

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].”

M202 Overview

XQ Badge Project PL Series Baseline Session

Month XX, XXXX



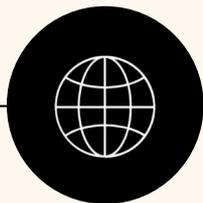
Welcome!

Community Builder:

Let's create a photo collage.

Please share an image that captures you as an educator.

Outcomes and Agenda



Participants will be able to:

- Explain the content and practice expectations for the M202 badge
- Analyze tasks through the lenses of (1) content and practice expectations and (2) learning principles
- Analyze student work for evidence of learning

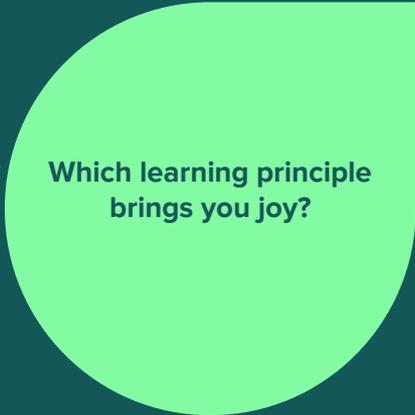


Agenda:

- 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
brings you joy?**

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 – Number and Quantity

Extend the properties of exponents to rational exponents.

1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Perform arithmetic operations with complex numbers.

1. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real.
2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use complex numbers in polynomial identities and equations.

7. Solve quadratic equations with real coefficients that have complex solutions.

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

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Share your thinking!

M202 Content and Practice Expectations (CPE)

202.a	Reason about and extend the properties of exponents to rational exponents.
202.b	Reason about and perform operations with complex numbers.
202.c	Analyze and use complex numbers in polynomial equations.

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**What
resonates with
you?**

M202 Content and Practice Expectations and Indicators

Content and Practice Expectations	Indicators Choose an artifact where you...
202.a: Reason about and extend the properties of exponents to rational exponents.	i. explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
	ii. Rewrite expressions involving radicals and rational exponents using the properties of exponents.
202.b: Reason about and perform operations with complex numbers.	i. Demonstrate understanding that there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real.
	ii. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

What new insights do you have?

Let's Investigate

Choose at least one task to explore:

- Evaluating Exponential Expressions
- Powers of a Complex Number

Which content and practice expectations are evident in each one?

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Come off mute
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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...?

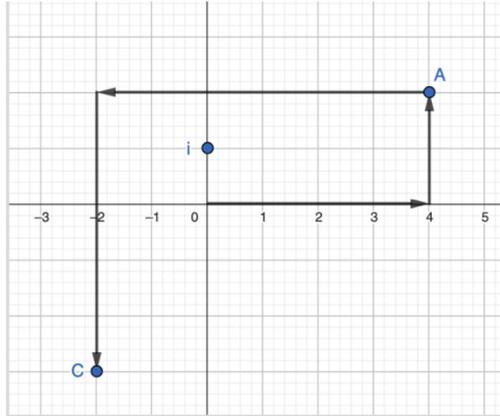
- About using multiple strategies flexibly
- Connected to the real-world in ways that make sense
- About understanding and applying
- Collaborative work
- Lived across continents and centuries
- Novel, challenging problems

02

Task 1: Expectations and Learning Principles

Let's Do Some Math!

1. The diagram represents the sum of two complex numbers: $(4 + 2i) + (-6 - 5i)$.

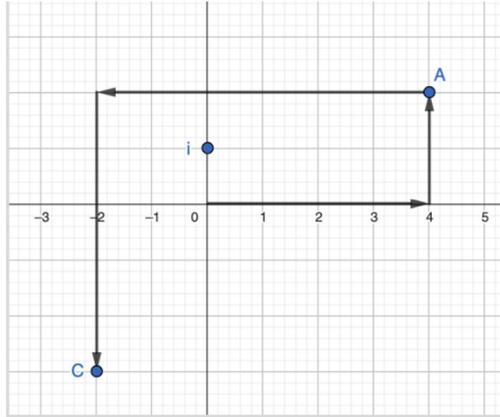


- Which part of the expression does Point A represent? Explain how you know.
 - What complex number does Point C represent? Explain how you know.
 - Based on the analysis above, describe how to find the sum of two complex numbers.
2. Write and record a tutorial for a new classmate that explains how to simplify expressions that involve addition or subtraction of two complex numbers. Be sure to include a diagram that illustrates why your method works.

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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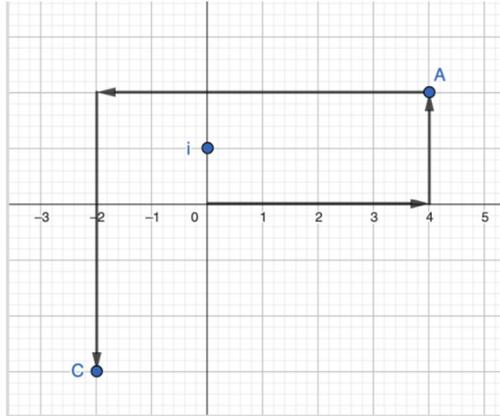


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Choose 1–2 Content and Practice Expectations that student work could give evidence of.

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202.b: Reason about and perform operations with complex numbers.

Learning Principles

In M202 Badge Title, students will employ the following learning principles:

- Engage with cognitively demanding tasks in heterogeneous settings (LP 1).
- Engage in social activities (LP 2).
- Build conceptual understanding through reasoning (LP 3).
- Have agency in their learning (LP 4).
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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?

“Undoing the harms of ability labeling is not just an issue of changing our language or implementing a standardized set of “best practices” or policies. It requires sustained action and ongoing learning at every level of our educational system, from individual classrooms to schools, school districts, universities, regions, states/provinces, and the nation. Many curricula, assessments, and instructional practices reproduce stratification—labeling students, their problem-solving strategies, and the learning opportunities they should receive on a scale from “remedial” to “sophisticated” (e.g., test score categories, systems for grouping students based on perceived ability, and strategies for sequencing student work for mathematical discussions).”

–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

Feedback helps us remember that learning is messy, in the best possible way! Every moment in the classroom is an opportunity to gather street data on the cognitive complexities of learning– the aha moments, the stumbling blocks, the bursts of creativity, the spirals of self-doubt and shame, the neurological effects of stress and trauma.

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?

202.b: Reason about and perform operations with complex numbers.

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

The student's artifact shows evidence of 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.

Accept

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

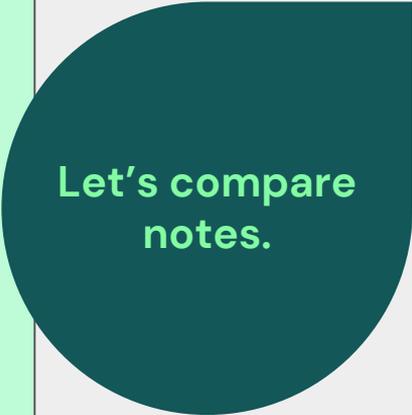
**Let's compare
notes.**

Example #2

insert image 2 of student work

**Let's compare
notes.**

Example #3

A dark teal rounded shape, resembling a teardrop or a semi-circle with a flat top, 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!

Part 1

Let's think about what $a^{\frac{1}{2}}$ means.

1. Select some value for a and develop a table to show that for some values for a^x , x is any set of integer values of your choice.
2. Based on the values from your table, make an educated guess about the value of $a^{\frac{1}{2}}$. Explain your reasoning.
3. Check the actual solution for $a^{\frac{1}{2}}$. Explain why this answer makes sense. If the answer is different from your guess above, write down two-three ideas or questions you can pose to help examine why $a^{\frac{1}{2}}$ has the designated value.

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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202.a: Reason about and extend the properties of exponents to rational exponents.

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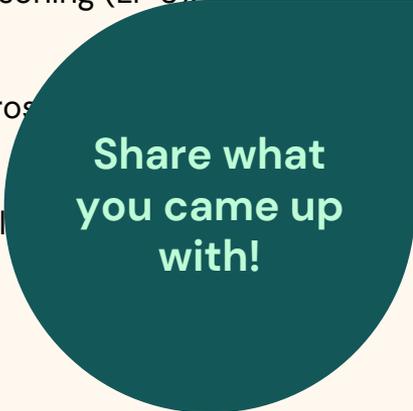
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05

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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 M202 content? Why?
3. What impact do you think using a portfolio system will have on your students? Why?