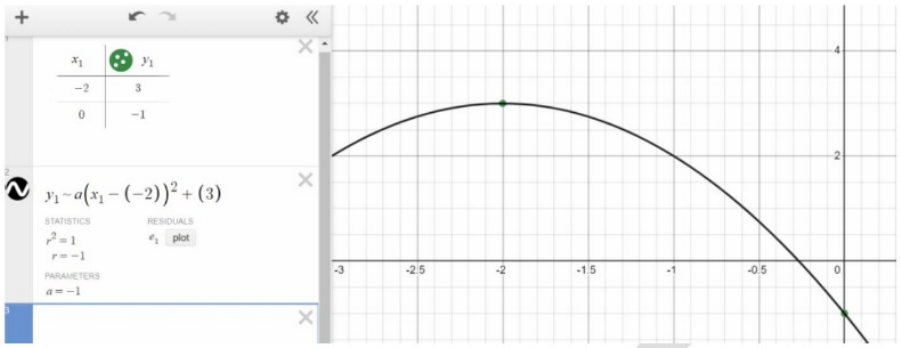


- Provide additional practice identifying the vertex of a parabola and a potential corresponding quadratic equation given the graph of a parabola.

Level 3: Informal Deduction

- Transition to writing the equation of a parabola given various points along the curve. Start by giving the students the coordinates of the vertex of a parabola and another point the parabola passes through, similar to p. 75, Example 3. Support students by allowing the use of the features of the Desmos graphing calculator to find the quadratic equation for the parabola. Enter the coordinates of the vertex and the ordered pair into a table in Desmos. Use the command $y_1 \sim a(x_1 - h)^2 + k$ to find the missing parameter, *a*, needed to write the quadratic equation. Be sure to replace the values of *h* and *k* in the command with the coordinates from the vertex, as shown, so the calculator recognizes which ordered pair in the table is the vertex.

Lesson Suggestions



Write the final equation for the quadratic equation using the resulting value of *a*.

- Provide practice writing the equation of a parabola given the vertex and another point. Include application problems, such as p. 75, Example 4. Continue to allow the use of the Desmos graphing calculator and the $y_1 \sim a(x_1 - h)^2 + k$ command. Teach the algebraic approach, as modeled on p. 75, only if time permits and only if students appear ready for this conceptual approach.

Level 4: Deduction

- Enter the parent function, $f(x) = x^2$ into Line 1 of Desmos. Input $g(x) = f(x) + 1$ in Line 2. Ask the students to compare the vertices of the parabolas, and explain the difference. Change the '1' in the $g(x)$ equation to a *k*, adding a slider. Explore how the translation affects the vertex of $g(x)$.
- Leave the parent function, $f(x) = x^2$ in Line 1 of Desmos. Change line 2 to $g(x) = f(x + 1)$. Ask the students to compare the vertices of the parabolas, and explain the difference. Change the '1' in the $g(x)$ equation to an *h*, adding a slider. Explore how the translation affects the vertex of $g(x)$.
- Leave the parent function, $f(x) = x^2$ in Line 1 of Desmos. Change line 2 to $g(x) = f(x + 1) + 1$. Ask the students to compare the vertices of the parabolas, and explain the difference. Change the $g(x)$ equation to $g(x) = f(x + h) + k$, adding the sliders. Explore how the translation affects the vertex of $g(x)$. Make clear that the function $g(x)$ is a translation of the quadratic function, $f(x)$.

Level 5: Rigor

- Apply student learning to solve more real world problems. Allow students to work in pairs to solve p. 79, #34, 35, and 38. Be sure to allow the use of the Desmos graphing calculator, as it is a strategic problem solving tool students should become adept at using.

Which is Which?

Identify the function shown in each of the cards. Sort them into piles according to their function type.

Linear Functions	Quadratic Functions	Exponential Functions

(Cut these cards out to place them in the corresponding cells in the table above.)

$f(x) = ax^2 + bx + c$	$f(x) = mx + b$	$f(x) = a(b)^x$
$y = -2x + 3$	$y = 4\left(\frac{1}{2}\right)^x$	$y = x^2 + 6x + 9$
$y = 2(3)^x$	$y = (x-3)^2 + 2$	$y - 4 = \frac{1}{3}(x+1)$