

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.
- 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].”

M101 Overview

**XQ Badge Project PL Series Baseline
Session**

Month DD, YYYY

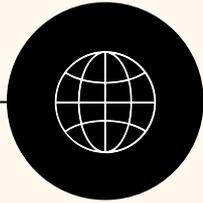


Welcome!

Joining Question:

- Please share your name, role, and where you're joining from.
- What advice would you give your younger self as you were beginning your career?

Outcomes and Agenda



Participants will be able to:

- Explain the content and practice expectations for the M101 badge
- Analyze tasks through the lenses of (1) content and practice expectations and (2) learning principles
- Analyze student work for evidence of learning

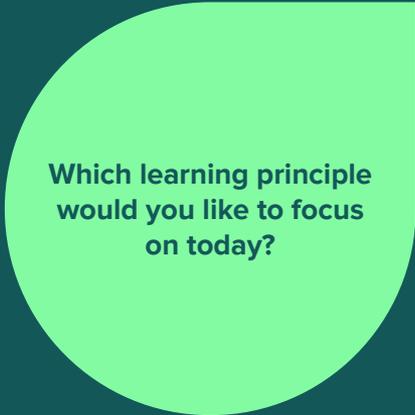


Agenda:

- Exploring the Content
- 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

Create equations that describe numbers or relationships

1. Create equations and inequalities in one variable and use them to solve problems.
2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

Understand solving equations as a process of reasoning and explain the reasoning

1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Solve linear equations in one variable

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

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

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Share your thinking!

M101 Content and Practice Expectations (CPE)

101.a	Reason about and solve one-variable linear equations and inequalities.
101.b	Solve real-life mathematical problems using linear expressions, equations, and inequalities.
101.c	Analyze and solve two-variable linear equations and pairs of simultaneous linear equations.
101.d	Represent and solve linear equations and inequalities graphically.

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**What
resonates with
you?**

M101 Content and Practice Expectations and Indicators

Content and Practice Expectations	Indicators Choose an artifact where you...
101.a: Reason about and solve one-variable linear equations and inequalities.	i. use variables to represent numbers and write equations when solving a real-world or mathematical problem. ii. demonstrate understanding that a variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set.
101.b: Solve real-life and mathematical problems using linear expressions, equations, and inequalities.	i. solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form while using tools strategically. ii. construct simple equations and inequalities to solve problems by reasoning about quantities.



**What new
insights do you
have?**

Let's Investigate

Choose at least one task to explore:

- Writing Constraints
- Solution Sets

Which content and practice expectations are evident in each one?

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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?

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or put your
thoughts in the
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Inequity Is our Reality

“From high school through graduate school, the half-life of students in the mathematics pipeline is about one year; on average, we lose half the students from mathematics each year. When mathematics acts as a filter, it not only filters students out of careers, but frequently out of school itself.” (National Research Council, 1989, p. 7)

Source: National Research Council. (1989). *Everybody counts: A report to the nation on the future of mathematics education*. Washington, D.C.: National Academies Press.

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!

Which of the following equations have the same solution as $x + 3 = 5x - 4$?

A. $x - 3 = 5x + 4$

B. $2x + 8 = 5x - 3$

C. $10x + 6 = 2x - 8$

D. $10x - 8 = 2x + 6$

E. $0.3 + \frac{x}{10} = \frac{1}{2}x - 0.4$

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

Content and Practice Expectations

Which of the following equations have the same solution as $x + 3 = 5x - 4$?

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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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101.a: Reason about and solve one-variable linear equations and inequalities.

Learning Principles

In M101 Linear Equations: Concepts and Skills, 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

Round 1: What do you notice?

- Jot down one thing you notice about each piece of student work.

Which of the following equations have the same solution as $x + 3 = 5x - 4$? $x = -1.75$

- A. $x - 3 = 5x + 4$
- B. $2x + 8 = 5x - 3$
- C. $10x + 6 = 2x - 8$
- D. $10x - 8 = 2x + 6$
- E. $0.3 + \frac{x}{10} = \frac{1}{2}x - 0.4$

Prepare to share your response.

► Explain how you could tell which equations have the same solution as the given equation without solving each one (and without substituting a value).

It doubled the answer's number like: $(5x-4)$ $(10x-8)$
& $(x+3)$ $(2x+6)$

► Are there other equations on the list that share a common solution? Without solving, how could you tell?

All have subtraction & addition

A & C are common because they both $+3$ & -3

Round 1: What do you notice?

- Jot down one thing you notice about each piece of student work.

Come off mute
and share what
you saw!

Which of the following equations have the same solution

$x + 3 = 5x - 4$ -1.75

A. $x - 3 = 5x + 4$

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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

The criteria for success promote “a culture of revision and redemption that encourages students to attempt challenging work, provides continual opportunities for practice and revision, and supports students in developing the courage and confidence to work continuously to improve in their successive efforts.”

(Darling–Hammond, 2002, p.29)

Source: Darling–Hammond, Linda. *10 features of good small schools: What matters and what works: 10 features of good small schools*. San Francisco, Stanford University, 2002. *Stanford Library Searchworks Catalog*, <https://searchworks.stanford.edu/view/11757869>.

Round 2: What evidence of learning is there?

101.a: Reason about and solve one-variable linear equations and inequalities.

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, there is a large red callout bubble with 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

Which of the following equations have the same solution as $x + 3 = 5x - 4$?

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Prepare to share your response.

Let's compare notes.

➤ Explain how you could tell which equations have the same solution as the given equation without solving each one (and without substituting a value).

It doubled the answer's number like: $(5x - 4)$ $(10x - 8)$
& $(x + 3)$ $(2x + 6)$

➤ Are there other equations on the list that share a common solution? Without solving, how could you tell?

All have subtraction & addition

A & C are common because they both $+3$ & -3

Example #3

Let's compare notes.

Task 1: Solutions

Which of the following equations have the same solution as $x + 3 = 5x - 4$?

A. $x - 3 = 5x + 4$

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Prepare to share your response.

- Explain how you could tell which equations have the same solution as the given equation without solving each one (and without substituting a value).
- Are there other equations on the list that share a common solution? Without solving, how could you tell?

1. the way I could tell they had same solution is that use commutative and just swapped subtraction symbols the other equations with the same solution are C and D because they swapped -8 for +6. check

$$\begin{array}{r} 0.3 + \frac{x}{10} + \frac{1}{2}x - 0.4 \\ \frac{x}{10} + \frac{1}{2}x - 0.1 \\ + 7 \\ \hline 0.8x + 1.2x \end{array}$$

found 3 on back

$$\begin{array}{r} x + 3 = 5x - 4 \\ + 3 = 4 - 3 \\ x = 5x - 7 \\ + 7 = \quad + 7 \\ \hline 7x = 5x \end{array}$$

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

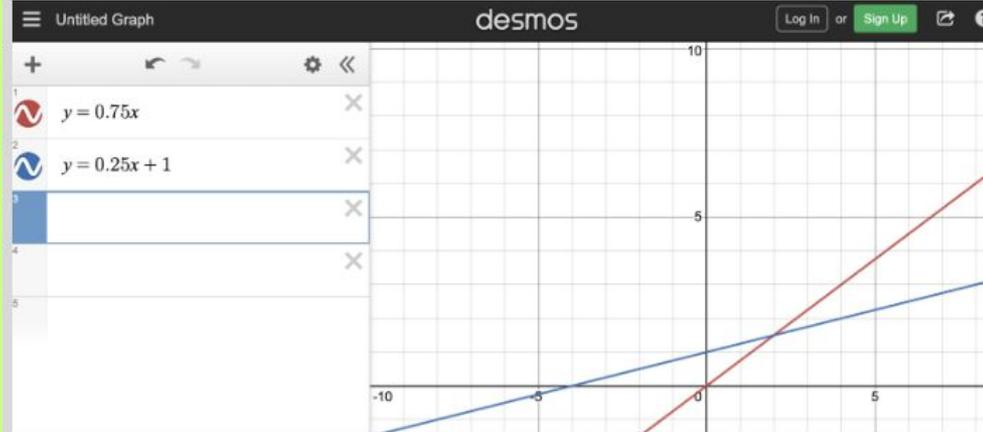
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Let's Do Some Math!

Consider the equation $0.75x = 0.25x + 1$

- Think about the expressions " $0.75x$ " and " $0.25x + 1$." Create a real-world situation that could be represented by these expressions.
- Based on this, what could x represent?
- Why would it make sense to have these two expressions be equal to one another based on the context?
- How could you use technology to create a graphical representation that shows the solution to the equation $0.75x = 0.25x + 1$?

Sample graph using technology:



- What is the solution to $0.75x = 0.25x + 1$? What does the solution to the equation mean relative to the context you created?
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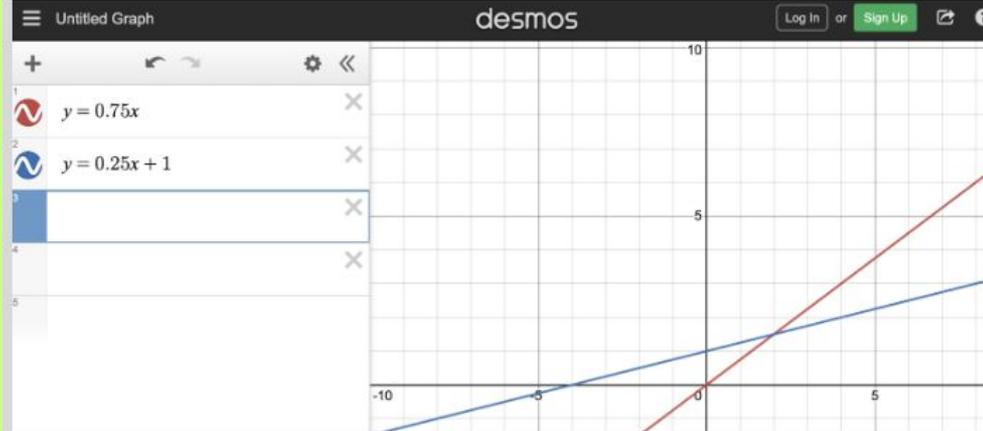
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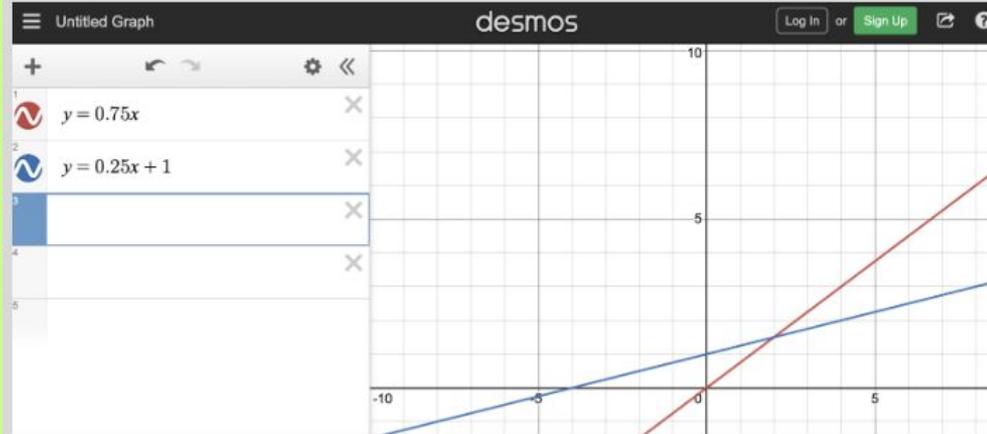
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101.b: Solve real-life mathematical problems using linear expressions

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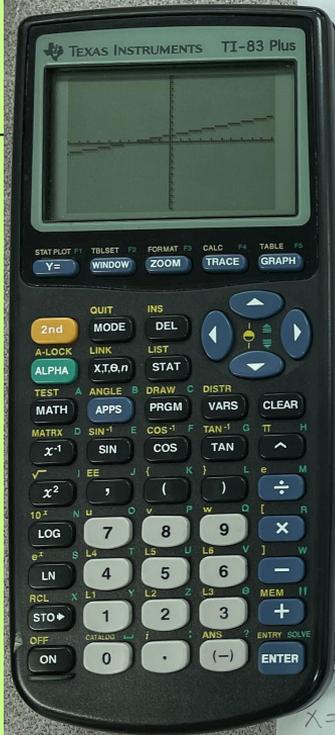
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05

Task 2: Student Work

Round 1: What do you notice?

- Jot down one thing you notice about each piece of student work.



Task 2: Finding a Context

Consider the equation

$$0.75x = 0.25x + 1$$

- Think about the expressions "0.75x" and "0.25x + 1." Create a real-world situation that could be represented by these expressions.
 $0.75x$ could represent \$0.75 for entry per person to an aquarium
 $0.25x + 1$ could represent \$0.25 for entry per person to an aquarium plus a 1-dollar fee
- Based on this, what could x represent?
 the number of people paying to get into the aquarium
- Why would it make sense to have these two expressions be equal to one another based on the context?
 The group that pays \$0.75 would be paying more than \$0.25 but with the \$1 fee, it pretty much equals it out.
- How could you use technology to create a graphical representation that shows the solution to the equation $0.75x = 0.25x + 1$?
 I would replace the x on the 0.75 and I would solve for y, this would properly graph the equation
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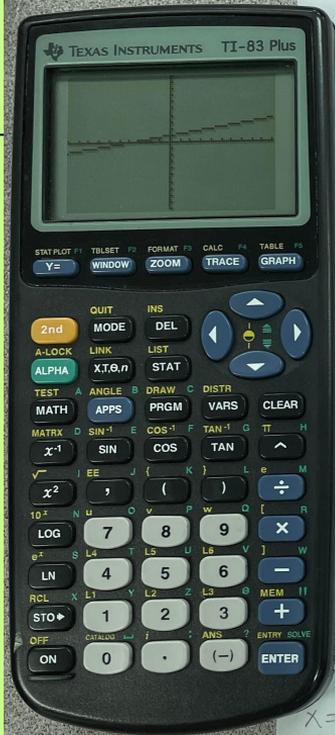
$$\begin{aligned} 0.75x &= 0.25x + 1 \\ -0.25x & \quad -0.25x \\ \hline 0.50x &= 1 \\ \frac{0.50x}{0.50} &= \frac{1}{0.50} \\ x &= 2 \end{aligned}$$
 The solution means that 2 people paying 0.75 cents per person for entry would pay the same amount as 2 people paying 0.25 cents per person with a 1 dollar fee.
- What is another way you could have found the solution to $0.75x = 0.25x + 1$?

$$\begin{aligned} x=2 \quad 0.75x &= 0.25x + 1 \\ 0.75(2) &= 0.25(2) + 1 \\ 1.50 &= 0.50 + 1 \\ 1.50 &= 1.50 \end{aligned}$$
 If I was given the value of x, I could substitute to solve the equation, this equation and its solution show that if two people go with the different prices, they will pay the same amount.

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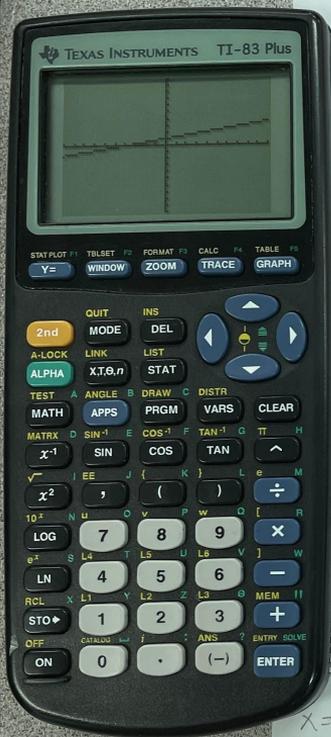
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- What is the solution to $0.75x = 0.25x + 1$? What does the solution to the equation mean relative to the context you created?

$$\begin{aligned} 0.75x &= 0.25x + 1 \\ 0.50x &= 1 \\ \frac{0.50x}{0.50} &= \frac{1}{0.50} \\ x &= 2 \end{aligned}$$

The solution means that 2 people paying 0.75 cents per person for entry would pay the same amount as 2 people paying 0.25 cents per person with a 1 dollar fee.

- What is another way you could have found the solution to $0.75x = 0.25x + 1$?

$$\begin{aligned} x=2 \quad 0.75x &= 0.25x + 1 \\ 0.75(2) &= 0.25(2) + 1 \\ 1.50 &= 0.50 + 1 \\ 1.50 &= 1.50 \end{aligned}$$

If I was given the value of x, I could substitute to solve the equation, this equation and its solution show that if two people go with the different prices, they will pay the same amount.

Example #2

Let's compare notes.

Task 2: Finding a Context

Consider the equation

$$0.75x = 0.25x + 1$$

- Think about the expressions " $0.75x$ " and " $0.25x + 1$." Create a real-world situation that could be represented by these expressions.

A company is having a special where chips cost $.25x$ and a 1 purchase fee. Another company is selling them for $0.75x$, with no fee.

- Based on this, what could x represent?

x could represent the amount that you buy.

- Why would it make sense to have these two expressions be equal to one another based on the context?

It would make sense to have the expressions be equal to find which deal is better.

- How could you use technology to create a graphical representation that shows the solution to the equation $0.75x = 0.25x + 1$?

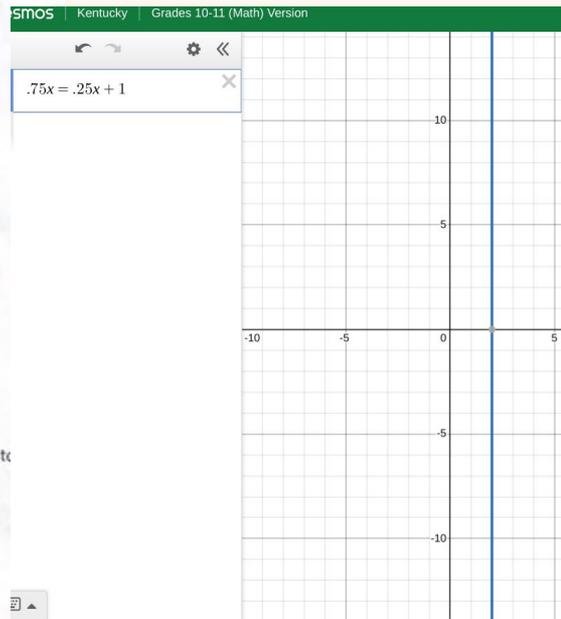
You could plug the equation into a graphing calculator.

- What is the solution to $0.75x = 0.25x + 1$? What does the solution to the equation mean relative to the context you created?

The solution is $x=2$. This means that when you buy two bags of chips from both companies, the two costs are equal.

- What is another way you could have found the solution to $0.75x = 0.25x + 1$?

You could have solved it on paper inverse operations.



Example #3



Let's compare notes.

$0.75x = 0.25x + 1$

Think about the expressions "0.75x" and "0.25x + 1."
Create a real-world situation that could be represented by these expressions.

Based on this, what could x represent?

minutes

Why would it make sense to have these two expressions be equal to one another based on the context?

We are both making bracelets but started differently and working on a different rate.

How could you use **technology** to create a **graphical representation** that shows the **solution** to the equation $0.75x = 0.25x + 1$?

What is the **solution** to $0.75x = 0.25x + 1$?

$x = 2$

What does the **solution** to the equation mean **relative to the context** you created?

x was minutes so in 2 minutes me and my sister made the same amount of bracelets

What is **another way** you could have found the **solution** to $0.75x = 0.25x + 1$?

Solve algebraically

$0.75x = 0.25x + 1$
 $-0.25x \quad -0.25x$
 $0.50x = 1$
 $\frac{0.50x}{0.50} = \frac{1}{0.50}$
 $x = 2$

$0.75(2) = 0.25(2) + 1$
 $1.50 = 0.50 + 1$
 $1.50 = 1.50$

$x = 2$

Handwritten notes from the student:
 I started at 0 but each minute the amount of bracelets I make increases by 0.75. My sister started with 1 bracelet and each minute she makes them increases by 0.25.
 x = 15 minutes me
 0.75x + 0 = 0.25x + 1
 sister

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 M101 content? Why?
3. What impact do you think using a portfolio system will have on your students? Why?