

Preparation Notes

Please review and customize this deck to prepare it for use. Some notes:

- These professional learning (PL) materials (slide deck and accompanying handout) are being offered in editable forms so that you may make adjustments to better support the specific work happening in your school or district.
- For the 2024–25 school year, student work samples are not provided for most sessions. The facilitator will need to collect or create student work samples when implementing these materials during 2024–25.
- These PL materials are designed to easily accommodate remote delivery:
 - A [Jamboard template](#) is provided to facilitate discussion of student work; the facilitator will need to make a copy of this and be ready to share the link with participants as noted in the deck.
 - Text that can be readily pasted (marked with “—”) into a video call chat feature is included when participants need to reference the handout.
 - There are placeholders for handout links to be shared with participants in the notes field of selected slides; the facilitator will need to add a link to the handout where indicated by “[insert link].”

M154 Overview

XQ Badge Project PL Series Baseline Session

Month XX, XXXX

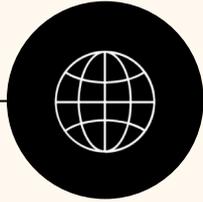


Welcome!

Community Builder:

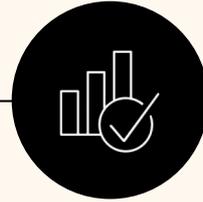
Write a 6 word story that describes your teaching style.

Outcomes and Agenda



Participants will be able to:

- Explain the content and practice expectations for the M154 badge
- Analyze tasks through the lenses of (1) content and practice expectations and (2) learning principles
- Analyze student work for evidence of learning

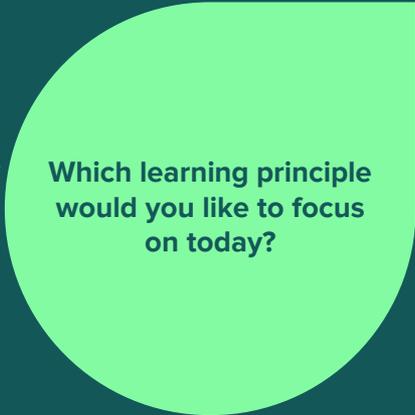


Agenda:

- Task 1: Expectations and Learning Principles
- Task 1: Student Work
- Task 2: Expectations and Learning Principles
- Task 2: Student Work
- Closing

Learning Principles

1. Engage with cognitively demanding tasks in heterogeneous settings.
2. Engage in social activities.
3. Build conceptual understanding through reasoning.
4. Have agency in their learning.
5. View mathematics as a human endeavor across centuries.
6. See mathematics as relevant.
7. Employ technology as a tool for problem-solving and understanding.



**Which learning principle
would you like to focus
on today?**

01

Exploring the Content

What comes to mind?
What knowledge and skills
should students learn to
earn this badge?



Come off mute
or put your
thoughts in the
chat!

What's the Story of these Standards?

Selected Common Core Standards for Mathematics High School – Geometry

Translate between the geometric description and the equation for a conic section.

1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
2. Derive the equation of a parabola given a focus and directrix.

Use coordinates to prove simple geometric theorems algebraically.

1. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.*
2. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
3. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
4. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★

**How would you synthesize these?
What are the key takeaways
for students?**

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Share your thinking!

M154 Content and Practice Expectations (CPE)

154.a	Translate between the geometric description and the equation for a conic section, specifically of a circle and parabola.
154.b	Use coordinates to prove simple geometric theorems algebraically.
154.c	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
154.d	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
154.e	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

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**What
resonates with
you?**

M154 Content and Practice Expectations and Indicators

Content and Practice Expectations	Indicators Choose an artifact where you...
154.a: Translate between the geometric description and the equation for a conic section, specifically of a circle and parabola.	i. explain how the Pythagorean Theorem can be used to derive the equation of a circle.
	ii. write the equation for a parabola using the focus and directrix.
154.b: Use coordinates to prove simple geometric theorems algebraically.	i. use the distance formula to find the distance between two points on a coordinate plane.
	ii. use coordinates along with the slope formula, distance formula, and/or midpoint formula to prove simple geometric theorems algebraically.
	iii. use coordinates to prove that a quadrilateral is, or is not, a specific quadrilateral.



What new
insights do you
have?

Let's Investigate

Choose at least one task to explore:

- Explaining the Equation for a Circle
- A Midpoint Miracle

Which content and practice expectations are evident in each one?

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Come off mute
or put your
thoughts in the
chat! What did
you find?

What's the Same?

What's Different?

1. How do these content and practice expectations align to ways you've taught this topic before?
2. How are they different?

**Come off mute
or put your
thoughts in the
chat!**

Inequity Is our Reality

About

60%

of community college students and 40 percent of four-year students are placed into non-credit bearing developmental mathematics (Ganga et al., 2018)

Only

33%

of community college students complete the developmental math sequence. Only 20 percent complete a college-level math course over three years (Bailey, Jeong, & Cho, 2010).

We Must Lead the Movement

How can this approach give space for what math can be?

Is math...?

- About getting one right answer, the teacher's way
- Irrelevant
- About doing procedures
- Independent work
- Something my teacher made up
- Formulaic

Or could math be...?

- About using multiple strategies flexibly
- Connected to the real-world in ways that make sense
- About understanding and applying
- Collaborative work
- Lived across continents and centuries
- Novel, challenging problems

02

Task 1: Expectations and Learning Principles

Let's Do Some Math!

Cities have begun to offer micro-mobility options like shared electric scooters and bikes in hopes of meeting the transportation needs of their communities. For this task, you will explore the limits and possibilities of using such devices.

Use Google Maps to locate at least three places of interest. Some options could include your school site, a place you go to often, or a place of work. Use technological tools, like [Desmos](#) or [GeoGebra](#), or transparency paper to superimpose a coordinate system over your map.

1. If you were to use an electric scooter that can travel 35 miles on a single charge, would you be able to make the trip from the first place of interest to the second, and return back to the first point of interest? Justify your response using words, numbers, and symbols.
2. How long would it normally take to make that round trip using other modes of transportation you have access to (car, bus, or walking)? How long do you estimate it would take to make the trip on a scooter?
3. What are the advantages and disadvantages of offering micro-mobility options?

Do the task as a student would. Jot down any reflections that you have as you do the math!

Content and Practice Expectations

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Choose 1–2 Content and Practice Expectations that student work could give evidence of.

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154.e: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Learning Principles

In M154 Coordinate Geometry, students will employ the following learning principles:

- Engage with cognitively demanding tasks in heterogeneous settings (LP 1).
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Which of these principles does this task lend itself to? Which ones can the task be easily adapted to accommodate?

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**Share what
you came up
with!**

03

Task 1: Student Work

What is the impact of our labels?

“The development of mathematical understanding over the course of human history and for students in classrooms today relies on diverse and multidimensional ways of thinking, learning, and knowing (Boaler & Staples, 2008; Joseph, 2011). Ability labels obscure and distort this fact, compressing mathematical ability into a single linear scale. For example, a student may be fast and accurate with arithmetic computations but struggle to explain their reasoning. Teachers may label such a student “high” or “advanced” because the predominant culture privileges quick computation as an indicator of mathematical ability. But this label omits many important facets of the student’s current strengths and learning needs.” – National Council of Teachers of Mathematics

Round 1: What do you notice?

Jot down

- One thing you notice about each piece of student work.

Insert image of student work here

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**Come off mute
and share what
you saw!**

Insert image of student work here

Criteria for Success

Conference and Provide Revision Support	Accept with Revision	Accept
<p>The student's artifact shows an emerging understanding of the expectations of the indicator(s). After conferencing and additional instruction/learning, the student may provide a revised or different artifact as evidence of the indicator(s).</p>	<p>The student's artifact is approaching a full understanding of the expectations of the indicator(s). The artifact may contain execution errors that should be corrected in revision. The student may revise the selected artifact or submit a different artifact.</p>	<p>The student's artifact demonstrates evidence that they have met the expectations of the indicator(s).</p>

What resonates with you? What questions surface for you?

Humanizing Assessment

“When it comes to cognition, performance assessments epitomize high-quality street data. Each task offers its own rich landscape of insight into a learner’s cognitive processes, values, misconceptions, academic identity, and more.” (Safir and Dugan, 2021, p. 135–136)

Source: Safir, Shane, and Jamila Dugan. *Street Data: A Next-Generation Model for Equity, Pedagogy, and School Transformation*. Corwin, 2021.

Round 2: What evidence of learning is there?

154.e: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Let's examine some work together:

Conference and Provide Revision Support

The student's artifact shows evidence of an emerging understanding of the expectations of the indicator(s). After conferencing and additional instruction/learning, the student may provide a revised or different artifact as evidence of the indicator(s).

Accept with Revision

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The student's artifact demonstrates evidence that they have met the expectations of the indicator(s).

Examining Student Work

The image shows a digital workspace interface for reviewing student work. At the top, there are three buttons: "Conference and Provide Revision Support", "Accept with Revision", and "Accept". On the left side, there is a vertical toolbar with several icons: a pencil, an eraser, a mouse cursor, a document icon (highlighted with a red circle and a red arrow), a photo icon, a circle icon, a text box icon, and a scissors icon. In the center of the workspace, a large red callout bubble contains the text "Put your thoughts on the Jamboard!". In the bottom right corner, there is a red circular badge with the text "Work Sample 1".

Example #1

insert image 1 of student work

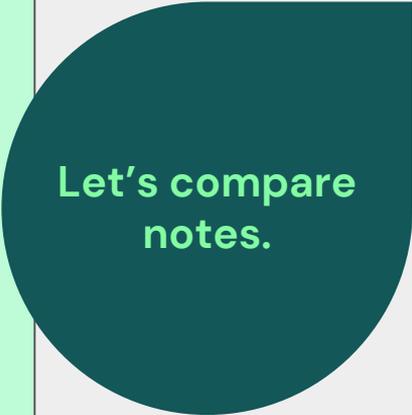
**Let's compare
notes.**

Example #2

insert image 2 of student work

**Let's compare
notes.**

Example #3

A dark teal rounded shape, resembling a quarter-circle on the left side and a rounded rectangle on the right, containing the text 'Let's compare notes.'

Let's compare
notes.

insert image 3 of student work

Three Key Components of the Math Badging System

- Content and Practice Expectations
- Learning Principles
- Criteria for Success

Which one excites you the most?

What one will have the greatest impact on students?

What questions surface for you?



**Come off
mute or share in
the chat!**

04

Task 2: Expectations and Learning Principles

Let's Do Some Math!

Students are given a problem like this.

Cesare Marchetti, a physicist and systems analyst, proclaimed that people are willing to commute from their homes for about half an hour each way. This idea is known as the Marchetti Constant.

Ancient Rome, around 275 CE, was a "walking city," meaning that the main mode of transportation was by walking. The map below illustrates an outline of the city during that period.



(Source: [The Commuting Principle That Shaped Urban History](#) - Bloomberg)

Use geometric concepts and tools to determine the degree of accuracy of the model outlined in purple in the diagram above. Aspects to explore and express in mathematical terms are as follows:

1. *What is the approximate diameter of the city? Why does that make sense, in terms of what you know about typical walking rates?*
2. *What is the approximate area of ancient Rome?*

Running water into homes was a luxury in ancient Rome. Therefore, Roman citizens were provided potable water by way of strategically placed water fountains throughout the city. It is believed that water fountains were located within a 50-meter radius from each other ([Water System of Ancient Rome](#)).

3. *Based on the work you've done so far, about how many water fountains were present in the city at that time?*

Do the task as a student would. Jot down any reflections that you have as you do the math!

Content and Practice Expectations

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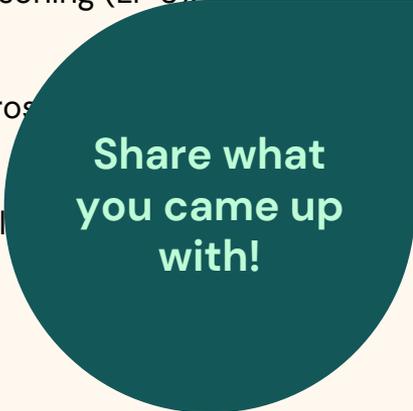
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**Let's compare
notes.**

Example #2

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Example #3

insert image 3 of student work

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Let's Hear Some Reflections

What kinds of support will students need to demonstrate evidence of learning?

Has your thinking changed at all on how to implement this task? If so, how?

**Come off
mute or share in
the chat!**

06

Closing

What Are Your Takeaways?

Choose one question to respond to:

1. Which content and practice expectation are you most excited about? Why?
2. Which learning principle are you most excited about connecting to M154 content? Why?
3. What impact do you think using a portfolio system will have on your students? Why?