

# 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].”

# M204 Overview

XQ Badge Project PL Series Baseline Session

Month XX, XXXX

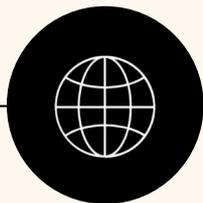


Welcome!

Community Builder:

Write a 6 word story that describes what it's like to learn mathematics.

# Outcomes and Agenda



## Participants will be able to:

- Explain the content and practice expectations for the M204 badge
- Analyze tasks through the lenses of (1) content and practice expectations and (2) learning principles
- Analyze student work for evidence of learning

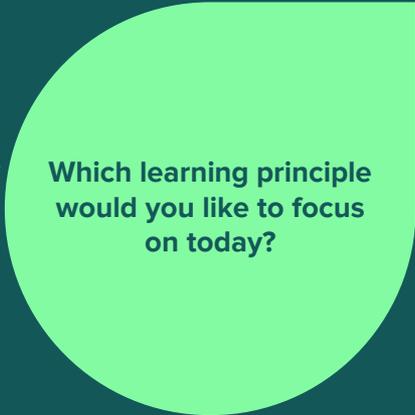


## Agenda:

- 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 – Algebra

### Write expressions in equivalent forms to solve problems.

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★
  - a. Factor a quadratic expression to reveal the zeros of the function it defines.
  - b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
  - c. Use the properties of exponents to transform expressions for exponential functions.
  
4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.★

### Interpret functions that arise in applications in terms of the context.

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★
  
5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.★

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

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**Share your thinking!**

# M204 Content and Practice Expectations (CPE)

|       |   |
|-------|---|
| 204.a | Understand the relationship between exponential and logarithmic functions.                          |
| 204.b | Graph exponential and logarithmic functions.  |
| 204.c | Interpret logarithmic and exponential functions that arise in applications in terms of the context. |
| 204.d | Use logarithms to analyze exponential models.   |

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**What  
resonates with  
you?**

# M204 Content and Practice Expectations and Indicators

| Content and Practice Expectations   | Indicators<br>Choose an artifact where you...  |
|---|--|
| 204.a: Understand the relationship between exponential and logarithmic functions. | i. use reasoning about exponents to explain the value of a logarithmic expression.                         |
|   | ii. write an exponential expression to verify the value of a logarithmic expression.                       |
| 204.b: Graph exponential and logarithmic functions.                               | i. graph an exponential function over a domain that includes non-integers.                                 |
|   | ii. graph a logarithmic function.  |
|   | iii. explain the effect of changing the parameters in an exponential or logarithmic function on its graph. |



What new insights do you have?

# Let's Investigate

Choose at least one task to explore:

- Exponentials and Logarithms I
- Newton's Law of Cooling

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!

## Task 1: Investigating Exponentials

Students are given a prompt like this:

Consider the following scenarios.

1. There are currently 289 million registered cars in the United States, increasing by about 1.5% annually.
2. For the original strand of COVID-19, one infected person was responsible for further infecting about two people during their infectious period. The spread of the virus continued in that pattern. The current US population is about 330 million people.
3. There are 20,000 fish in an infected pond. The population of fish declines to 8,000 in four hours.

For each of the scenarios above, write down questions you could ask about the situation. Write as many questions as you can think of.

As a group, you will choose some interesting questions to answer. If you would need to do calculations, make a sketch, or draw a graph in order to answer a question, then it's probably an interesting question.

Write a report to explain your questions and answers. The report should include:

- a context for your situation. Write a story that includes all the relevant information. If the description of the situation is missing some details, fill them in however you want.
- an equation to describe the situation, with an explanation of what each part of the equation represents.
- a labeled graph of the situation, including the questions you chose and your answers. Include your process for finding the answers. Say what the answers mean in the context of this situation.

Adapted from [Illustrative Mathematics Modeling Prompt](#) (Illustrative Mathematics, 2019)

### Sample Learning Experience

Provide time for students to consider the question posed and independently develop a response before they are encouraged to work with a partner or small group.

Monitor and select students to share their approach as they work on these prompts. Consider using the following questions to facilitate the discussion:

- How would you describe the relationships captured in your preliminary work: linear, exponential, or something

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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**204.c: Interpret logarithmic and exponential functions that arise in applications in terms of the context.**

# Learning Principles

**In M204 Exponential and Logarithmic Functions and Equations, students will employ the following learning principles:**

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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

# Our Focus: Evidence of Learning



## Disrupting “High,” “Medium,” and “Low” in Mathematics Education

**Question:** Why is labeling students “high,” “medium,” and “low” problematic?

Do you, your school, or your district attempt to ensure that all students have access to mathematics learning opportunities that are rigorous, challenging, and affirming of their identities as learners and human beings? At the same time, do you, your school, or your district use terms such as “high,” “advanced,” “gifted,” “below basic,” “far below basic,” “remedial,” and “low” to characterize students’ mathematical abilities? These practices are fundamentally incompatible. If our society is to ever make high-quality mathematics teaching and learning for each and every student a reality, the practice of ability labeling must end.

Ability labels are widely used in education and especially in mathematics education. They are connected to cultural beliefs that frame mathematical ability as innate and fixed, positioning some people as “good at math” and others as “bad” at the subject (Boaler, 2016). Furthermore, mathematical abilities are frequently associated with a narrow range of qualities, particularly speed and accuracy in computation (Boaler & Staples, 2008) as well as whiteness, Asianness, and maleness (Martin, 2009). The following declarations highlight problems with these ways of thinking and acting and assert the need for change at many levels of policy and practice.

### **Ability labels are false.**

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. Moreover, mathematical thinking, learning, and knowing vary across time and context. For example, students may display fluency

# Round 1: What do you notice?

## Jot down

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

Insert image of student work here

# Round 1: What do you notice?

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

**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?**

# Street Data quote

“A strong performance-based assessment system shifts our lens from breadth—or content coverage—to depth.”  
(Safir and Dugan, 2021, p. 144)

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?

**204.c: Interpret logarithmic and exponential functions that arise in applications in terms of the context..**

## 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 labeled "Work Sample 1".

# Example #1

insert image 1 of student work

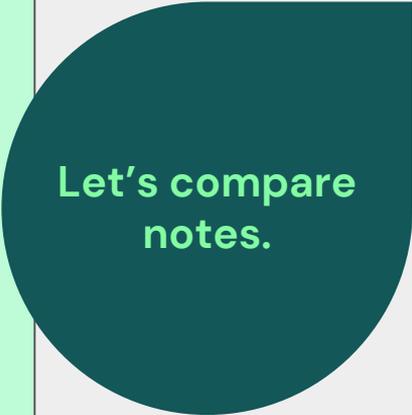
**Let's compare  
notes.**

# Example #2

insert image 2 of student work

**Let's compare  
notes.**

# Example #3

A dark teal rounded shape, resembling a semi-circle on the left side and a rounded rectangle on the right, containing the text "Let's compare notes." in a light green font.

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!

## Task 2: Viral Load Prompt

Students are given a prompt like this:

When a virus invades our body, it gets our body to make so many copies of it that it disrupts normal functioning of our body at the cellular level and makes us sick. Watch this video from [Life Noggin- Just How Fast Does a Virus Spread?](#) to learn more. As the virus spreads to other cells in our body, the viral load in our body increases. The viral load measures how much viral RNA is present in some body fluid, such as blood or saliva. The unit of measure is in copies per mL using  $\log_{10}$ .

### Part 1: Making sense of log base 10

Let's explore how this works. Study the table below.

|              |    |     |       |
|--------------|----|-----|-------|
| $x$          | 10 | 100 | 1,000 |
| $\log_{10}x$ | 1  | 2   | 3     |

1. What do you notice? How are the numbers changing?
2. How would you describe what  $\log_{10}x$  is?
3. What would the graph of  $y = \log_{10}x$  look like?
4. What do you anticipate this has to do with the concept "viral load"?

### Part 2: Making connections to the medical field

A group of researchers set out to understand how viral load is associated with the risk of COVID-19 transmission. They found that the median viral load among the cases they looked at was " $5.6\log_{10}$  copies of RNA per mL of saliva." [source: [SARS-CoV-2 viral load is associated with risk of transmission to household and community contacts | BMC Infectious Diseases.](#) ]

4. What about this expression makes sense to you at this point?
5. What questions do you have?

The medical field uses  $\log_{10}$  both as a label and in its mathematical sense. Examine the table below to see how.

|              |              |              |              |              |                |
|--------------|--------------|--------------|--------------|--------------|----------------|
| $W\log_{10}$ | $1\log_{10}$ | $2\log_{10}$ | $3\log_{10}$ | $4\log_{10}$ | $5.6\log_{10}$ |
|--------------|--------------|--------------|--------------|--------------|----------------|

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.

# Content and Practice Expectations

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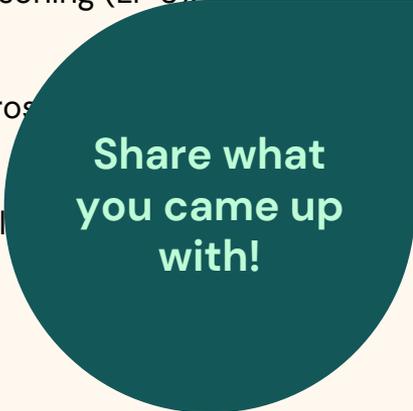
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05

# Task 2: Student Work

# Round 1: What do you notice?

## Jot down

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Insert image of student work here

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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 tabs: "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

insert image 3 of student work

**Let's compare  
notes.**

# 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 M204 content? Why?
3. What impact do you think using a portfolio system will have on your students? Why?