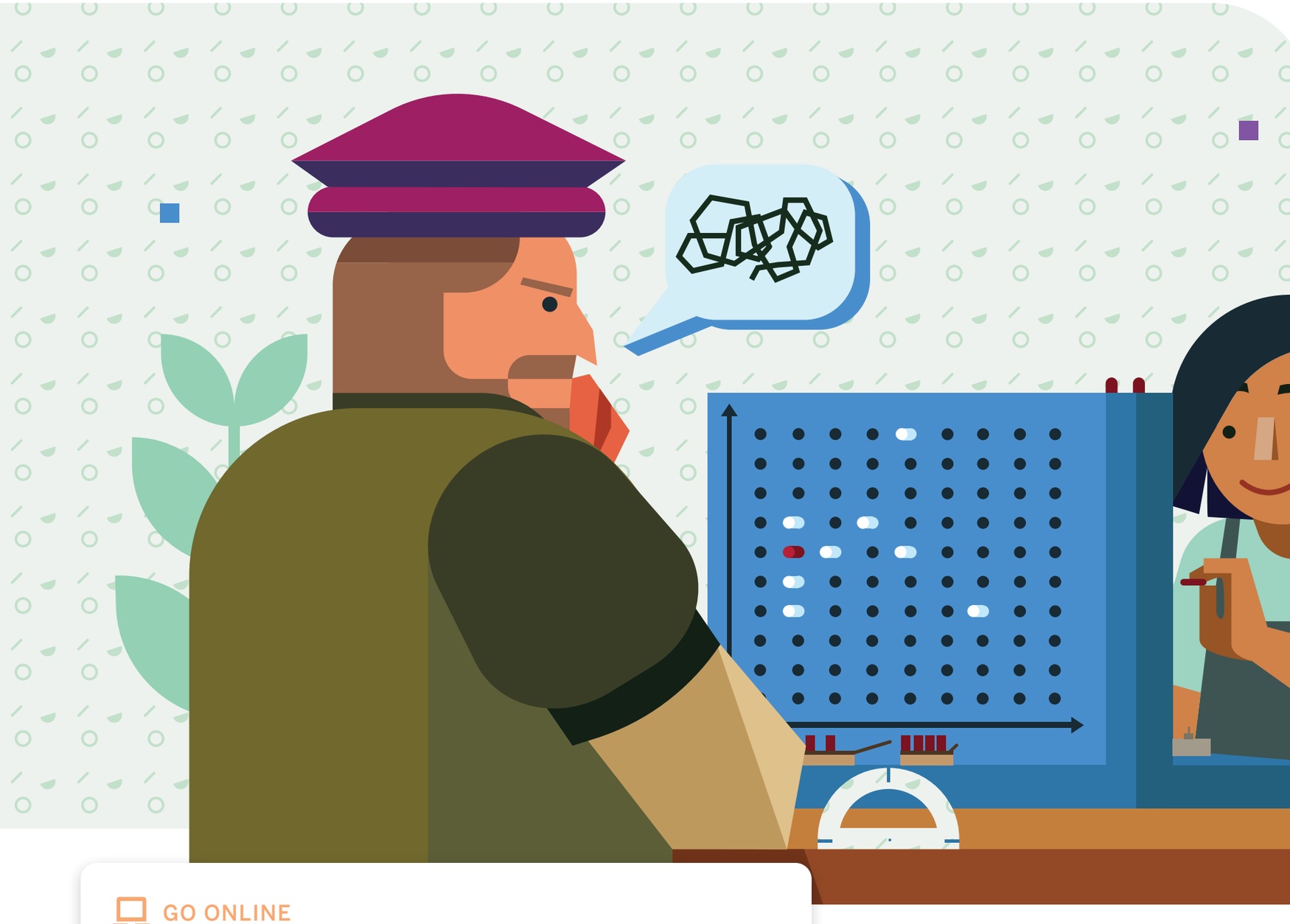
START HERE

Amplify Math

Grades 6–8, Algebra 1

Program guide

FEATURING Amps POWERED BY desmos



GO ONLINE

Visit amplify.com/math612 for additional program information on topics such as instructional routines, math language development, 5 Practices for Orchestrating Productive Discussions, and much more!

Amplify. desmos

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SIERPINSKI TRIANGLE

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Meet Amplify Math

About Amplify Math

Get all students talking and thinking together about grade-level math.

Amplify Math is designed around the idea that a core math curriculum needs to serve 100 percent of students in accessing grade-level math every day. To that end, the program delivers:

- **Productive discourse made easier to facilitate and more accessible for students**
- **Flexible, social problem-solving experiences both online and off**
- **Real-time insights, data, and reporting that inform instruction**

You can learn more about the program design and how Amplify Math will work in your classroom in the pages that follow. But first, we wanted to call out just a few things that set this core math program apart:

1 Productive discourse made easier to facilitate and more accessible for students

Clean and clear lesson design

The lessons all include straightforward "1, 2, 3 step" guidance for launching and facilitating discussions around the tasks. Thoughtful and specific differentiation supports are included for every activity. Every lesson ends with a summary and reflection moment, an Exit Ticket, and a practice problem set.

Narrative and storytelling

All students ask, "Why do I need to know this? When am I ever going to use this in the real world?" Amplify Math helps students make connections with math and their everyday lives to help them see and appreciate the relevance of the math they're figuring out in class. Throughout the units, students will be introduced to historical and current narratives that show their connection to the content, the many places mathematics inhabits in our world, and how the work they do in class connects to our history and their own reality.

2 Flexible, social problem-solving experiences online

Social learning experiences online

By partnering with Desmos, we've been able to deliver digital lessons, which we call **Amps**, that get students thinking, talking, revising, and celebrating their ideas. As students work in the interactive slides, new functionality may appear and they will often be asked to justify their actions and thinking. All of this is made visible to the teacher in real time.

Automatic, just-in-time supports

Our **Power-ups** provide just-in-time support at point of use before activities for your students. Not teaching online? They're available in this Teacher Edition, too. Phil Daro partnered with us on this feature to ensure we were giving all students—even the ones who might be three years behind in math, but only 15 minutes behind the day's lesson—the chance to experience success in math.

3 Real-time insights, data, and reporting that inform instruction

Classroom monitoring tools

Once a teacher launches an Amp, students will be automatically moved to the lesson of the day and will see the interactive screens. Teachers will have the ability not only to pace the lesson the way they want to, but also to see student work in real time. The monitoring tools offer teachers ways to overlay student work to spot misconceptions and also the ability to spotlight student work anonymously to discuss with the class.

Embedded and standalone assessments

Amplify Math includes both a suite of standalone assessments and embedded assessments that allow teachers and leaders insights into where students are and how they might best be supported. The full reporting suite covers student and class performance based on work done in lessons, Exit Tickets, practice sets, performance by standards, and performance on Interim assessments.

Guided by expert advisors, partners, and educators

Working closely with our advisors and partners, educator advisory board, and field trial teachers, the curriculum team at Amplify focused Amplify Math on productive discourse and equitable experiences for students, making it possible to deliver high-quality, student-centered instruction that accelerates learning for all.

Based on the best

The core lesson content within Amplify Math is based on the highly rated IM K–12™ Math curriculum authored by *Illustrative Mathematics*. Led by Bill McCallum, the *Illustrative Mathematics* developers struck the right balance between conceptual understanding, procedural fluency, and application.

Illustrative Mathematics*

Flexible, social problem-solving experiences powered by Desmos

Digital lessons, when designed the right way, can be powerful in their ability to surface student thinking and spark interesting and productive discussions. To do this, lessons need to be social and flexible in their ability to celebrate student brilliance, ensuring students feel connected to one another and you, the teacher.

We've partnered with Desmos to bring this vision to life with our complete library of Amps—social, collaborative lessons powered by Desmos technology.

Amps
POWERED BY desmos

Advisors

Phil Daro

Board member: Strategic Education Research Partnership (SERP)
Area of focus:
Content strategy

Fawn Nguyen

Rio School District, California
Area of focus:
Problem solving

Sunil Singh

Educator, author, storyteller
Area of focus:
Narrative and storytelling

Paulo Tan, Ph.D.

Johns Hopkins University, School of Education
Area of focus:
Meeting the needs of all students

Partners

English Learners Success Forum - Math is a language that needs to be developed. Our work with ELSF supports the development of all students' language skills.

Research projects

The Amplify development team is supporting two research projects that will inform program enhancements.

- Discourse Builder UX: Supporting the 5 Practices in Math Instruction[1] - Kathleen Sheehy, lead; Bill & Melinda Gates Foundation, grant number INV-003779
- Storytelling for Mathematics Learning and Engagement, Dr. Erica Walker, lead; National Science Foundation, grant number 2010276

Field trial districts and schools

- Berryessa Union School District, California
- Chicago Jesuit Academy, Illinois
- Irvine Unified School District, California
- Lake Tahoe Unified School District, California
- Leadership Learning Academy, Utah
- Lusher Charter School, Louisiana
- Memphis Grizzlies Preparatory Charter School, Tennessee
- Saddleback Valley Unified School District, California
- San Juan Unified School District, California
- Santa Paula Unified School District, California
- Silver Summit Academy, Utah
- West Contra Costa Unified School District, California
- Wyoming City Schools, Ohio
- Young Women's Leadership School of Brooklyn, New York

Educator Advisory Board

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Jerry Schmidt
Brentwood School District, Missouri

Deloris Scott
Yazoo County School District, Mississippi

Noah Sharrow
Clarkston Community Schools, Michigan

Myla Simmons
Plainfield Public Schools, New Jersey

Michele Stassfurth
North Plainfield School District, New Jersey

English Learners Success Forum is a fiscally sponsored project of the New Venture Fund (NVF), a 501(c)(3) public charity.

The National Science Foundation is an independent agency of the United States government that supports fundamental research and education in all the non-medical fields of science and engineering.

1 Through a partnership between Amplify and the Bill & Melinda Gates Foundation, this project aimed to create a prototype for a digital tool to support teachers in operationalizing the pedagogical model of the 5 Practices. The findings and conclusions of the project are those of the authors and do not necessarily reflect positions or policies of the Gates Foundation.

Program scope and sequence

Grade 6

Suggested instructional days: **161**

UNIT 1

Area and Surface Area

20 Instructional Days
3 Assessment Days

23 days total

UNIT 2

Introducing Ratios

20 Instructional Days
3 Assessment Days

23 days total

UNIT 3

Rates and Percentages

15 Instructional Days
2 Assessment Days

17 days total

UNIT 4

Dividing Fractions

17 Instructional Days
3 Assessment Days

20 days total

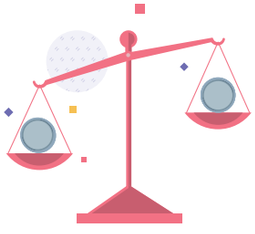
UNIT 5

Arithmetic in Base Ten

14 Instructional Days
2 Assessment Days

16 days total

UNIT 6



Expressions and Equations

19 Instructional Days
2 Assessment Days

21 days total

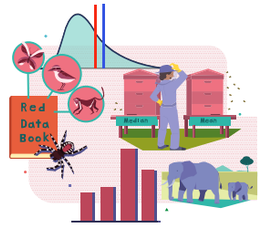
UNIT 7

Rational Numbers

19 Instructional Days
2 Assessment Days

21 days total

UNIT 8



Data Sets and Distributions

17 Instructional Days
3 Assessment Days

20 days total

Grade 7

Suggested instructional days: **153**

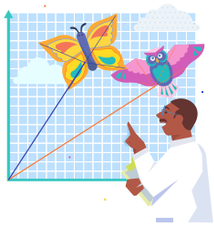
UNIT 1

Scale Drawings

13 Instructional Days
2 Assessment Days

15 days total

UNIT 2



Introducing Proportional Relationships

17 Instructional Days
2 Assessment Days

19 days total

UNIT 3

Measuring Circles

12 Instructional Days
2 Assessment Days

14 days total

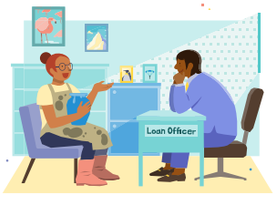
UNIT 4

Proportional Relationships and Percentages

13 Instructional Days
2 Assessment Days

15 days total

UNIT 5



Rational Number Arithmetic

20 Instructional Days
3 Assessment Days

23 days total

UNIT 6

Expressions, Equations, and Inequalities

23 Instructional Days
3 Assessment Days

26 days total

UNIT 7

Angles, Triangles, and Prisms

18 Instructional Days
3 Assessment Days

21 days total

UNIT 8

Probability and Sampling

17 Instructional Days
3 Assessment Days

20 days total

Grade 8

Suggested instructional days: **145**

UNIT 1

Rigid Transformation and Congruence

18 Instructional Days
3 Assessment Days

21 days total

UNIT 2

Dilations, Similarity, and Introducing Slope

12 Instructional Days
2 Assessment Days

14 days total

UNIT 3

Linear Relationships

19 Instructional Days
2 Assessment Days

21 days total

UNIT 4

Linear Equations and Systems of Linear Equations

17 Instructional Days
2 Assessment Days

19 days total

UNIT 5

Functions and Volume

21 Instructional Days
3 Assessment Days

24 days total

UNIT 6

Exponents and Scientific Notation

15 Instructional Days
2 Assessment Days

17 days total

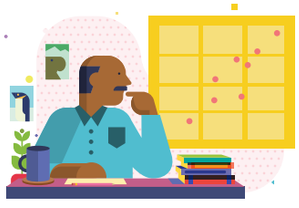
UNIT 7

Irrational and the Pythagorean Theorem

16 Instructional Days
2 Assessment Days

18 days total

UNIT 8



Associations in Data

9 Instructional Days
2 Assessment Days

11 days total

Algebra 1

Suggested instructional days: **155**

UNIT 1

Linear Equations, Inequalities, and Systems

26 Instructional Days
3 Assessment Days

29 days total

UNIT 2

Data Analysis and Statistics

22 Instructional Days
3 Assessment Days

25 days total

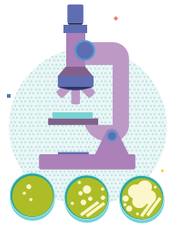
UNIT 3

Functions and Their Graphs

22 Instructional Days
3 Assessment Days

25 days total

UNIT 4



Introducing Exponential Functions

22 Instructional Days
3 Assessment Days

25 days total

UNIT 5

Introducing Quadratic Functions

23 Instructional Days
3 Assessment Days

26 days total

UNIT 6

Quadratic Equations

22 Instructional Days
3 Assessment Days

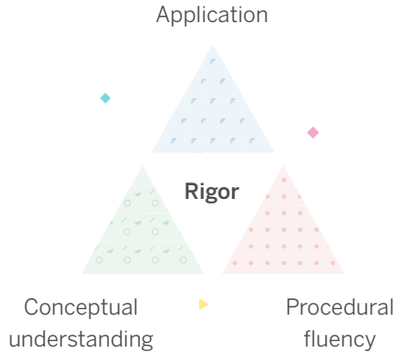
25 days total

Clean and clear design

Program structure

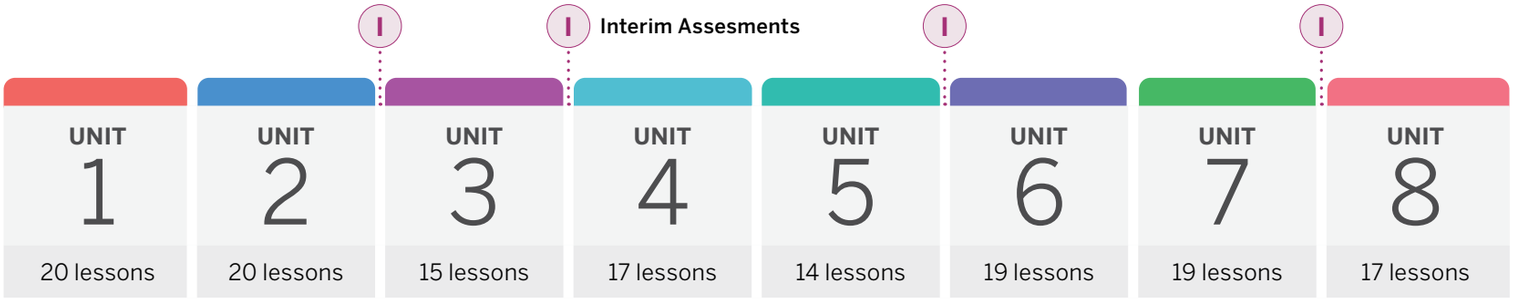
Amplify Math lessons ask students to grapple with relevant and interesting problems and situations. The contexts make sense to them and play to their curious and competitive nature. Whether using the print or digital lessons, teachers have easy-to-use tools that allow them insights into student thinking and opportunities to truly differentiate instruction.

Every unit outlines how the pillars of rigor—conceptual understanding, procedural fluency, and application—will be addressed over the course of each lesson.



Course structure

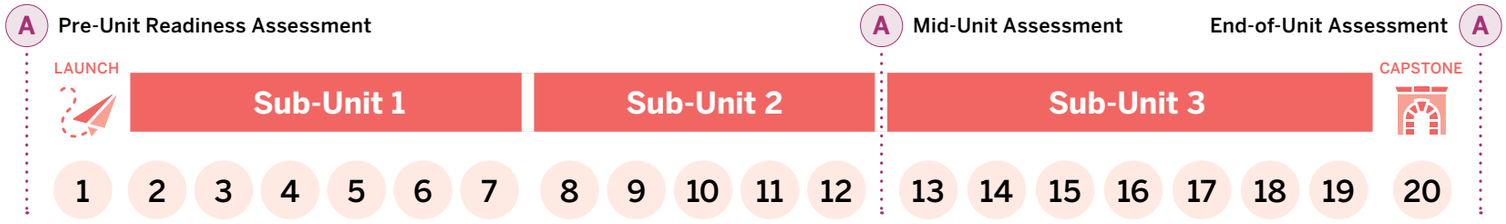
The grades 6–8 courses are made up of eight units each. Algebra 1 includes 6 units.



Note: Interim assessments may be administered according to your district/school's timeline; this depiction is just one of many possible administrations.

Unit structure

Amplify Math units have been developed around central topics and broken into sub-units addressing compelling historical and modern narratives and stories making math both accessible and relevant. Solving problems in the sub-unit lessons, students develop strategies to build upon prior knowledge and deepen their understanding of mathematical concepts and skills. Teachers have multiple opportunities to assess student understanding, including Pre- and Post-Unit Assessments, Warm-ups, and Exit Tickets.



Note: The number of sub-units and lessons vary from unit to unit; this depiction shows the general structure of a unit.

Lesson structure

Amplify Math grades 6–8 lessons are designed to be completed in 45 minutes, with Algebra 1 lessons completed in 50 minutes.

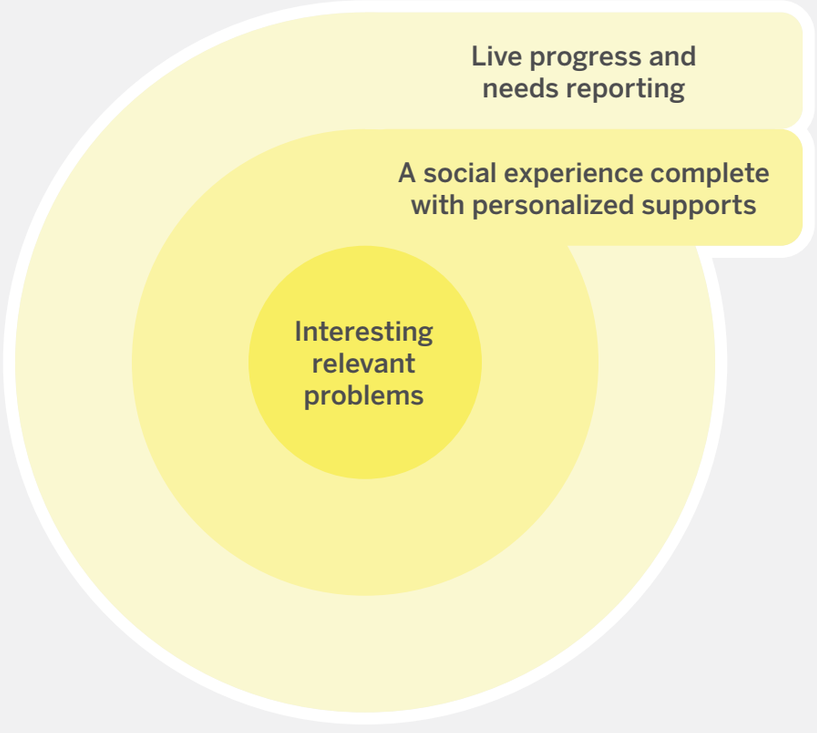
Note: The number of activities vary from lesson to lesson; this depiction shows the general structure of a lesson.

Key:

- Independent
- Small Groups
- Pairs
- Whole Class

Layered lesson design

Sparking and guiding productive classroom discussions doesn't need to feel impossible. Amplify Math provides teachers a layered lesson design with easy-to-follow instructional supports that make implementing productive discourse possible through experiences that tap into the social nature of middle and high schoolers.



Amplify Math lessons are effective because they're multi-layered.

1 **Interesting, relevant problems:** By starting with the *Illustrative Mathematics* curriculum IM K–12 Math, an extensively field-tested and highly-rated curriculum, Amplify Math is full of interesting and relevant problems as well as proven teaching strategies. You'll see this in our lessons framed around compelling narratives, from both current and historical contexts.

2 **A social experience complete with personalized supports:** By partnering with Desmos, we've been able to bring the IM K–12 Math content alive online. Students are given opportunities to collaborate with one another, and teachers gain better insights into student thinking in real-time. If the teacher chooses to use Power-ups, students are offered personalized supports, based on their recent work in the digital platform, that serve as on-ramps to grade-level content.

3 **Live progress and needs reporting:** And when teachers and students work digitally, Amplify Math can offer live progress updates and reporting that outlines student needs and suggested next steps, enhancing the experience for students and teachers.

The Amplify Math lesson model

Amplify Math grades 6–8 lessons are designed to be completed in 45 minutes, with Algebra 1 lessons completed in 55 minutes.

1

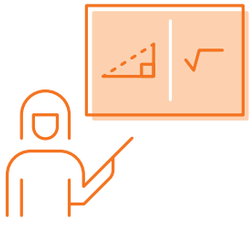
Warm-up (5 minutes)

Each lesson begins with students diving into the math and interacting with each other during a warm-up task. Lessons include automatic, just-in-time supports called Power-ups.

2

Activities (30 minutes in grades 6–8; 35 minutes in Algebra 1)

Students dig into three to five tasks and share their observations and reasoning, allowing the teacher to use the strategy of sequencing and selecting to promote more math talk.



3

Summary and Reflection (5 minutes)

The teacher helps students connect their ideas with the overall mathematical picture of the lesson, unit, and course.

4

Exit Ticket and Practice (5+ minutes)

The lesson concludes with students completing an embedded, formative Exit Ticket. Additionally, teachers can assign practice problems to work on outside of class.

Narrative and storytelling

The role of narrative

Amplify Math organizes the units and sub-units around compelling narratives and stories (both historical and modern). Students are introduced to historical and current narratives that show a connection between the content and the many places mathematics inhabits in our world and how the work they do in class connects to our history and their own reality. Narrative:

- **Makes math more approachable and engaging.** Stories connect numbers to people. They show us the who, why, and when of math, and the motivations and even emotions of mathematicians. They help make math easier to teach by triggering students' curiosity, showing personal or historical relevance, and opening up new possibilities for classroom conversation and collaboration.
- **Makes math relevant.** Retellings of important historical moments and vignettes featuring modern applications of math help students understand how math has relevance outside of the math classroom.
- **Highlighting diversity in mathematics.** Stories can create more opportunities to highlight diversity in the rich history of mathematics. They can make for more inclusive spaces where students see themselves in the content.

You'll see our narratives and stories play out at the unit, sub-unit, and lesson levels within the program as you review.

Sub-unit openers

Highlighting diverse mathematicians

Helping students see themselves as mathematicians

Helping our students develop a strong, healthy, and flexible math identity is crucial if we are to prepare the next generation of creative problem solvers.

To that end, we've designed Amplify Math to show students three things:

1. They are mathematicians.
2. The math of today's world was largely shaped by a diverse range of mathematicians who deserve to be learned about.
3. Learning is never finished.

In support of the first two principles, we've embedded numerous featured mathematicians into the program. These diverse mathematicians and their work are introduced to students within the context of the lesson. Students are always shown the connection between the featured mathematician's work and the work they are doing in class. Learning about their lives and contributions, students see that there's no one face of math achievement.

Maryam Mirzakhani

Taking the IM K–12 Math content further

Illustrative Mathematics curriculum IM K–12 Math™, is highly rated on EdReports.org, well regarded by teachers who know and use it, and growing in popularity with district leaders. The program is coherent and puts engaging, real-world problems at the center of instruction. While Amplify Math is based on and protects the most valuable aspects of the IM K–12 Math™ program, we have decided to make certain changes and additions to better serve busy teachers.

Amplify Math offers:

Clear, concise, and effective teacher supports.

Teachers want time back in their day, and we deliver that by making lessons easy to read through and understand while still providing just-in-time support to keep the classroom discussion moving. Amplify Math teachers will find they need to spend less time preparing to teach and can more easily navigate the provided guidance during instruction.

A tested lesson design.

We've tested our lessons with field trial teachers to ensure we're not asking teachers and students to accomplish too much during a 45- or 50-minute session or a double period block.

Low-floor, high-ceiling unit launch lessons.

Each unit begins with a low-floor, high-ceiling lesson that introduces the unit's big idea through a compelling story that often relates to a student's community, culture, or identity.

Data-driven differentiation for all students.

Instead of generic instructional suggestions, Amplify Math's differentiated supports make math more accessible for all students, and include Power-ups to ensure just-in-time support for all students.

A more visual and social experience, providing teachers with real-time insights.

Amps, our social digital lessons powered by Desmos technology, make more visual, collaborative moments possible while providing teachers with real time insights into student thinking.

A narrative and storytelling element.

Infusing math instruction with history and storytelling allows students to make connections with math and their everyday lives. It's also a way to help foster positive math identities for students who might not see themselves in other core math programs.

A comprehensive suite of assessments.

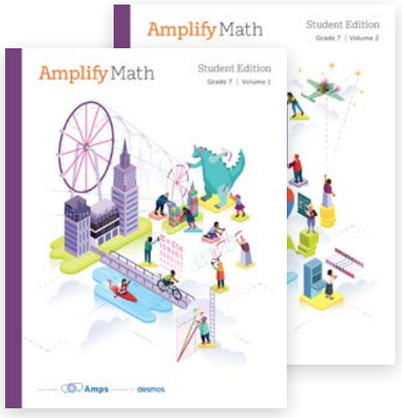
Insights, data, and reporting in Amplify Math drive performance for all learners and allow teachers to know where their students are, what they think, what they might not yet understand, and what needs to happen next.

Intuitive and easy-to-follow print resources.

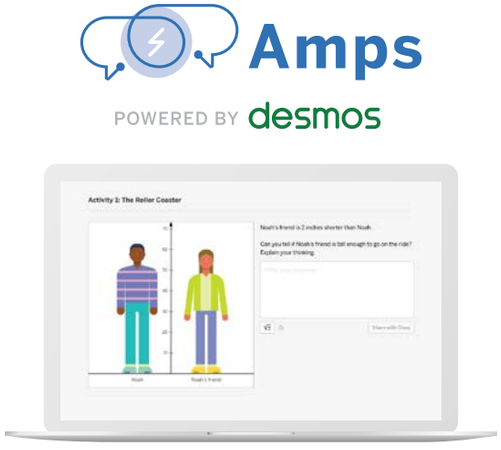
Amplify Math's print resources are engaging and inviting for students. Streamlined and easy to follow, they allow teachers to focus on creating moments for student collaboration and discussion.

Program resources

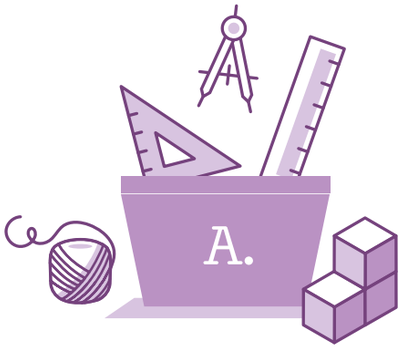
Student materials



Student workbooks, 2 volumes

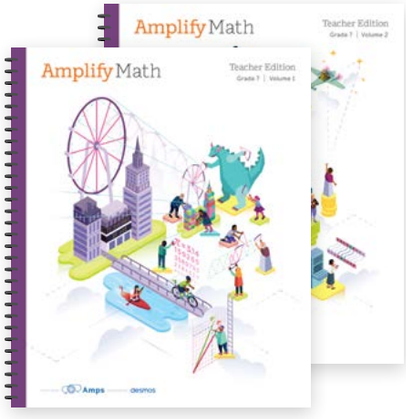


Amps, our exclusive collection of digital lessons powered by Desmos

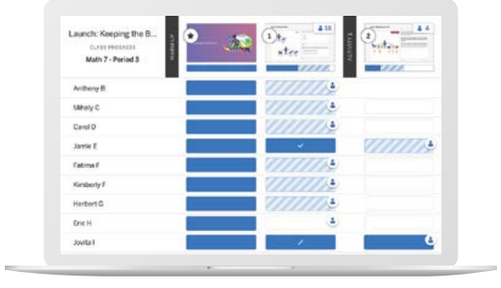


Hands-on manipulatives (optional)

Teacher materials

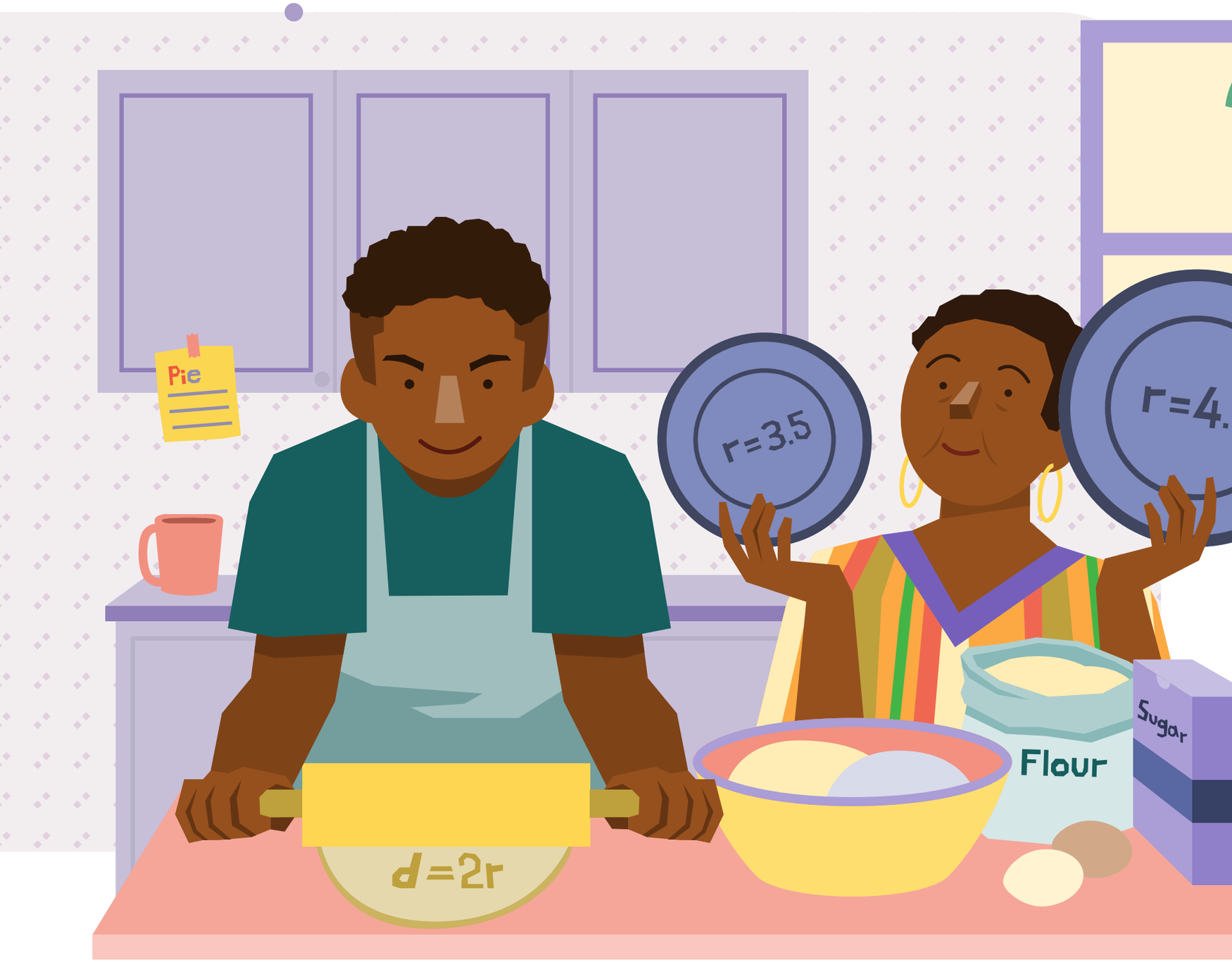


Teacher Edition, 2 volumes



Digital Teacher Edition and class monitoring tools

Additional Practice and Assessment Guide blackline masters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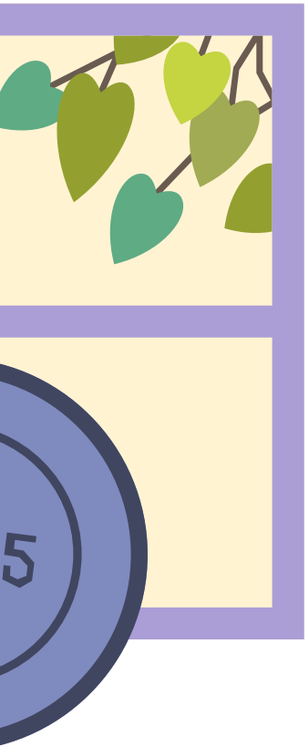


Supporting features

Access and equity

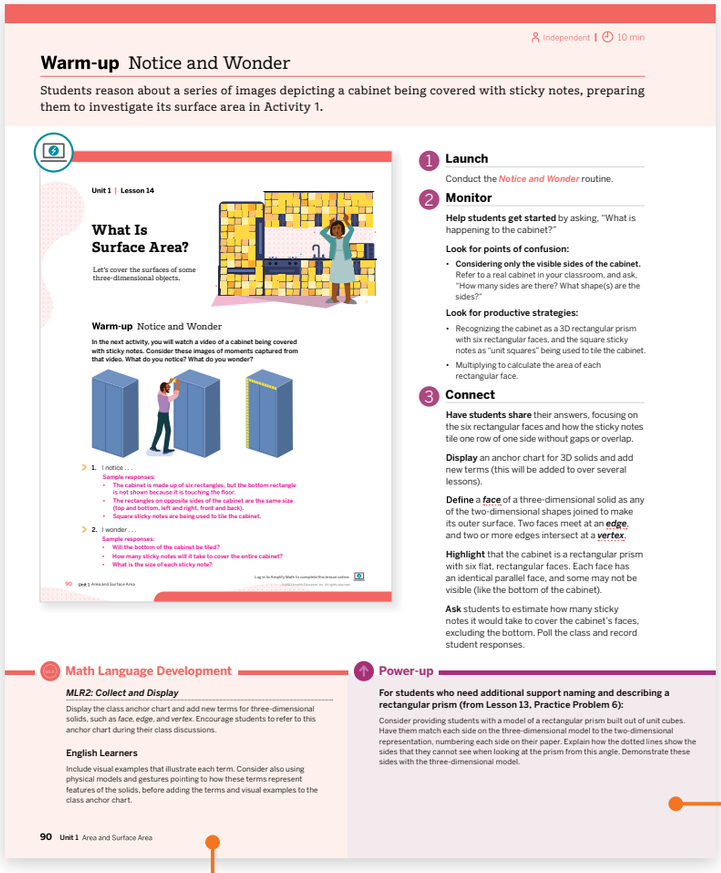
Engaging all students in grade-level content every day

Amplify Math includes numerous, tightly connected supports to ensure all students can access grade-level content every day. Design features include:

- Consistent lesson structure.
- Automatically assigned differentiated just-in-time supports called **Power-ups**.
- Compelling historical and modern narratives and real-world situations.

The materials make use of instructional strategies that break down barriers that might stand between students and the content, including:

- Instructional and mathematical language routines
- Physical and digital manipulatives
- Visual aids
- Graphic organizers



Independent | 10 min

Warm-up Notice and Wonder

Students reason about a series of images depicting a cabinet being covered with sticky notes, preparing them to investigate its surface area in Activity 1.

Unit 1 | Lesson 14

What Is Surface Area?

Let's cover the surfaces of some three-dimensional objects.

Warm-up Notice and Wonder

In the next activity, you will watch a video of a cabinet being covered with sticky notes. Consider these images of moments captured from that video. What do you notice? What do you wonder?

1. I notice . . .
   Sample responses:
   - The cabinet is made up of six rectangles, but the bottom rectangle is not shown because it is touching the floor.
   - The rectangles on opposite sides of the cabinet are the same size (top and bottom, left and right, front and back).
   - Square sticky notes are being used to tile the cabinet.
2. I wonder . . .
   Sample responses:
   - Will the bottom of the cabinet be tiled?
   - How many sticky notes will it take to cover the entire cabinet?
   - What is the size of each sticky note?

90 Unit 1 Area and Surface Area

1 Launch

Conduct the *Notice and Wonder* routine.

2 Monitor

Help students get started by asking, "What is happening to the cabinet?"

Look for points of confusion:

- **Considering only the visible sides of the cabinet.** Refer to a real cabinet in your classroom, and ask, "How many sides are there? What shape(s) are the sides?"

Look for productive strategies:

- Recognizing the cabinet as a 3D rectangular prism with six rectangular faces, and the square sticky notes as "unit squares" being used to tile the cabinet.
- Multiplying to calculate the area of each rectangular face.

3 Connect

Have students share their answers, focusing on the six rectangular faces and how the sticky notes tile one row of one side without gaps or overlap.

Display an anchor chart for 3D solids and add new terms (this will be added to over several lessons).

Define a ***face*** of a three-dimensional solid as any of the two-dimensional shapes joined to make its outer surface. Two faces meet at an ***edge***, and two or more edges intersect at a ***vertex***.

Highlight that the cabinet is a rectangular prism with six flat, rectangular faces. Each face has an identical parallel face, and some may not be visible (like the bottom of the cabinet).

Ask students to estimate how many sticky notes it would take to cover the cabinet's faces, excluding the bottom. Poll the class and record student responses.

Math Language Development

MLR2: Collect and Display

Display the class anchor chart and add new terms for three-dimensional solids, such as *face*, *edge*, and *vertex*. Encourage students to refer to this anchor chart during their class discussions.

English Learners

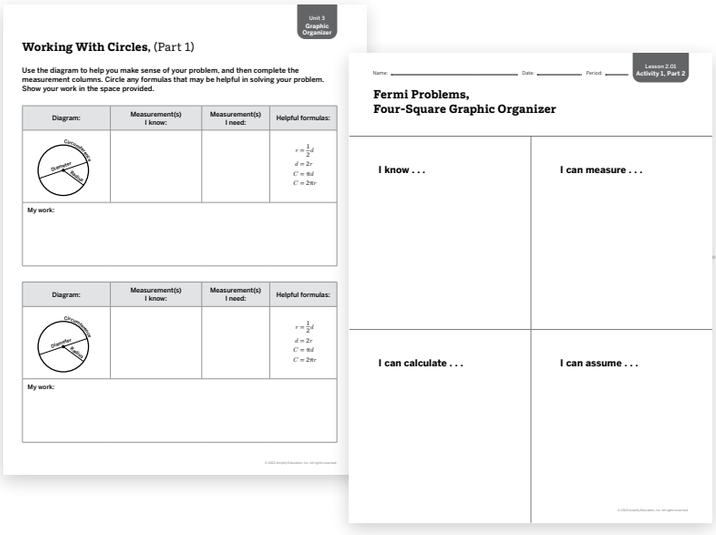
Include visual examples that illustrate each term. Consider also using physical models and gestures pointing to how these terms represent features of the solids, before adding the terms and visual examples to the class anchor chart.

Power-up

For students who need additional support naming and describing a rectangular prism (from Lesson 13, Practice Problem 6):

Consider providing students with a model of a rectangular prism built out of unit cubes. Have them match each side on the three-dimensional model to the two-dimensional representation, numbering each side on their paper. Explain how the dotted lines show the sides that they cannot see when looking at the prism from this angle. Demonstrate these sides with the three-dimensional model.

90 Unit 1 Area and Surface Area



Unit 3 Graphic Organizer

Working With Circles, (Part 1)

Use the diagram to help you make sense of your problem, and then complete the measurement columns. Circle any formulas that may be helpful in solving your problem. Show your work in the space provided.

Diagram:	Measurement(s) I know:	Measurement(s) I need:	Helpful formulas:
			$r = \frac{1}{2}d$ $d = 2r$ $C = \pi d$ $C = 2\pi r$
My work:			

Diagram:	Measurement(s) I know:	Measurement(s) I need:	Helpful formulas:
			$r = \frac{1}{2}d$ $d = 2r$ $C = \pi d$ $C = 2\pi r$
My work:			

Name: _____ Date: _____ Period: _____

Lesson 2.GO Activity 1, Part 2

Fermi Problems, Four-Square Graphic Organizer

I know . . .	I can measure . . .
I can calculate . . .	I can assume . . .

Graphic organizers

Math Language Development

MLR2: Collect and Display

Display the class anchor chart and add new terms for three-dimensional solids, such as *face*, *edge*, and *vertex*. Encourage students to refer to this anchor chart during their class discussions.

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Include visual examples that illustrate each term. Consider also using physical models and gestures pointing to how these terms represent features of the solids, before adding the terms and visual examples to the class anchor chart.

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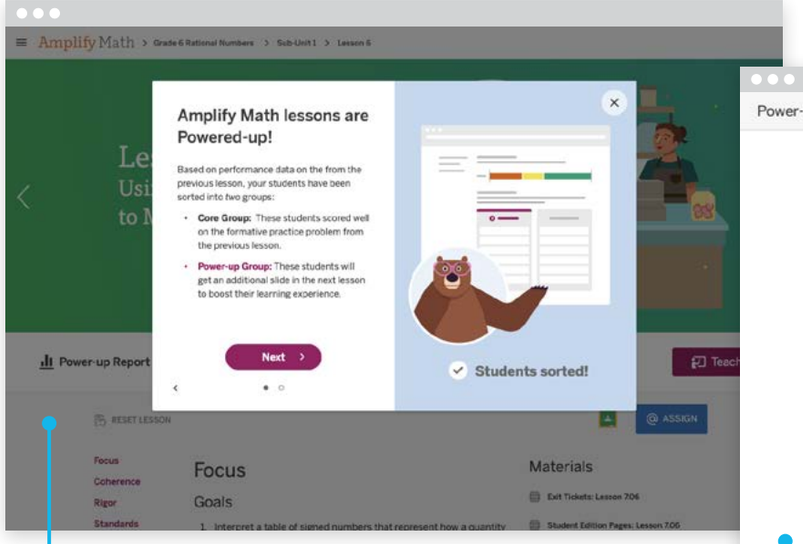
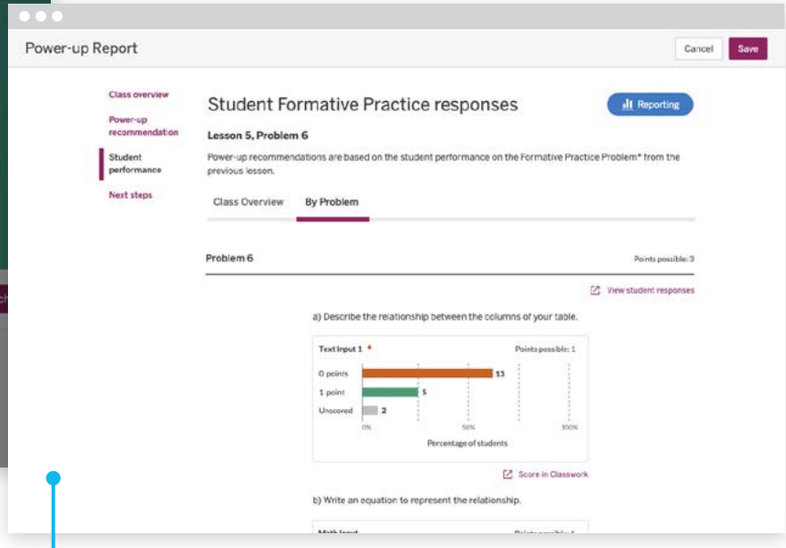
Power-ups are automatically assigned supports for students who need an additional boost to their learning experience. These just-in-time supports give students the chance to experience success with the lesson's content.



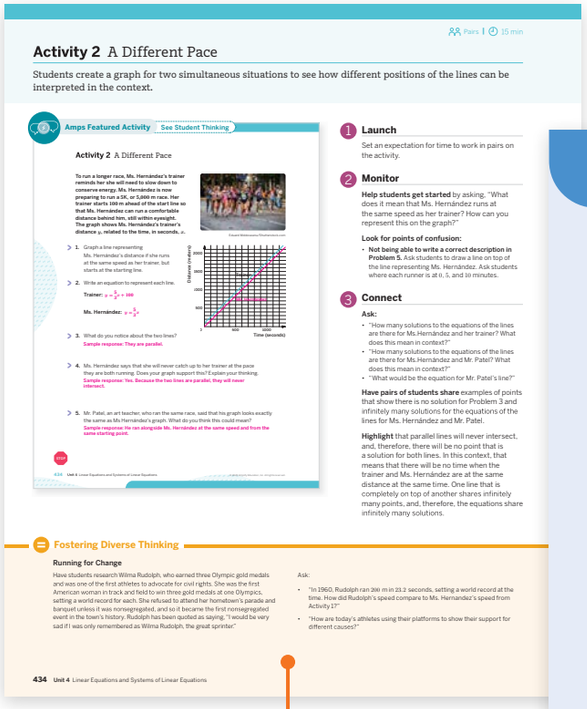
Based on performance data, students are sorted into two groups with students who need additional support assigned the Power-up activity.



Power-up reports group students based on performance and provide item analysis for the formative practice problem, along with suggested next steps.

Bringing in and including student background knowledge in the classroom

In many cases, Amplify Math creates optional opportunities for students to share background experiences and activate background knowledge as they relate to the math activities.



Pairs | 15 min

Activity 2 A Different Pace

Students create a graph for two simultaneous situations to see how different positions of the lines can be interpreted in the context.

Amps Featured Activity | See Student Thinking

Activity 2 A Different Pace

To run a longer race, Ms. Hernández's trainer reminds her she will need to slow down to conserve energy. Ms. Hernández is now preparing to run a 5K, or 5,000 m race. Her trainer starts 100 m ahead of the start line so that Ms. Hernández can run a comfortable distance behind him, still within eyesight. The graph shows Ms. Hernández's trainer's distance y, related to the time, in seconds, x.

1. Graph a line representing Ms. Hernández's distance if she runs at the same speed as her trainer, but starts at the starting line.
2. Write an equation to represent each line.

Trainer: $y = \frac{5}{4}x + 100$

Ms. Hernández: $y = \frac{5}{4}x$

3. What do you notice about the two lines?

Sample response: They are parallel.

4. Ms. Hernández says that she will never catch up to her trainer at the pace they are both running. Does your graph support this? Explain your thinking.

Sample response: Yes. Because the two lines are parallel, they will never intersect.

5. Mr. Patel, an art teacher, who ran the same race, said that his graph looks exactly the same as Ms Hernandez's graph. What do you think this could mean?

Sample response: He ran alongside Ms. Hernández at the same speed and from the same starting point.

STOP

434 Unit 4 Linear Equations and Systems of Linear Equations

1 **Launch**

Set an expectation for time to work in pairs on the activity.

2 **Monitor**

Help students get started by asking, "What does it mean that Ms. Hernández runs at the same speed as her trainer? How can you represent this on the graph?"

Look for points of confusion:

- **Not being able to write a correct description in Problem 5.** Ask students to draw a line on top of the line representing Ms. Hernández. Ask students where each runner is at 0, 5, and 10 minutes.

3 **Connect**

Ask:

- "How many solutions to the equations of the lines are there for Ms.Hernández and her trainer? What does this mean in context?"
- "How many solutions to the equations of the lines are there for Ms.Hernández and Mr. Patel? What does this mean in context?"
- "What would be the equation for Mr. Patel's line?"

Have pairs of students share examples of points that show there is no solution for Problem 3 and infinitely many solutions for the equations of the lines for Ms. Hernández and Mr. Patel.

Highlight that parallel lines will never intersect, and, therefore, there will be no point that is a solution for both lines. In this context, that means that there will be no time when the trainer and Ms. Hernández are at the same distance at the same time. One line that is completely on top of another shares infinitely many points, and, therefore, the equations share infinitely many solutions.

Fostering Diverse Thinking

Running for Change

Have students research Wilma Rudolph, who earned three Olympic gold medals and was one of the first athletes to advocate for civil rights. She was the first American woman in track and field to win three gold medals at one Olympics, setting a world record for each. She refused to attend her hometown's parade and banquet unless it was nonsegregated, and so it became the first nonsegregated event in the town's history. Rudolph has been quoted as saying, "I would be very sad if I was only remembered as Wilma Rudolph, the great sprinter."

Ask:

- "In 1960, Rudolph ran 200 m in 23.2 seconds, setting a world record at the time. How did Rudolph's speed compare to Ms. Hernandez's speed from Activity 1?"
- "How are today's athletes using their platforms to show their support for different causes?"

434 Unit 4 Linear Equations and Systems of Linear Equations

Sub-Unit 2
Equivalent Ratios

Whole Class

In this Sub-Unit, students utilize greatest common factors, least common multiples, and other strategies to complete tables of equivalent ratios, and also represent them using double number lines and coordinate graphs.

SUB-UNIT 2

How do you put your music where your mouth is?

Antoinette Clinton was just 20 years old when she took the stage in Leipzig, Germany. Better known by her stage name, Butterscotch, she was born in Sacramento, California, and had come from a musical family. Her mother was a piano teacher; her siblings played trumpet, cello, clarinet, and trombone. But here in Germany, on the night of the first Beatbox Battle World Championship, she'd come to showcase an entirely different musical instrument: herself!

Originating from the streets of New York in the 1980s, beatboxing has long been a core element of hip-hop. Pioneered and popularized by artists like Doug E. Fresh, Biz Markie, and Darrell "Buffy" Robinson, performers use their mouth, throat, and nose to replicate the sounds of a drum kit by laying out the beats and rhythms for an MC to rap over.

More than 20 years later, beatboxing re-emerged as an international phenomenon. In 2005, Butterscotch was crowned the first Individual Female Beatbox Battle World Champion. And two years later, she beat out 16 men to become the West Coast beatboxing champion.

To be a champion beatboxer, you need a strong sense of timing and tempo. An artist needs to know how long each of their "hits" are, as well as how many percussive "hits" they can fit into a single measure of music. Ratios give performers a way to conceptualize and map those hits so that they never miss a beat.

Sub-Unit 2 Equivalent Ratios 171

Fostering Diverse Thinking

Play part of a Butterscotch performance for your class. Butterscotch describes her mission as "empowering and elevating people through music and compassion." Ask:

- Where do you hear ratios in Butterscotch's beatboxing?
- How do you think artists can use their music to help make a difference in society?

Sub-Unit 2 Equivalent Ratios 171

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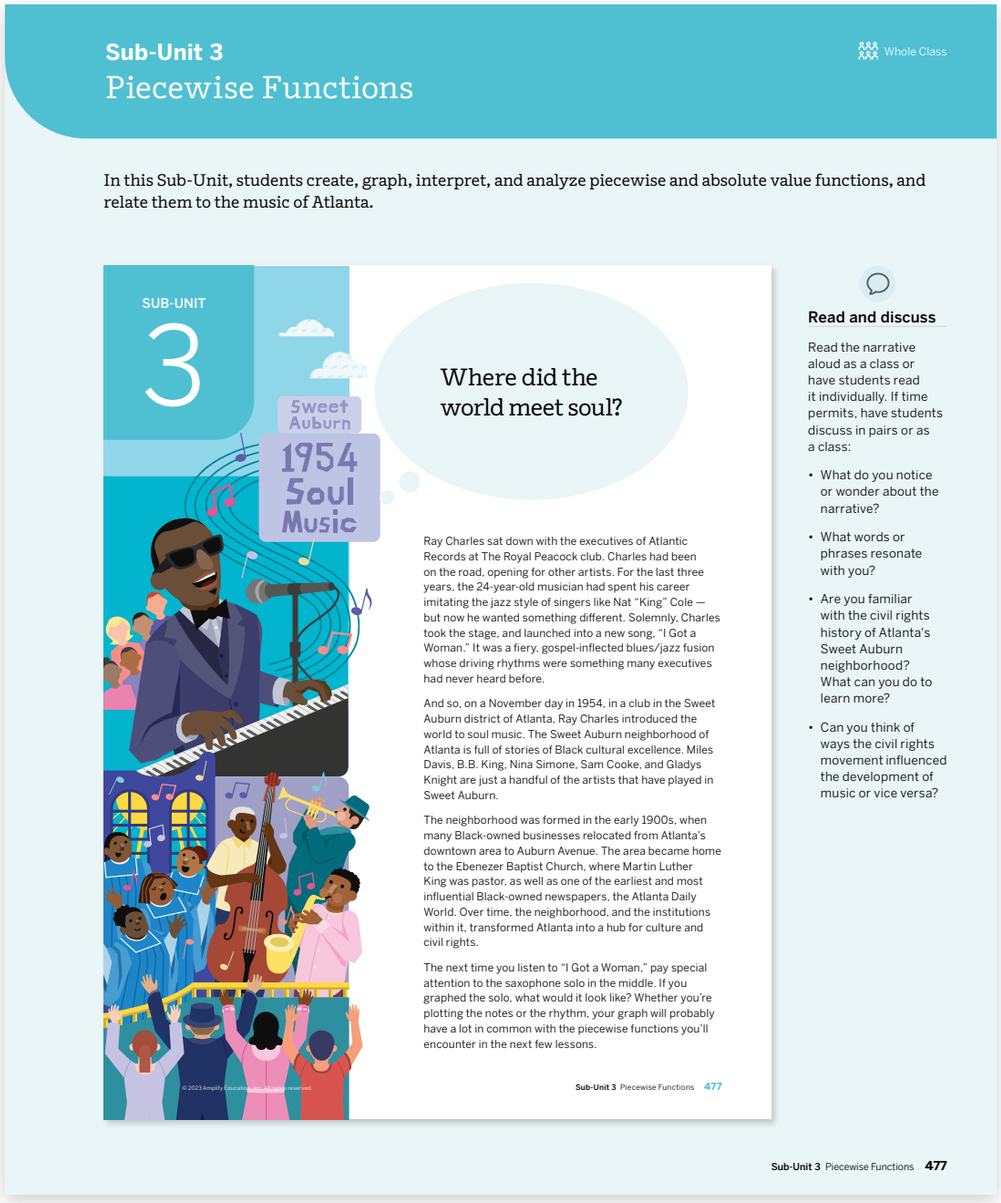
- "How are today's athletes using their platforms to show their support for different causes?"

Celebrating and working from what students know and can do

When students feel they are able to bring their whole selves to math class, they are more likely to see both the utility and the beauty of mathematics. If they can see themselves, their experiences, their families, and communities in the content, they are more likely to consider themselves doers of math.

1 Expose your students to a wide range of relevant scenarios, ideas, and people to ensure they can see themselves as players in the world of math.



Sub-Unit 3
Piecewise Functions

Whole Class

In this Sub-Unit, students create, graph, interpret, and analyze piecewise and absolute value functions, and relate them to the music of Atlanta.

SUB-UNIT 3

Where did the world meet soul?

Sweet Auburn 1954 Soul Music

Ray Charles sat down with the executives of Atlantic Records at The Royal Peacock club. Charles had been on the road, opening for other artists. For the last three years, the 24-year-old musician had spent his career imitating the jazz style of singers like Nat "King" Cole — but now he wanted something different. Solemnly, Charles took the stage, and launched into a new song, "I Got a Woman." It was a fiery, gospel-inflected blues/jazz fusion whose driving rhythms were something many executives had never heard before.

And so, on a November day in 1954, in a club in the Sweet Auburn district of Atlanta, Ray Charles introduced the world to soul music. The Sweet Auburn neighborhood of Atlanta is full of stories of Black cultural excellence. Miles Davis, B.B. King, Nina Simone, Sam Cooke, and Gladys Knight are just a handful of the artists that have played in Sweet Auburn.

The neighborhood was formed in the early 1900s, when many Black-owned businesses relocated from Atlanta's downtown area to Auburn Avenue. The area became home to the Ebenezer Baptist Church, where Martin Luther King was pastor, as well as one of the earliest and most influential Black-owned newspapers, the Atlanta Daily World. Over time, the neighborhood, and the institutions within it, transformed Atlanta into a hub for culture and civil rights.

The next time you listen to "I Got a Woman," pay special attention to the saxophone solo in the middle. If you graphed the solo, what would it look like? Whether you're plotting the notes or the rhythm, your graph will probably have a lot in common with the piecewise functions you'll encounter in the next few lessons.

Sub-Unit 3 Piecewise Functions 477

Read and discuss

Read the narrative aloud as a class or have students read it individually. If time permits, have students discuss in pairs or as a class:

- What do you notice or wonder about the narrative?
- What words or phrases resonate with you?
- Are you familiar with the civil rights history of Atlanta's Sweet Auburn neighborhood? What can you do to learn more?
- Can you think of ways the civil rights movement influenced the development of music or vice versa?

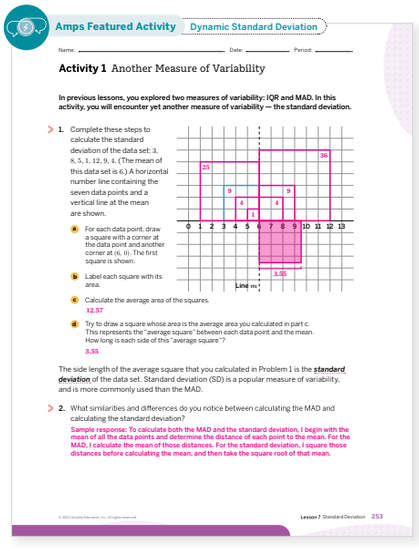
Sub-Unit 3 Piecewise Functions 477

2 Create spaces where their thinking can be explained and examined without being immediately graded as right or wrong.

Independent | 20 min

Activity 1 Another Measure of Variability

Students draw squares to geometrically calculate and interpret a data set's standard deviation.


Amps Featured Activity Dynamic Standard Deviation

Name: Date: Period:

Activity 1 Another Measure of Variability

In previous lessons, you explored two measures of variability: IQR and MAD. In this activity, you will encounter yet another measure of variability — the standard deviation.

1. Complete these steps to calculate the standard deviation of the data set: 3, 8, 5, 1, 12, 9, 4. (The mean of this data set is 6.) A horizontal number line containing the seven data points and a vertical line at the mean are shown.
   a. For each data point, draw a square with a corner at the data point and another corner at (6, 0). The first square is shown.
   b. Label each square with its area.
   c. Calculate the average area of the squares.
      12.57
   d. Try to draw a square whose area is the average area you calculated in part c. This represents the "average square" between each data point and the mean. How long is each side of this "average square"?
      3.55

The side length of the average square that you calculated in Problem 1 is the ***standard deviation*** of the data set. Standard deviation (SD) is a popular measure of variability, and is more commonly used than the MAD.

2. What similarities and differences do you notice between calculating the MAD and calculating the standard deviation?
   Sample response: To calculate both the MAD and the standard deviation, I begin with the mean of all the data points and determine the distance of each point to the mean. For the MAD, I calculate the mean of those distances. For the standard deviation, I square those distances before calculating the mean, and then take the square root of that mean.

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Lesson 7 Standard Deviation 253

1 Launch

Distribute graph paper, rulers, and colored pens/pencils to each student. Have students complete Problems 1 and 2 independently, then share their work with a partner. If differing responses arise, have them work together to reach a consensus. Then have students complete Problem 3 with their partner.

2 Monitor

Help students get started by modeling the instructions using the provided example.

Look for points of confusion:

- **Excluding the area of squares with double values in Problems 3 and 4.** Have students compare the number of data values to the number of squares they sketched.
- **Squaring the values of the data set to determine the areas of the squares.** Refer to the Warm-up, reminding students that they are working with distances rather than data values.

Look for productive strategies:

- Using a ruler to sketch the side lengths of the "average square".
- Understanding properties of a square to utilize the line segment lengths.
- Generalizing a process to calculate the standard deviation in Problem 3.

Activity 1 continued >

Differentiated Support

Accessibility: *Optimize Access to Technology, Guide Processing and Visualization*

Have students use the Amps slides for this activity, in which they can use a geometric approach to visualize and calculate the standard deviation and how this measure of variability compares to the MAD.

Accessibility: *Vary Demands to Optimize Challenge*

Provide students with a graph of several squares pre-populated for the data set. Have them determine the areas of the pre-populated squares and then sketch the remaining squares and determine those areas.

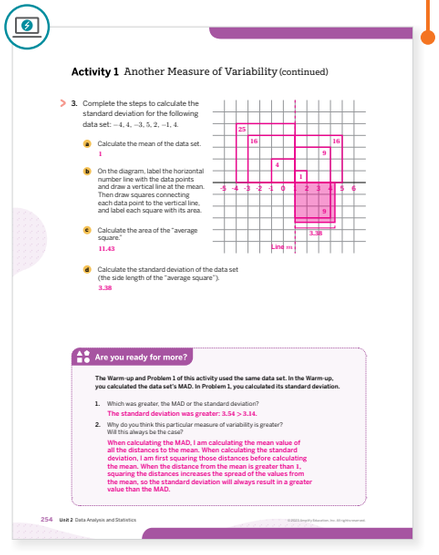
Accessibility: *Activate Prior Knowledge, Clarify Vocabulary and Symbols*

Before students begin the activity, remind them of the IQR (interquartile range) and MAD (mean absolute deviation) and what they describe about a data set. At some point in the activity, or during the Connect, emphasize the acronym they will use for the standard deviation is SD. Consider creating and displaying a graphic organizer that compares and contrasts these three measures of variability:

- Interquartile range (IQR)
- Mean absolute deviation (MAD)
- Standard deviation (SD)

Independent | 20 min

Activity 1 Another Measure of Variability (continued)


Activity 1 Another Measure of Variability (continued)

3. Complete the steps to calculate the standard deviation for the following data set: −4, 4, −3, 5, 2, −1, 4.
   a. Calculate the mean of the data set.
      1
   b. On the diagram, label the horizontal number line with the data points and draw a vertical line at the mean. Then draw squares connecting each data point to the vertical line, and label each square with its area.
   c. Calculate the area of the "average square."
      11.43
   d. Calculate the standard deviation of the data set (the side length of the "average square").
      3.38

Are you ready for more?

The Warm-up and Problem 1 of this activity used the same data set. In the Warm-up, you calculated the data set's MAD. In Problem 1, you calculated its standard deviation.

1. Which was greater, the MAD or the standard deviation?
   The standard deviation was greater: 3.54 > 3.14.
2. Why do you think this particular measure of variability is greater? Will this always be the case?
   When calculating the MAD, I am calculating the mean value of all the distances to the mean. When calculating the standard deviation, I am first squaring those distances before calculating the mean. When the distance from the mean is greater than 1, squaring the distances increases the spread of the values from the mean, so the standard deviation will always result in a greater value than the MAD.

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3 Connect

Have pairs of students share their resulting graphs for Problems 1 and 3, modeling their strategies for creating their graphs. Select and sequence students using productive strategies, highlighting anyone generalizing the process. Discuss the process for calculating the side length of the "average square."

Define the term ***standard deviation***.

Ask, "How are the processes for calculating the standard deviation and MAD similar? How are they different?"

Highlight that the side length of the "average square" represents the standard deviation of a data set, similar to the average distance representing the MAD. This measure of variability is used most commonly in applications. It is also typically calculated using technology.

Note: There are *two* formulas for standard deviation. In this activity, students computed the average before taking the square root, dividing the sum of the squares by the number of data points. Standard deviation is more commonly computed by dividing the sum by *one less* than the number of data points. Students should be made aware that their hand calculations of standard deviation with "average squares" may be slightly different from the standard deviation calculated using technology. They can learn about this distinction in an advanced statistics course.

Differentiated Support

Extension: *Math Enrichment*

Have students write a procedure they can use to determine the MAD and SD for a data set, and then explain how they are similar and how they are different. Sample response: When calculating either the MAD or the SD, I need to determine the distance each data value is from the mean. However, with the MAD, I then determine the absolute value of these distances and then determine the average distance. With the SD, I determine the squares of these distances, determine the average square, and then take the square root.

Ask students to explain why using either the MAD or the SD ensures that the distances each data value is from the mean is a positive value. Sample response: When using the MAD, I determine the absolute value of the distances and absolute value is always positive. When using the SD, I determine the squares of these distances and squaring a value always results in a positive value.

Tell students that most mathematicians and statisticians use the SD, as opposed to the MAD. This is because the SD has some nice mathematical properties that students can study in further advanced statistics or science courses.

1 Launch

Distribute graph paper, rulers, and colored pens/pencils to each student. Have students complete Problems 1 and 2 independently, then share their work with a partner. If differing responses arise, have them work together to reach a consensus. Then have students complete Problem 3 with their partner.

Note: There are *two* formulas for standard deviation. In this activity, students computed the average before taking the square root, dividing the sum of the squares by the number of data points. Standard deviation is more commonly computed by dividing the sum by *one less* than the number of data points.

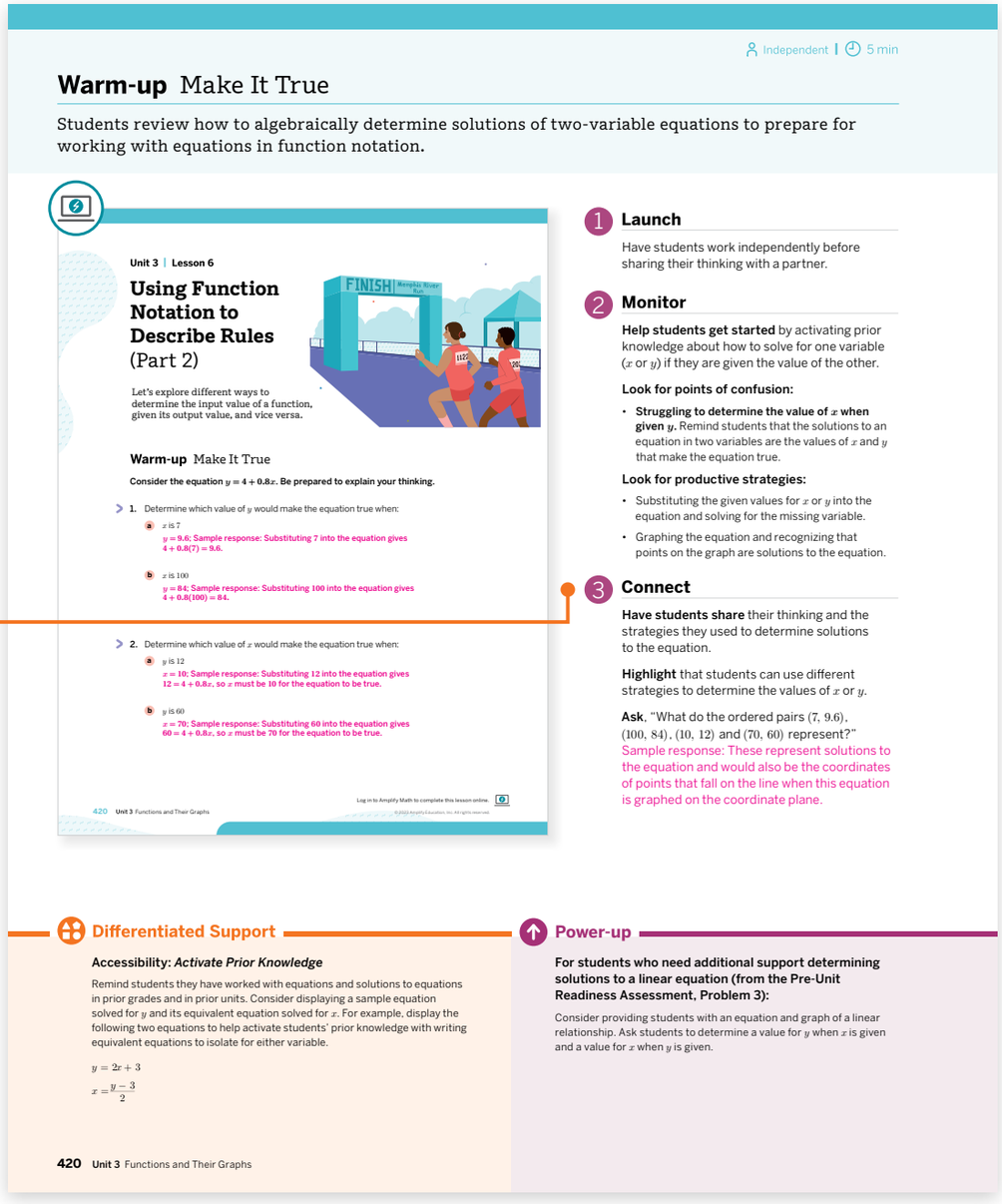
3 Celebrate work while understanding what it tells you about how to advance the class discussion in productive ways.

3 Connect

Have students share their thinking and the strategies they used to determine solutions to the equation.

Highlight that students can use different strategies to determine the values of x or y.

Ask, "What do the ordered pairs $(7, 9.6)$, $(100, 84)$, $(10, 12)$ and $(70, 60)$ represent?" Sample response: These represent solutions to the equation and would also be the coordinates of points that fall on the line when this equation is graphed on the coordinate plane.



Independent | 5 min

Warm-up Make It True

Students review how to algebraically determine solutions of two-variable equations to prepare for working with equations in function notation.

Unit 3 | Lesson 6

Using Function Notation to Describe Rules (Part 2)

Let's explore different ways to determine the input value of a function, given its output value, and vice versa.

Warm-up Make It True

Consider the equation $y = 4 + 0.8x$. Be prepared to explain your thinking.

1. Determine which value of y would make the equation true when:
   - a. x is 7
     $y = 9.6$; Sample response: Substituting 7 into the equation gives $4 + 0.8(7) = 9.6$.
   - b. x is 100
     $y = 84$; Sample response: Substituting 100 into the equation gives $4 + 0.8(100) = 84$.
2. Determine which value of x would make the equation true when:
   - a. y is 12
     $x = 10$; Sample response: Substituting 12 into the equation gives $12 = 4 + 0.8x$, so x must be 10 for the equation to be true.
   - b. y is 60
     $x = 70$; Sample response: Substituting 60 into the equation gives $60 = 4 + 0.8x$, so x must be 70 for the equation to be true.

Log in to Amplify Math to complete this lesson online.

420 Unit 3 Functions and Their Graphs

1 Launch

Have students work independently before sharing their thinking with a partner.

2 Monitor

Help students get started by activating prior knowledge about how to solve for one variable (x or y) if they are given the value of the other.

Look for points of confusion:

- **Struggling to determine the value of x when given y.** Remind students that the solutions to an equation in two variables are the values of x and y that make the equation true.

Look for productive strategies:

- Substituting the given values for x or y into the equation and solving for the missing variable.
- Graphing the equation and recognizing that points on the graph are solutions to the equation.

3 Connect

Have students share their thinking and the strategies they used to determine solutions to the equation.

Highlight that students can use different strategies to determine the values of x or y.

Ask, "What do the ordered pairs $(7, 9.6)$, $(100, 84)$, $(10, 12)$ and $(70, 60)$ represent?" Sample response: These represent solutions to the equation and would also be the coordinates of points that fall on the line when this equation is graphed on the coordinate plane.

Differentiated Support

Accessibility: *Activate Prior Knowledge*

Remind students they have worked with equations and solutions to equations in prior grades and in prior units. Consider displaying a sample equation solved for y and its equivalent equation solved for x. For example, display the following two equations to help activate students' prior knowledge with writing equivalent equations to isolate for either variable.

$y = 2x + 3$

$x = \frac{y - 3}{2}$

Power-up

For students who need additional support determining solutions to a linear equation (from the Pre-Unit Readiness Assessment, Problem 3):

Consider providing students with an equation and graph of a linear relationship. Ask students to determine a value for y when x is given and a value for x when y is given.

420 Unit 3 Functions and Their Graphs

Fostering a positive math identity

Amplify Math is a program that acknowledges and celebrates the experiences and heritages of all students. Activities and instructional supports have been designed to reflect and leverage the knowledge systems of diverse groups including, Indigenous, Black/African American, Latinx, and non-Western peoples and cultures.

The inclusion of these activities and instructional supports in the program help:

- Students develop positive social identities based in the cultures in which they claim membership
- Students build empathy and respect for people both different and similar to them.

Reflect

Prior to synthesizing the concepts of the lesson, allow students a few moments for reflection. Encourage them to record any observations in their Student Edition. To help them engage in meaningful reflection, consider asking:

- "What was the most surprising thing when working with the digital instrument?"
- "What questions do you still have about the relationship between ratios and music?"

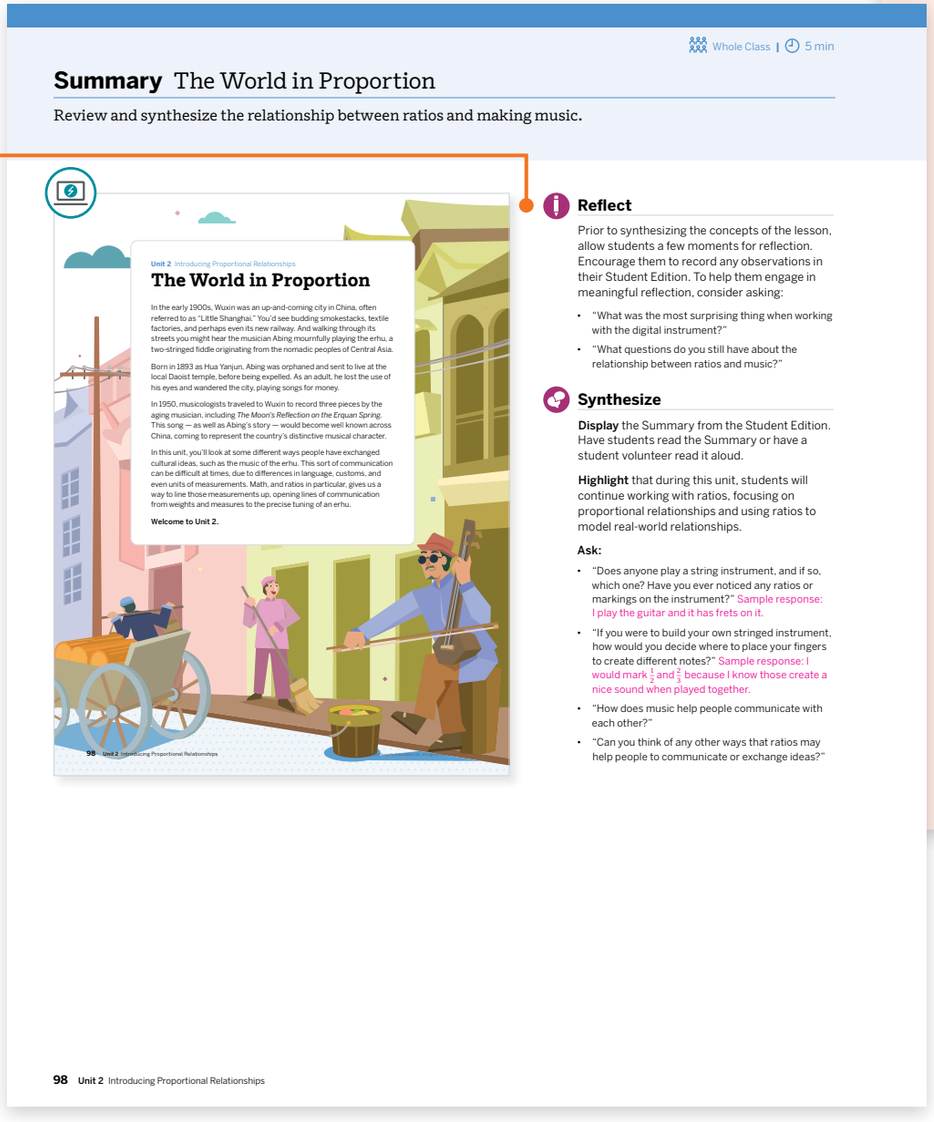
Synthesize

Display the Summary from the Student Edition. Have students read the Summary or have a student volunteer read it aloud.

Highlight that during this unit, students will continue working with ratios, focusing on proportional relationships and using ratios to model real-world relationships.

Ask:

- "Does anyone play a string instrument, and if so, which one? Have you ever noticed any ratios or markings on the instrument?" Sample response: I play the guitar and it has frets on it.
- "If you were to build your own stringed instrument, how would you decide where to place your fingers to create different notes?" Sample response: I would mark $\frac{1}{2}$ and $\frac{2}{3}$ because I know those create a nice sound when played together.
- "How does music help people communicate with each other?"
- "Can you think of any other ways that ratios may help people to communicate or exchange ideas?"



Whole Class | 5 min

Summary The World in Proportion

Review and synthesize the relationship between ratios and making music.

Reflect

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- "How does music help people communicate with each other?"
- "Can you think of any other ways that ratios may help people to communicate or exchange ideas?"

Unit 2 Introducing Proportional Relationships

The World in Proportion

In the early 1900s, Wuxin was an up-and-coming city in China, often referred to as "Little Shanghai." You'd see budding smokestacks, textile factories, and perhaps even its new railway. And walking through its streets you might hear the musician Abing mournfully playing the erhu, a two-stringed fiddle originating from the nomadic peoples of Central Asia.

Born in 1893 as Hua Yanjun, Abing was orphaned and sent to live at the local Daoist temple, before being expelled. As an adult, he lost the use of his eyes and wandered the city, playing songs for money.

In 1950, musicologists traveled to Wuxin to record three pieces by the aging musician, including *The Moon's Reflection on the Erquan Spring*. This song — as well as Abing's story — would become well known across China, coming to represent the country's distinctive musical character.

In this unit, you'll look at some different ways people have exchanged cultural ideas, such as the music of the erhu. This sort of communication can be difficult at times, due to differences in language, customs, and even units of measurements. Math, and ratios in particular, gives us a way to line those measurements up, opening lines of communication from weights and measures to the precise tuning of an erhu.

Welcome to Unit 2.

98 Unit 2 Introducing Proportional Relationships

- Have you had any personal experiences that are related to the narrative in any way?

3 Connect

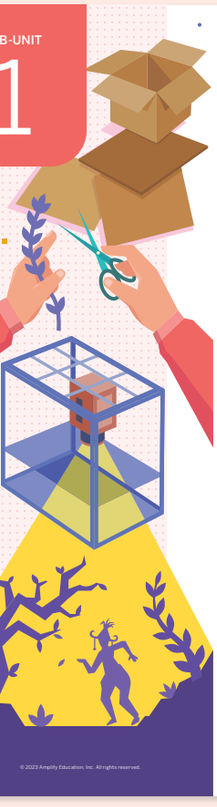
Have students share the strategies they used to transform the images. Focus on students who used tracing paper and students who used the grid units to draw the transformations.

Unit 1
id Transformations

Whole Class

ts begin by studying examples of transformations in the plane. Then, students attend to precision with rmations using the structure of a grid and the coordinates of points.

B-UNIT
1



How do you make a piece of cardboard come alive?

Before Walt Disney, there was Lotte Reiniger.

As a girl living in Berlin, Reiniger was clever with a pair of scissors, cutting intricate figures out of the cardboard from old soap boxes. For many kids, this was just a way to pass the time. But for Reiniger, it was something more.

As a teenager, her interest in puppets led her into the world of German art and cinema. By the time she was twenty, she started making her own films.

Her most famous achievement is *The Adventures of Prince Achmed* — the world's first animated full-length feature film — ten years before Disney's *Snow White*.

With a staff of just five people, Reiniger constructed elaborate paper puppets. Then, using a camera of her own invention, she would lay the puppets out and change their position frame-by-frame. It was a long and tedious process, but when the images were run through a film projector, they came out as a single fluid movement.

By changing the position of solid figures, Reiniger turned a piece of cardboard into a flap of a bird's wing, a gesture of an arm, or a sorcerer casting a spell. With only a pair of scissors, her imagination, and clever uses of transformation, Reiniger changed the world of animation forever.

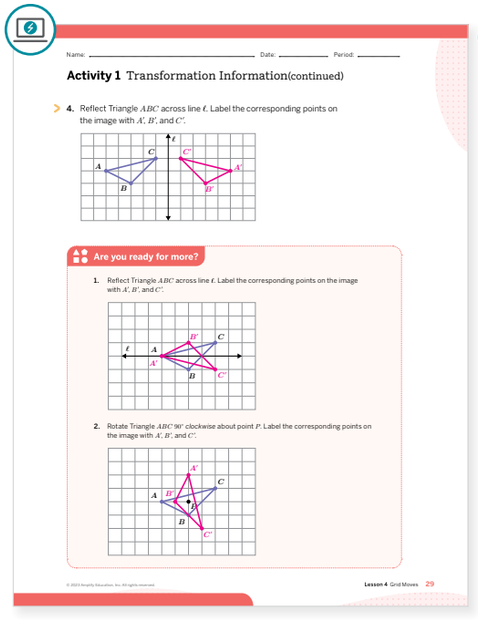
Read and discuss

Read the narrative aloud as a class or have students read it individually. If time permits, have students discuss in pairs or as a class:

- What do you notice or wonder about the narrative?
- What words or phrases resonate with you?
- Have you had any personal experiences that are related to the narrative in any way?
- Do you have any hobbies or pastimes that you can see turning into a future career?

Independent | 15 min

Activity 1 Transformation Information(continued)



Name: _____ Date: _____ Period: _____

Activity 1 Transformation Information(continued)

4. Reflect Triangle ABC across line ℓ. Label the corresponding points on the image with A', B', and C'.

Are you ready for more?

1. Reflect Triangle ABC across line ℓ. Label the corresponding points on the image with A', B', and C'.

2. Rotate Triangle ABC 90° clockwise about point P. Label the corresponding points on the image with A', B', and C'.

3 Connect

Have students share the strategies they used to transform the images. Focus on students who used tracing paper and students who used the grid units to draw the transformations.

Ask:

- "How do the translations in Problems 1 and 2 differ?" In Problem 1, the triangle is translated in one direction (to the right). In Problem 2, the triangle is translated in two directions (down and to the right).
- "When rotating a figure, how does the orientation of the image vertices compare to the orientation of the preimage vertices, relative to the center of rotation?" The orientation is reversed.
- "Can you think of one word that you can use to describe any of these types of movements?" Sample responses: move, change, transform

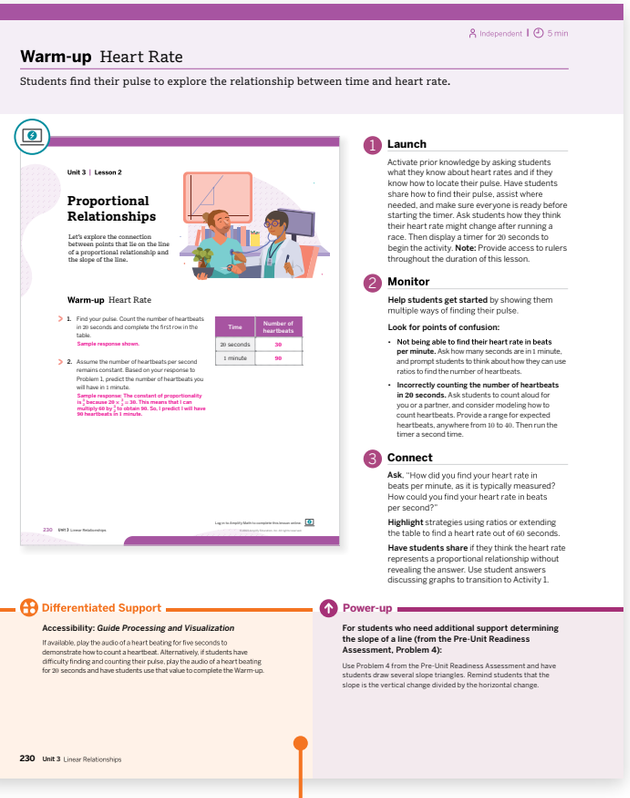
Define the term ***transformation*** as a rule for moving or changing figures on the plane. Translations, reflections, and rotations are all examples of transformations.

Highlight how the structure of the grid can help students perform each transformation.

Differentiating instruction

Multiple pathways to the math

Working with advisor Dr. Paulo Tan and experts at the English Learners Success Forum (ELSF), the Amplify Math curriculum team has developed intentional and point-of-use differentiated supports that invite all students into the mathematical conversation.



Independent | 5 min

Warm-up Heart Rate

Students find their pulse to explore the relationship between time and heart rate.

Unit 3 | Lesson 2

Proportional Relationships

Let's explore the connection between points that lie on the line of a proportional relationship and the slope of the line.

Warm-up Heart Rate

1. Find your pulse. Count the number of heartbeats in 20 seconds and complete the first row in the table.
Sample response shown.

2. Assume the number of heartbeats per second remains constant. Based on your response to Problem 1, predict the number of heartbeats you will have in 1 minute.
Sample response: The constant of proportionality is $\frac{3}{2}$ because $20 \times \frac{3}{2} = 30$. This means that I can multiply 60 by $\frac{3}{2}$ to obtain 90. So, I predict I will have 90 heartbeats in 1 minute.

Time	Number of heartbeats
20 seconds	30
1 minute	90

1 Launch

Activate prior knowledge by asking students what they know about heart rates and if they know how to locate their pulse. Have students share how to find their pulse, assist where needed, and make sure everyone is ready before starting the timer. Ask students how they think their heart rate might change after running a race. Then display a timer for 20 seconds to begin the activity. **Note:** Provide access to rulers throughout the duration of this lesson.

2 Monitor

Help students get started by showing them multiple ways of finding their pulse.

Look for points of confusion:

- **Not being able to find their heart rate in beats per minute.** Ask how many seconds are in 1 minute, and prompt students to think about how they can use ratios to find the number of heartbeats.
- **Incorrectly counting the number of heartbeats in 20 seconds.** Ask students to count aloud for you or a partner, and consider modeling how to count heartbeats. Provide a range for expected heartbeats, anywhere from 10 to 40. Then run the timer a second time.

3 Connect

Ask. "How did you find your heart rate in beats per minute, as it is typically measured? How could you find your heart rate in beats per second?"

Highlight strategies using ratios or extending the table to find a heart rate out of 60 seconds.

Have students share if they think the heart rate represents a proportional relationship without revealing the answer. Use student answers discussing graphs to transition to Activity 1.

Differentiated Support

Accessibility: *Guide Processing and Visualization*

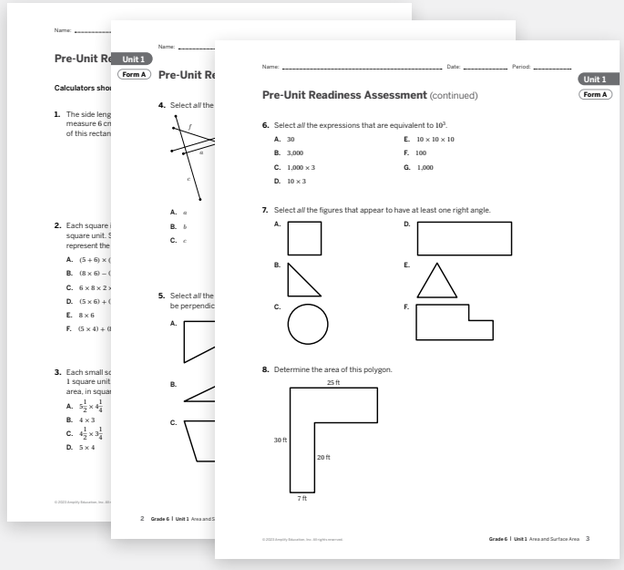
If available, play the audio of a heart beating for five seconds to demonstrate how to count a heartbeat. Alternatively, if students have difficulty finding and counting their pulse, play the audio of a heart beating for 20 seconds and have students use that value to complete the Warm-up.

Power-up

For students who need additional support determining the slope of a line (from the Pre-Unit Readiness Assessment, Problem 4):

Use Problem 4 from the Pre-Unit Readiness Assessment and have students draw several slope triangles. Remind students that the slope is the vertical change divided by the horizontal change.

230 Unit 3 Linear Relationships



Pre-Unit Readiness Assessment (continued)

Unit 1 | Form A

6. Select all the expressions that are equivalent to 10^3.
A. 30
B. 3,000
C. $1,000 \times 3$
D. 10×3
E. $10 \times 10 \times 10$
F. 100
G. 1,000

7. Select all the figures that appear to have at least one right angle.

8. Determine the area of this polygon.
25 ft, 30 ft, 20 ft, 7 ft

PRINT | DIGITAL

Pre-Unit Readiness Assessment

Amplify Math's Pre-Unit Readiness Assessment helps teachers identify student needs. The problems of the Pre-Unit Readiness Assessment cover the lessons' prerequisite skills to help teachers know where they might provide additional support before and during the lessons in the unit, informing instruction by identifying specific student needs for the unit. Using these insights, teachers can use the flexible built-in support to differentiate appropriately at point of use.

Differentiated Support

Accessibility: *Guide Processing and Visualization*

If available, play the audio of a heart beating for five seconds to demonstrate how to count a heartbeat. Alternatively, if students have difficulty finding and counting their pulse, play the audio of a heart beating for 20 seconds and have students use that value to complete the Warm-up.

Power-up

For students who need additional support determining the slope of a line (from the Pre-Unit Readiness Assessment, Problem 4):

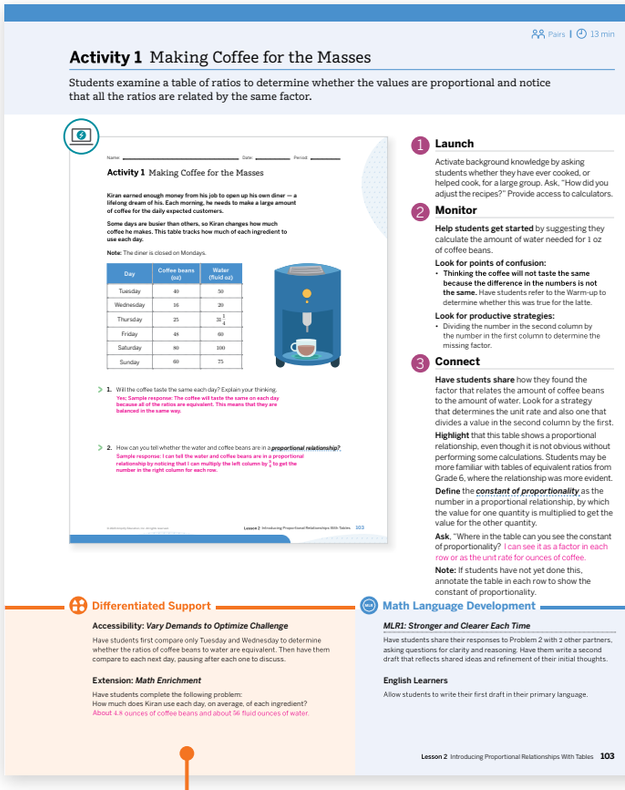
Use Problem 4 from the Pre-Unit Readiness Assessment and have students draw several slope triangles. Remind students that the slope is the vertical change divided by the horizontal change.

Accessibility and extension supports

Every Amplify Math lesson begins with a warm-up activity. But some students may require additional support with unfinished learning to get them ready for the grade-level content addressed in a particular lesson. Based on students' performance on formative practice problems, students who need this support are automatically identified for teachers, and given differentiated Power-ups to the grade-level content.

Students are never labeled as above or below grade level in Amplify Math. The wide range of differentiated instructional supports are categorized as either **accessibility** or **extension** supports within the Teacher Edition. These supports can be implemented flexibly as students may not need support for every lesson, but instead a particular activity within a lesson.

Grounded in the Universal Design for Learning (UDL) framework and guidelines (CAST, 2018), our accessibility supports provide students with the help they may need on a given activity and makes the content accessible for all students.


Pairs | 13 min

Activity 1 Making Coffee for the Masses

Students examine a table of ratios to determine whether the values are proportional and notice that all the ratios are related by the same factor.

Activity 1 Making Coffee for the Masses

Kiran earned enough money from his job to open up his own diner — a lifelong dream of his. Each morning, he needs to make a large amount of coffee for the daily expected customers.

Some days are busier than others, so Kiran changes how much coffee he makes. This table tracks how much of each ingredient to use each day.

Note: The diner is closed on Mondays.

Day	Coffee beans (oz)	Water (fluid oz)
Tuesday	40	50
Wednesday	16	20
Thursday	25	$31\frac{1}{4}$
Friday	48	60
Saturday	80	100
Sunday	60	75

1. Will the coffee taste the same each day? Explain your thinking.
Yes; Sample response: The coffee will taste the same on each day because all of the ratios are equivalent. This means that they are balanced in the same way.

2. How can you tell whether the water and coffee beans are in a *proportional relationship*?
Sample response: I can tell the water and coffee beans are in a proportional relationship by noticing that I can multiply the left column by $\frac{5}{4}$ to get the number in the right column for each row.

1 Launch

Activate background knowledge by asking students whether they have ever cooked, or helped cook, for a large group. Ask, "How did you adjust the recipes?" Provide access to calculators.

2 Monitor

Help students get started by suggesting they calculate the amount of water needed for 1 oz of coffee beans.

Look for points of confusion:
- **Thinking the coffee will not taste the same because the difference in the numbers is not the same.** Have students refer to the Warm-up to determine whether this was true for the latte.

Look for productive strategies:
- Dividing the number in the second column by the number in the first column to determine the missing factor.

3 Connect

Have students share how they found the factor that relates the amount of coffee beans to the amount of water. Look for a strategy that determines the unit rate and also one that divides a value in the second column by the first.

Highlight that this table shows a proportional relationship, even though it is not obvious without performing some calculations. Students may be more familiar with tables of equivalent ratios from Grade 6, where the relationship was more evident.

Define the ***constant of proportionality*** as the number in a proportional relationship, by which the value for one quantity is multiplied to get the value for the other quantity.

Ask, "Where in the table can you see the constant of proportionality? I can see it as a factor in each row or as the unit rate for ounces of coffee.

Note: If students have not yet done this, annotate the table in each row to show the constant of proportionality.

Differentiated Support

Accessibility: ***Vary Demands to Optimize Challenge***

Have students first compare only Tuesday and Wednesday to determine whether the ratios of coffee beans to water are equivalent. Then have them compare to each next day, pausing after each one to discuss.

Extension: ***Math Enrichment***

Have students complete the following problem:
How much does Kiran use each day, on average, of each ingredient?
About 4.8 ounces of coffee beans and about 56 fluid ounces of water.

Math Language Development

MLR1: Stronger and Clearer Each Time

Have students share their responses to Problem 2 with 2 other partners, asking questions for clarity and reasoning. Have them write a second draft that reflects shared ideas and refinement of their initial thoughts.

English Learners

Allow students to write their first draft in their primary language.

Lesson 2 Introducing Proportional Relationships With Tables 103

Examples of **accessibility supports** include:

- Removing or restricting physical requirements (for example, providing measurements instead of having students do the measuring).
- Scaffolding directions.
- Chunking the task into smaller, more manageable parts.
- Providing checklists, tables, and graphic organizers.
- Optimizing access to tools, such as physical and digital manipulatives, and technology.
- Providing options for students to use annotations and color coding to highlight connections.

Extension support provides teachers with opportunities for students to examine grade-level mathematics at a deeper level as opposed to introducing future grade or course mathematics.

Extension support subcategories include:

- Math Enrichment
- Math Around the World
- Interdisciplinary Connections

Differentiated Support

Accessibility: ***Vary Demands to Optimize Challenge***

Have students first compare only Tuesday and Wednesday to determine whether the ratios of coffee beans to water are equivalent. Then have them compare to each next day, pausing after each one to discuss.

Extension: ***Math Enrichment***

Have students complete the following problem:
How much does Kiran use each day, on average, of each ingredient?
About 4.8 ounces of coffee beans and about 56 fluid ounces of water.

Navigating the program

Navigating the print program

Amplify Math provides teachers with easy-to-follow instructional supports that make implementing the program easier and enjoyable for both you and your students.

Lesson Brief

UNIT 1 | **LESSON 3**

Symmetry and Reflection

Let's describe ways figures reflect on the plane.

Focus

Goals

1. **Language Goals:** Describe the movement of figures informally and formally using the terms *reflection*, *line of reflection*, *image*, and *preimage*. **(Speaking and Listening, Reading and Writing)**
2. **Language Goals:** Identify the features that determine a reflection. **(Speaking and Listening, Reading and Writing)**

Rigor

- Students build **conceptual understanding** of how figures can be flipped or reflected on a plane.
- Students build **fluency** in using precise mathematical vocabulary to describe reflections.

Coherence

Today

Students begin by studying different figures to review lines of symmetry. They move into drawing and measuring reflected triangles, coming to understand that the line of reflection lies halfway between the two triangles and is perpendicular to the line segments that connect the corresponding vertices.

Previously

In Lesson 2, students described the features that identified translations and rotations.

Coming Soon

In Lesson 4, students will translate, reflect, and rotate figures on a grid.

Lesson goals, **coherence mapping**, and a breakdown for how **conceptual understanding**, **procedural fluency**, and **application** are addressed are included for each lesson.

Lesson Brief | Warm-Up | Activities | Summary | Exit Ticket | Practice

Pacing Guide

Suggested Total Lesson Time ~**45 min**

Warm-up	Activity 1	Activity 2	Activity 3	Summary	Exit Ticket
5 min	15 min	8 min	8 min	5 min	5 min
Pairs	Pairs	Pairs	Pairs	Whole Class	Independent

*In this Warm-up, students build on their understanding of symmetry from Grade 4.

Amps powered by desmos | **Activity and Presentation Slides**

For a digitally interactive experience of this lesson, log in to Amplify Math at learning.amplify.com.

Practice Independent

Materials

- Exit Ticket
- Additional Practice
- geometry toolkits: rulers, tracing paper, protractors (optional)

Math Language Development

New words

- *image*
- *line of reflection*
- *orientation*
- *preimage**
- *prime notation*
- *reflection*

Review words

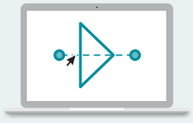
- *corresponding points*
- *perpendicular*
- *symmetry*
- *vertex*

*Students may confuse *preimage* and *image* throughout the unit when discussing the original image and the transformed image. Highlight the prefix *pre* in *preimage* indicates the original image.

Amps | **Featured Activity**

Activity 1
Real-Time Reflections

When students adjust the line of reflection, an animation shows the reflected image, giving students an opportunity to revise their response, if needed.



Amps powered by desmos

Building Math Identity and Community

Connecting Mathematical Practices

Self-management: Students may not want to make the effort required to use precise units and measuring tools to measure the exact distance of corresponding points to the line of reflection. Ask them to identify what the stumbling block is. By identifying the cause of their negative emotions, students will be able to form a plan that will help them regulate their behavior in response. For example, they might just need a peer to remind them how to use and read measurements on a ruler.

Modifications to Pacing

You may want to consider these additional modifications if you are short on time.

- In **Activity 2**, Problem choices D, E, and F may be omitted.
- **Activity 3**, Problem 1 may be omitted. In this activity, students practice drawing reflections. Students will have other opportunities to practice drawing reflections in the Practice.

19B **Unit 1** Rigid Transformations and Congruence

Suggested timing for the lesson and each activity is included for quick reference.

The benefits of teaching one or more of the activities **online** are outlined for each lesson.

Every lesson pacing guide includes **modification** suggestions.

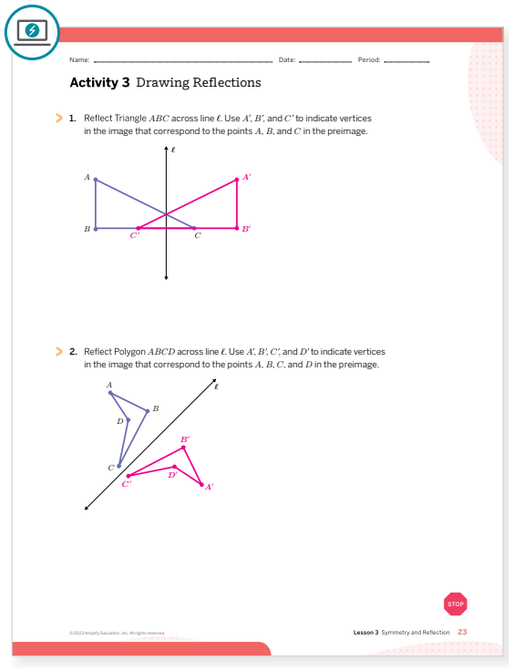
Lesson

The **student-facing** content is presented to the left.

Pairs | 8 min

Activity 3 Drawing Reflections

Students practice drawing reflections, strengthening their understanding of how the line of reflection relates to the corresponding points in the preimage and image.



Name: _____ Date: _____ Period: _____

Activity 3 Drawing Reflections

1. Reflect Triangle ABC across line ℓ. Use A', B', and C' to indicate vertices in the image that correspond to the points A, B, and C in the preimage.

2. Reflect Polygon $ABCD$ across line ℓ. Use A', B', C', and D' to indicate vertices in the image that correspond to the points A, B, C, and D in the preimage.

STOP

Lesson 3 Symmetry and Reflection 23

1 Launch

Have students use a ruler to draw the reflection of each figure and only use tracing paper to check their work.

2 Monitor

Help students get started by having them draw a perpendicular line from point A to the line ℓ in Problem 1, and then measure the distance from point A to the line ℓ.

Look for points of confusion:

- **Drawing a reflected point the same distance from the line as point A, but not perpendicular to line ℓ in Problem 2.** Use a protractor, or corner of an index card or paper, to help students create a right angle formed by line ℓ and point A.

Look for productive strategies:

- Using rulers to measure the distance from each point in the preimage to the line of reflection.
- Only using tracing paper to check their reflected image after it is drawn.

3 Connect

Display correct student drawings.

Have students share the strategies they used for drawing each image.

Highlight that an image is determined by the preimage and placement of the line of reflection. The line of reflection may not always be strictly vertical (as in Problem 1) or horizontal. The line of reflection may be slanted (as in Problem 2).

Differentiated Support

Accessibility: ***Vary Demands to Optimize Challenge***

If students need more processing time, have them focus on completing Problem 1, and only work on Problem 2 as time allows.

Accessibility: ***Optimize Access to Tools***

Provide access to tracing paper, should students wish to use it during the activity.

Extension: ***Math Enrichment***

Have students draw their own reflections and lines of reflections that satisfy the given criteria.

- Draw the reflection of a preimage in which the image overlaps the preimage.
- Draw the reflection of a preimage in which the image touches exactly one of the vertices of the preimage.
- Draw the reflection of a preimage in which the image touches exactly one of the sides of the preimage.

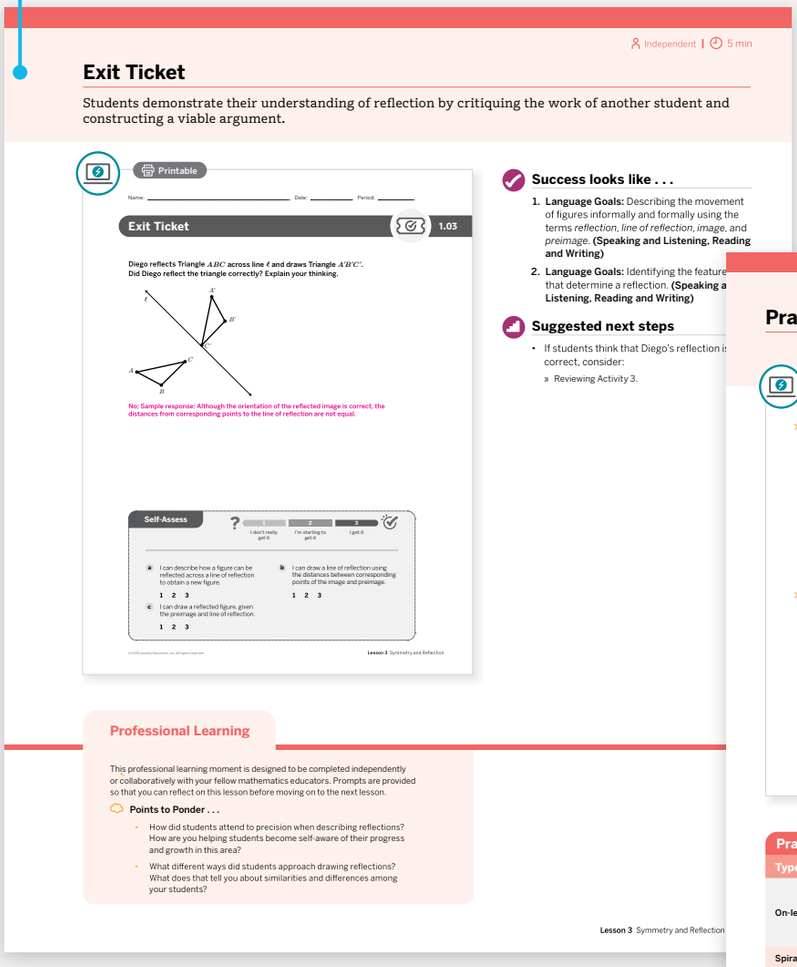
Lesson 3 Symmetry and Reflection 23

A short **description of the activity and its targeted goal** is outlined at the top.

Easy 1-2-3 guidance for teachers shortens the amount of time required to plan. The "look for" prompts are helpful to scan while teaching.

Differentiation supports, including our just-in-time supports called Power-ups, provide practical guidance for scaffolding or extending the learning for all students.

Each lesson ends with an **Exit Ticket** which includes a self-assessment for students.



Independent | 5 min

Exit Ticket

Students demonstrate their understanding of reflection by critiquing the work of another student and constructing a viable argument.

Printable

Name: _____ Date: _____ Period: _____

Exit Ticket 1.03

Diego reflects Triangle ABC across line ℓ and draws Triangle $A'B'C'$.
Did Diego reflect the triangle correctly? Explain your thinking.

No; Sample response: Although the orientation of the reflected image is correct, the distances from corresponding points to the line of reflection are not equal.

Self-Assess

	1	2	3
	I don't really get it	I'm starting to get it	I get it

a. I can describe how a figure can be reflected across a line of reflection to obtain a new figure. 1 2 3

b. I can draw a line of reflection using the distances between corresponding points of the image and preimage. 1 2 3

c. I can draw a reflected figure, given the preimage and line of reflection. 1 2 3

Lesson 3 Symmetry and Reflection

Success looks like . . .

1. **Language Goals:** Describing the movement of figures informally and formally using the terms *reflection*, *line of reflection*, *image*, and *preimage*. **(Speaking and Listening, Reading and Writing)**
2. **Language Goals:** Identifying the feature that determine a reflection. **(Speaking a Listening, Reading and Writing)**

Suggested next steps

- If students think that Diego's reflection i correct, consider:
  - » Reviewing Activity 3.

Professional Learning

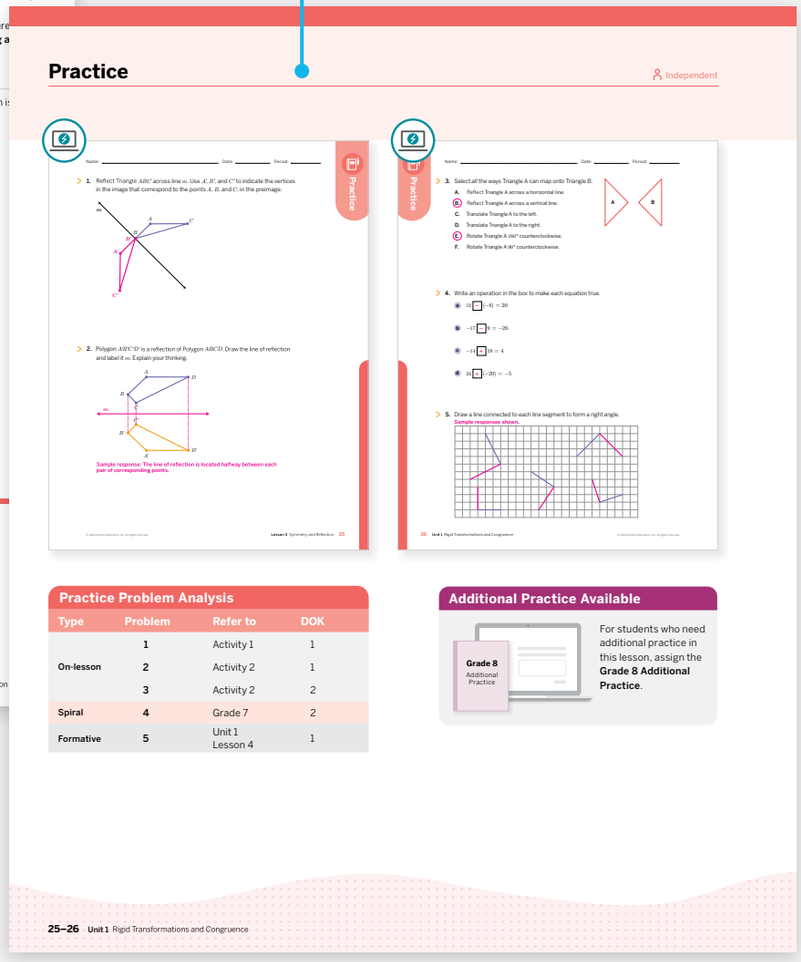
This professional learning moment is designed to be completed independently or collaboratively with your fellow mathematics educators. Prompts are provided so that you can reflect on this lesson before moving on to the next lesson.

Points to Ponder . . .

- How did students attend to precision when describing reflections? How are you helping students become self-aware of their progress and growth in this area?
- What different ways did students approach drawing reflections? What does that tell you about similarities and differences among your students?

Lesson 3 Symmetry and Reflection

A targeted set of 4–6 **practice problems** are included online and in the print Student Edition. Each set includes at least one spiral review problem and one formative problem as a prerequisite check for the next lesson.



Practice

Independent

Practice

Name: _____ Date: _____ Period: _____

1. Reflect Triangle ABC across line m. Use A', B', and C' to indicate the vertices in the image that correspond to the points A, B, and C in the preimage.

2. Polygon $ABCD$ is a reflection of Polygon $AB'C'D'$. Draw the line of reflection and label it m. Explain your thinking.

Sample response: The line of reflection is located halfway between each pair of corresponding points.

Lesson 3 Symmetry and Reflection 25

Practice

3. Select all the ways Triangle A can map onto Triangle B.
   - A. Reflect Triangle A across a horizontal line.
   - B. Reflect Triangle A across a vertical line.
   - C. Translate Triangle A to the left.
   - D. Translate Triangle A to the right.
   - E. Rotate Triangle A 180° counterclockwise.
   - F. Rotate Triangle A 90° counterclockwise.

4. Write an operation in the box to make each equation true.
   - a. $12 \square (-9) = 20$
   - b. $-12 \square 3 = -36$
   - c. $-11 \square 15 = 4$
   - d. $24 \square (-29) = -5$

5. Draw a line connected to each line segment to form a right angle.
   Sample responses shown.

26 Unit 1 Rigid Transformations and Congruence

Practice Problem Analysis

Type	Problem	Refer to	DOK
On-lesson	1	Activity 1	1
	2	Activity 2	1
	3	Activity 2	2
Spiral	4	Grade 7	2
Formative	5	Unit 1 Lesson 4	1

Additional Practice Available

For students who need additional practice in this lesson, assign the **Grade 8 Additional Practice**.

25–26 Unit 1 Rigid Transformations and Congruence

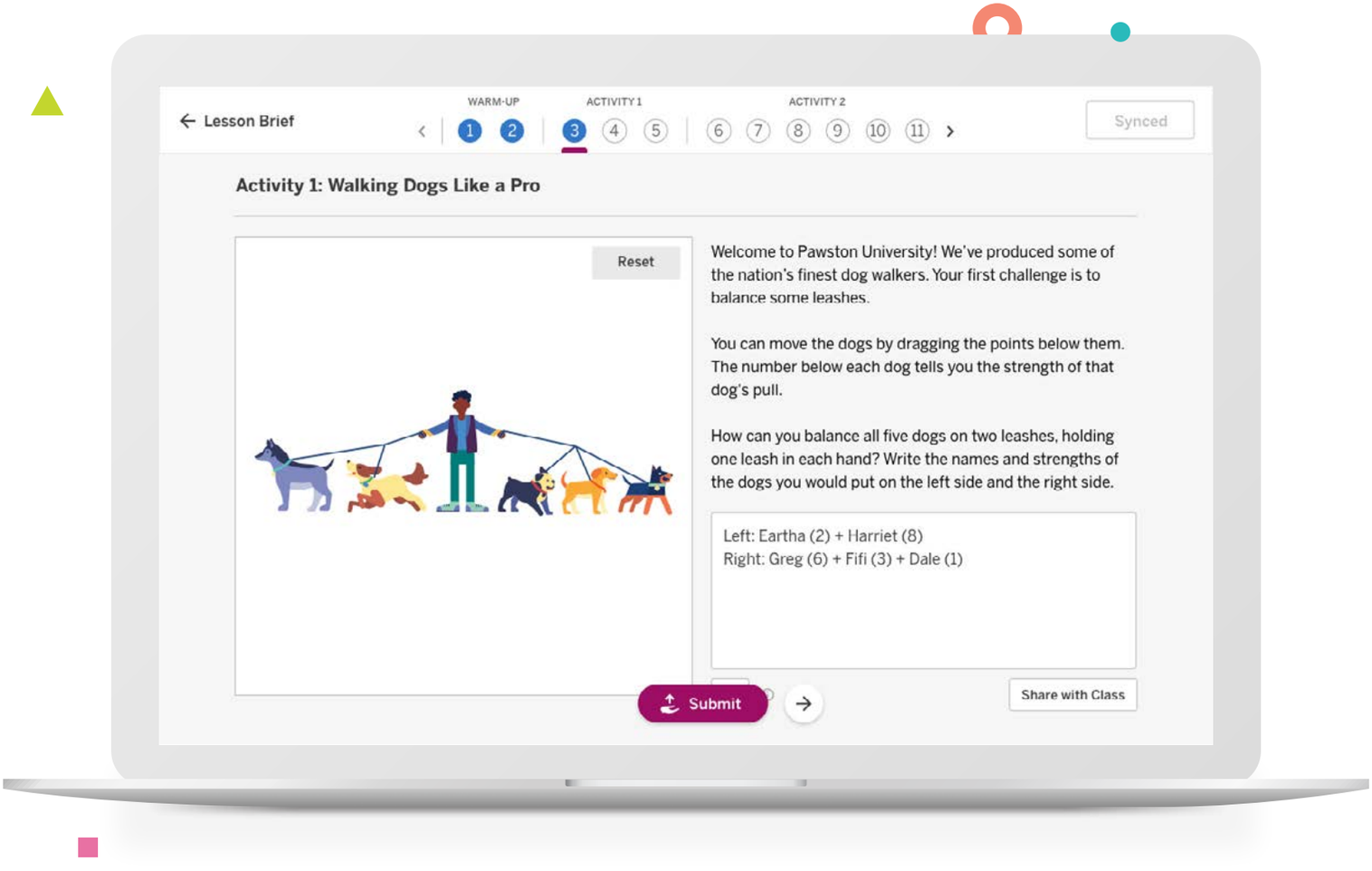
In the **Additional Practice book**, students will find a worked out example and four to eight practice problems per lesson.

Flexible, social problem-solving experiences

Digital lessons, when designed the right way, can be powerful in their ability to surface student thinking and spark interesting and productive discussions. To bring our vision of what digital lessons can and should be to life, we've partnered with Desmos to create our complete library of Amps—social, collaborative lessons powered by Desmos technology that make sense to students and work harder for teachers.

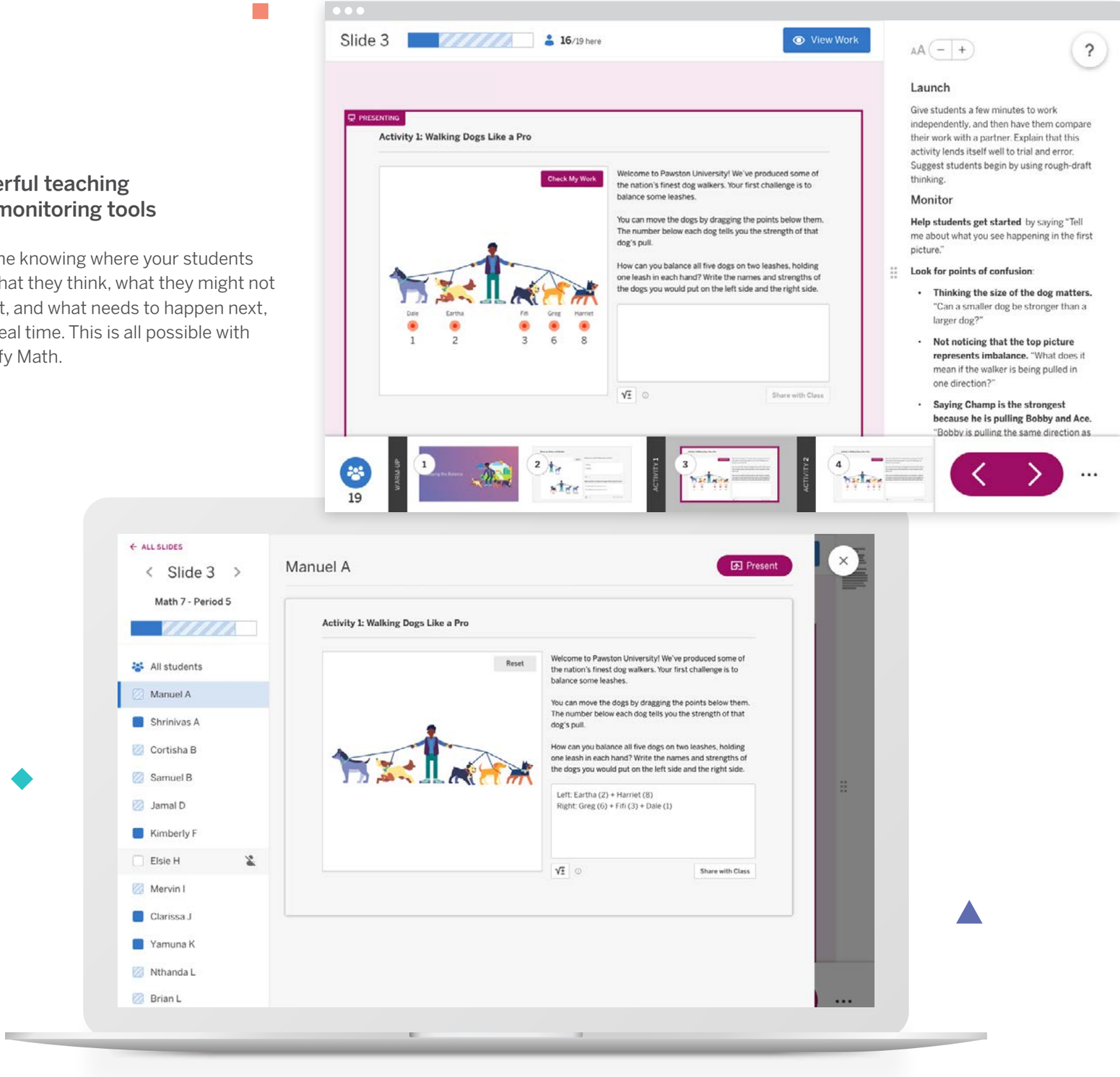
Intuitive and engaging student experience

The student experience is intuitive and engaging because the content and the tools are interesting and exciting. Students work together and interact with the mathematics in real time to quickly see that reasoning and revising are important parts of math class.



Powerful teaching and monitoring tools

Imagine knowing where your students are, what they think, what they might not get yet, and what needs to happen next, all in real time. This is all possible with Amplify Math.



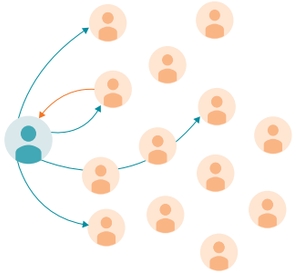
Amplify Math digital experience

Classroom monitoring tools

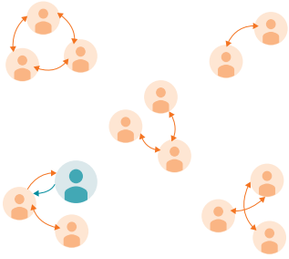
For students, Amplify Math's digital experience is fun and dynamic, with plenty of opportunities for students to talk through their reasoning, work with their peers, and gain new understanding. Teachers gain insight into student reasoning with real-time insights, data, and reporting the drive performance for all learners.

Amps
POWERED BY desmos

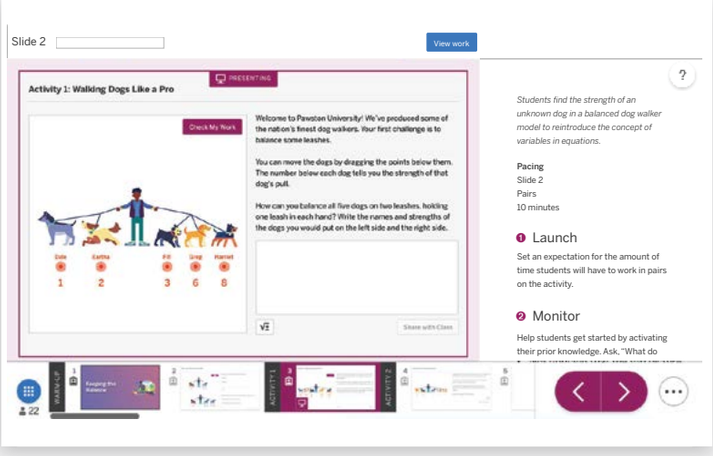
1 **Launch**
Teachers launch an activity and ensure students understand what's being asked.



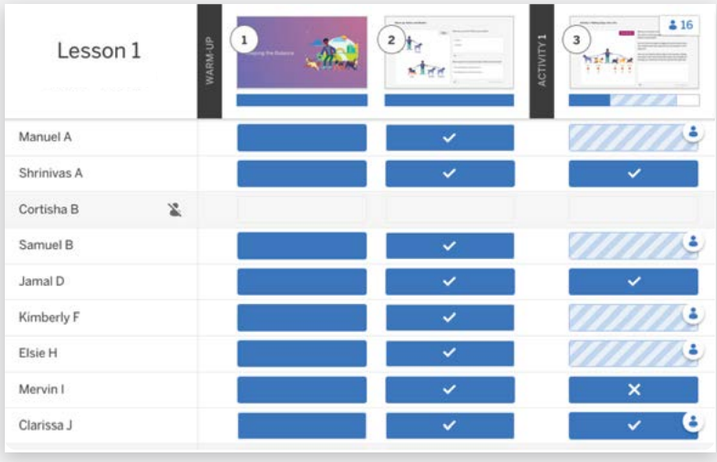
2 **Monitor**
Students interact with each other to discuss and work out strategies for solving a problem.



Teacher experience



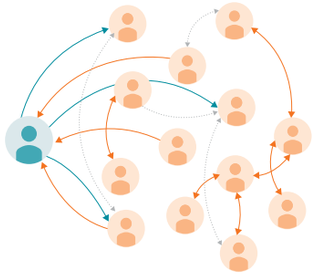
When you launch a lesson, you'll have access to **easy-to-skim teacher notes and all of the controls necessary** to manage the lesson.



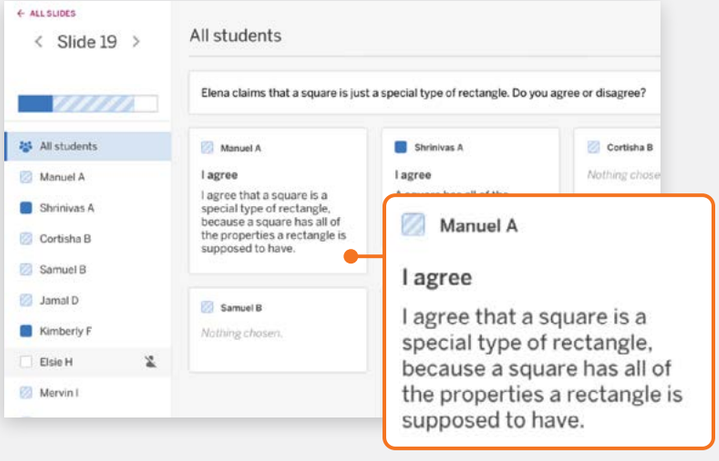
After students have started working you will access the Class Progress screen to **see where students are in the lesson and even control which problems they have access to**.

When you launch an **Amp**, you will be kickstarting small group and whole class discussions where students can see how their thinking can impact a situation and learn how their peers are justifying their actions and decisions.

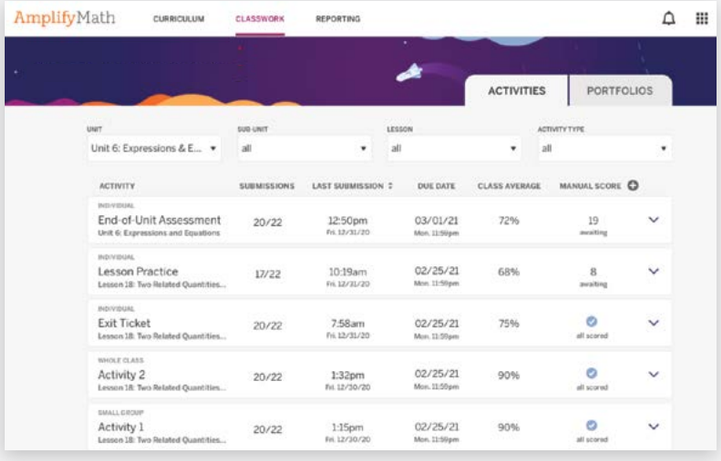
3 **Connect**
Students construct viable arguments and critique each other's reasoning, then synthesize with the teacher at the end.



4 **Review**
After class, teachers can provide feedback on submitted student work and run reports.



All student responses can be viewed easily on the All Students screen. You can often view a composite view of responses and spotlight student work anonymously.



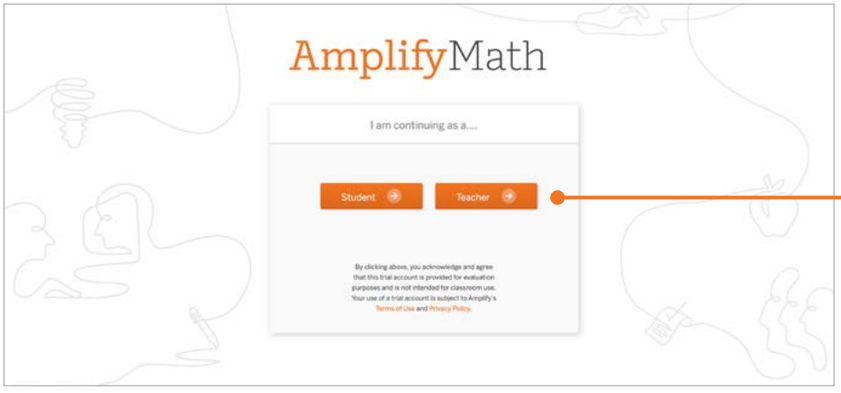
After students complete work that's ready for grading, you can head to Classwork to **quickly provide feedback**.

Once students have completed an Exit Ticket, a practice problem set, or an assessment, you can **run reports at the class, student, and standards levels to check in on student progress**.

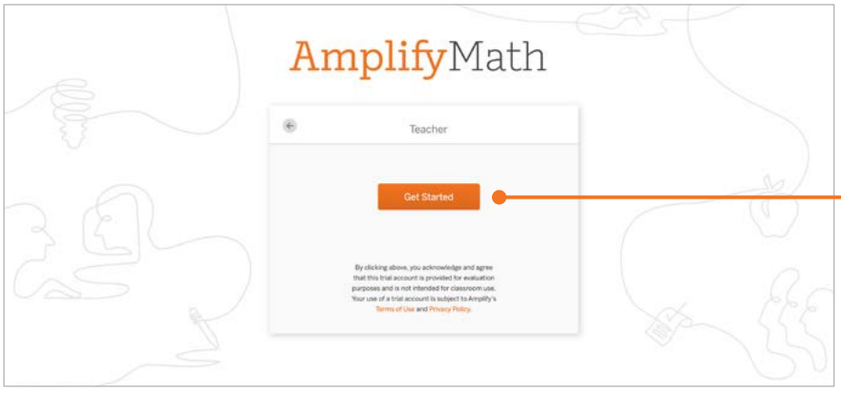
Navigating the digital program

Access your Amplify Math digital content using your unique login credentials or by visiting the digital review site **learning.amplify.com/math-review**.

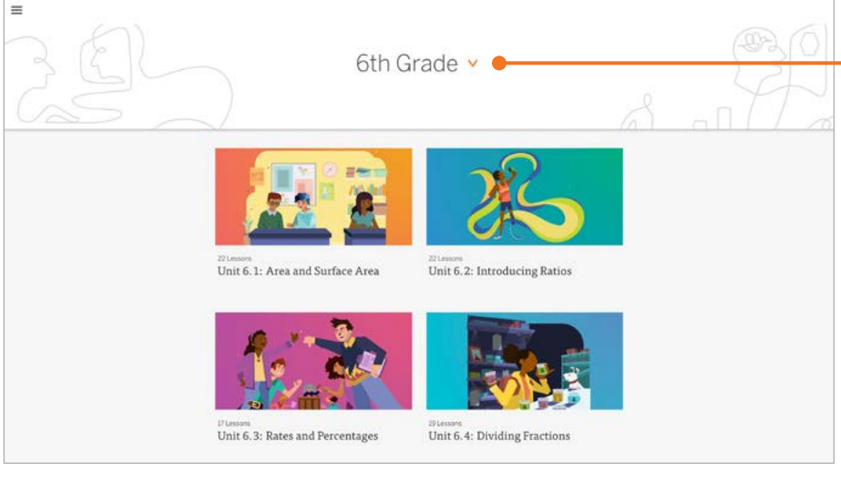
Log in



1. Click on **Teacher**



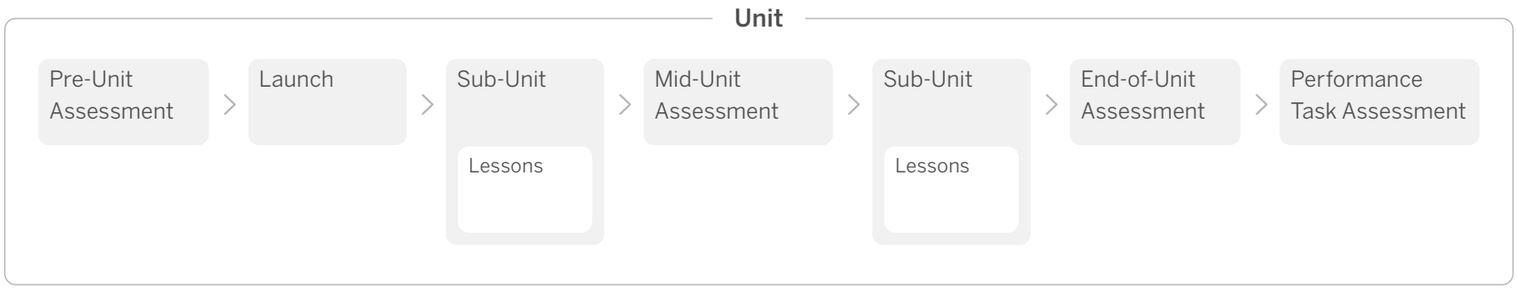
2. Click on **"Get Started"**



3. Choose your grade

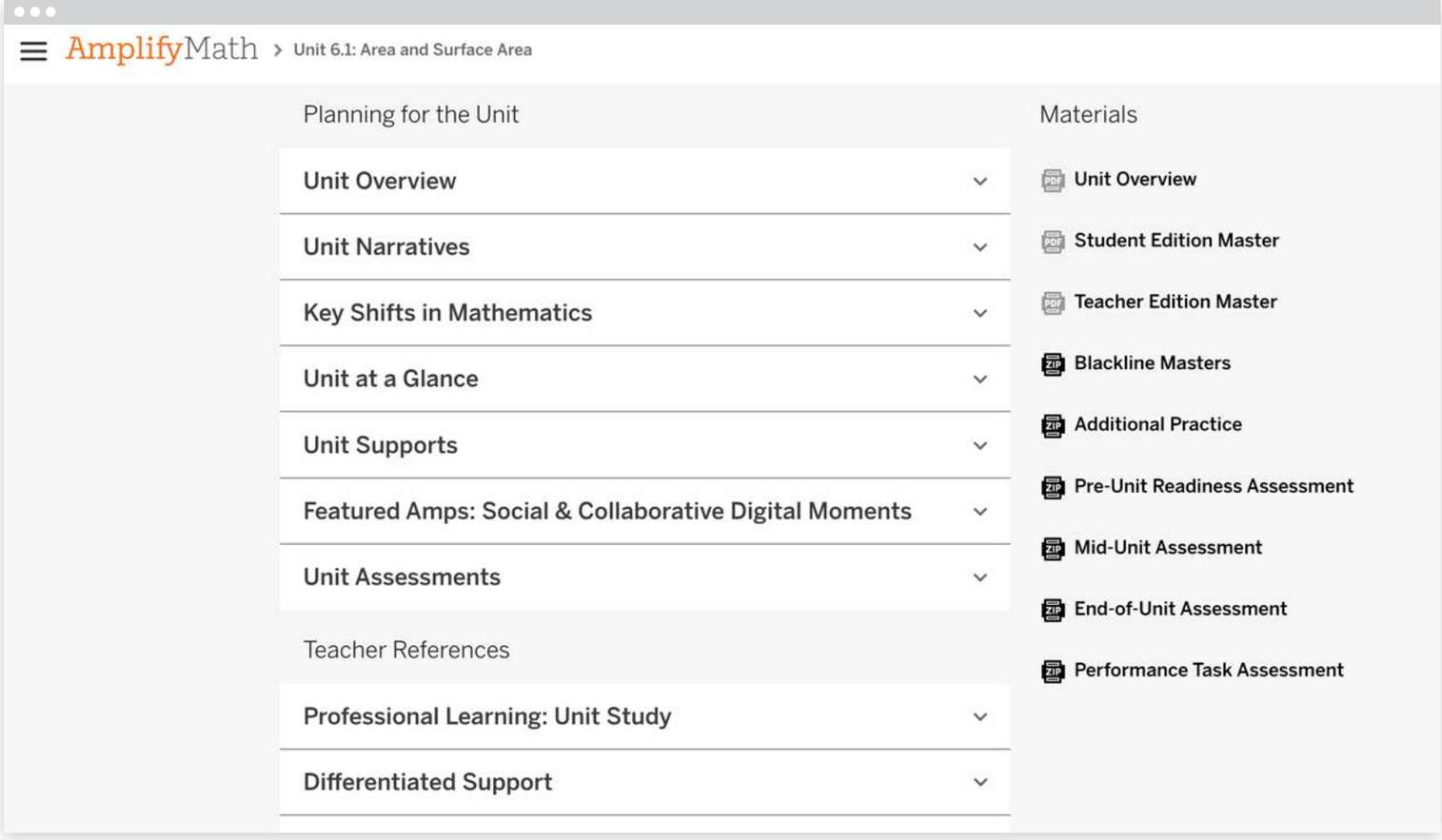
Unit organization

Amplify Math is organized by units. Grades 6–8 contain 8 units and Algebra 1 contains 6 units.



Navigating to and teaching a lesson

After selecting a unit, review the unit's planning resources. These resources include the Unit Overview, Unit Narratives, Professional Learning, Differentiated Support, and unit materials.



Navigating to the lesson content

Lessons are found in the Sub-Unit. Each lesson contains all the resources needed to plan and teach.

Sub-Unit 1: Area of Special Polygons

11 Lessons

Sub-Unit 1: Area of Special Polygons

JUMP DOWN TO SUB-UNIT OVERVIEW

Lesson 3:
Tiling the Plane

Lesson 4:
Composing and Rearranging to Determine Area

Lesson 5:
Reasoning to Determine Area

Lesson 6:
Parallelograms

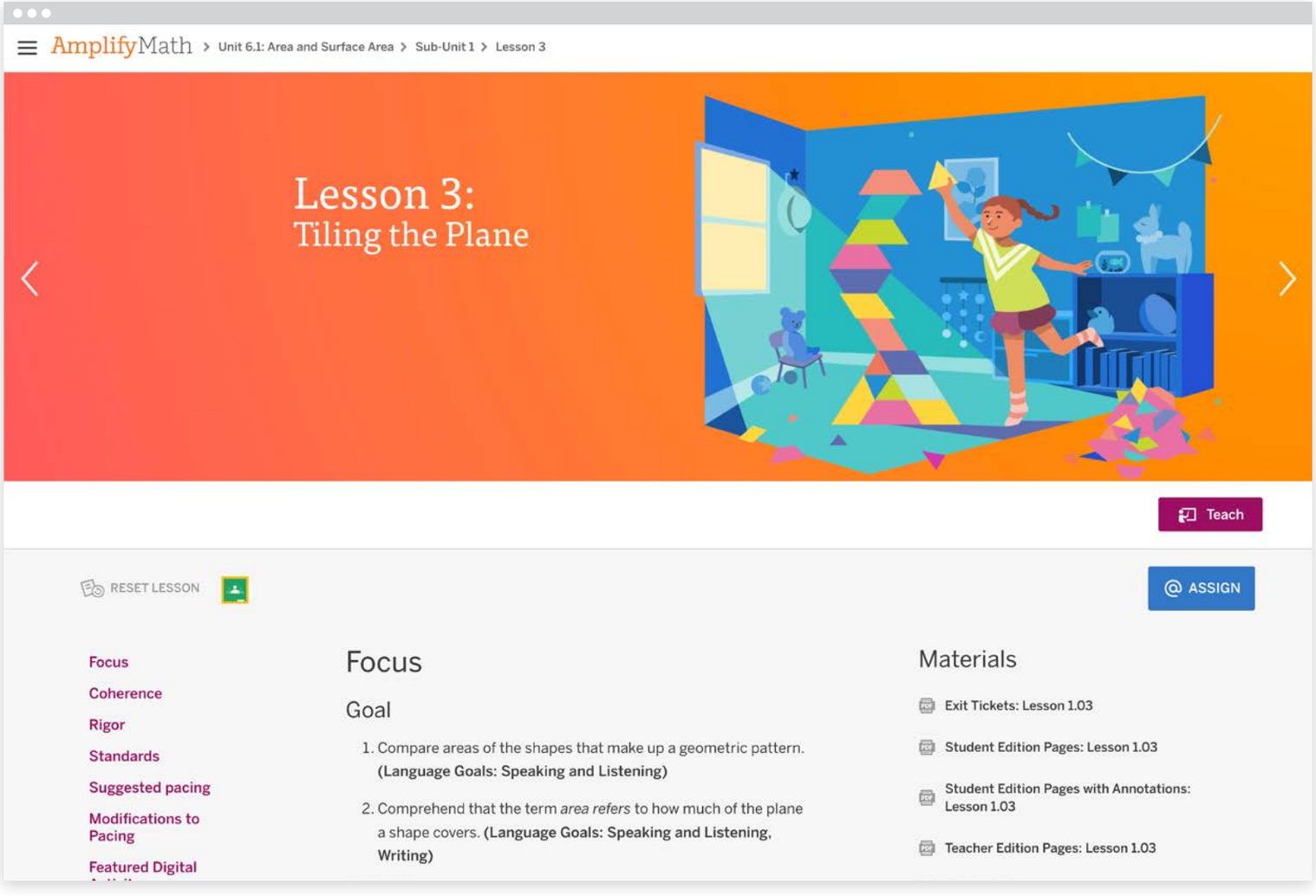
Lesson 7:
Bases and Heights of Parallelograms

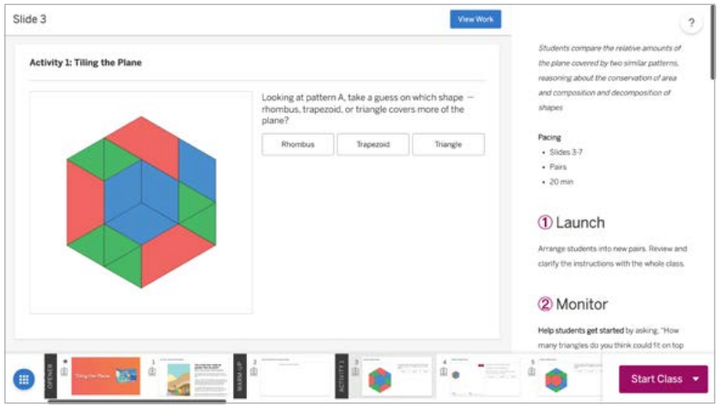
Lesson 8:
Area of Parallelograms

Teaching a lesson online

Similar to the unit level, here you can scroll down and learn more about the lesson. On the right side you'll find a list of downloadable resources.

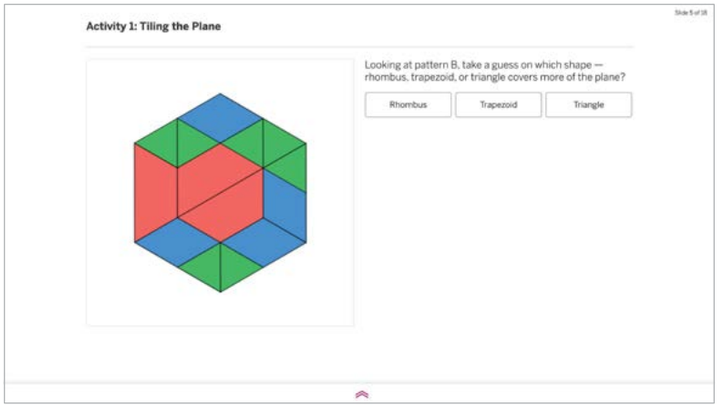
When you're ready, click the Teach button.



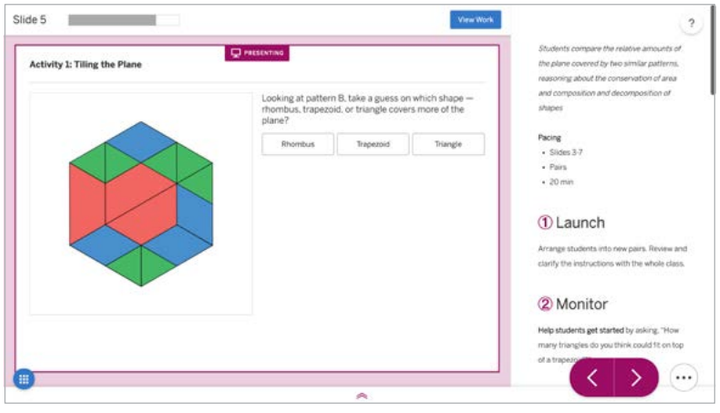


1 The tab that opens allows you to preview the lesson. You can look at any slide by scrolling the bottom carousel. Teacher notes are provided on the right. Your students will see anything in the large center portion of the screen.

Go ahead and click "**Start Class**" in the bottom right corner. You should see the class you already created.

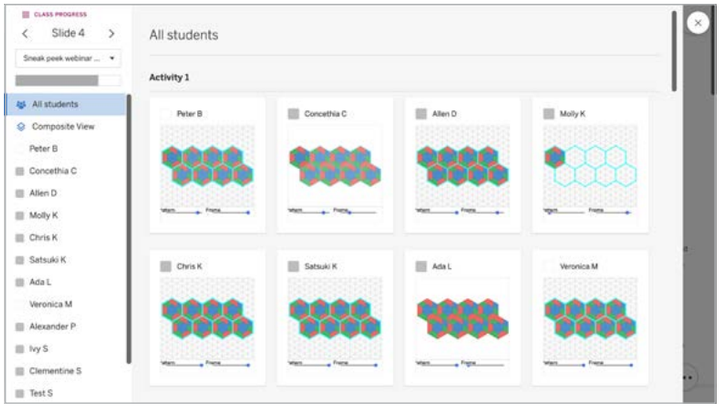


2 A new tab has opened. This is the tab you'd drag to the presenting screen if you were teaching. It will advance when you advance your Teacher Edition screen. For now, head back to the last tab.



3 You should notice that there's now a purple frame around the student-facing content. You're teaching! You can advance the lesson by clicking the arrows in the bottom right hand corner.

When you're ready, click "**View Work**" at the top.

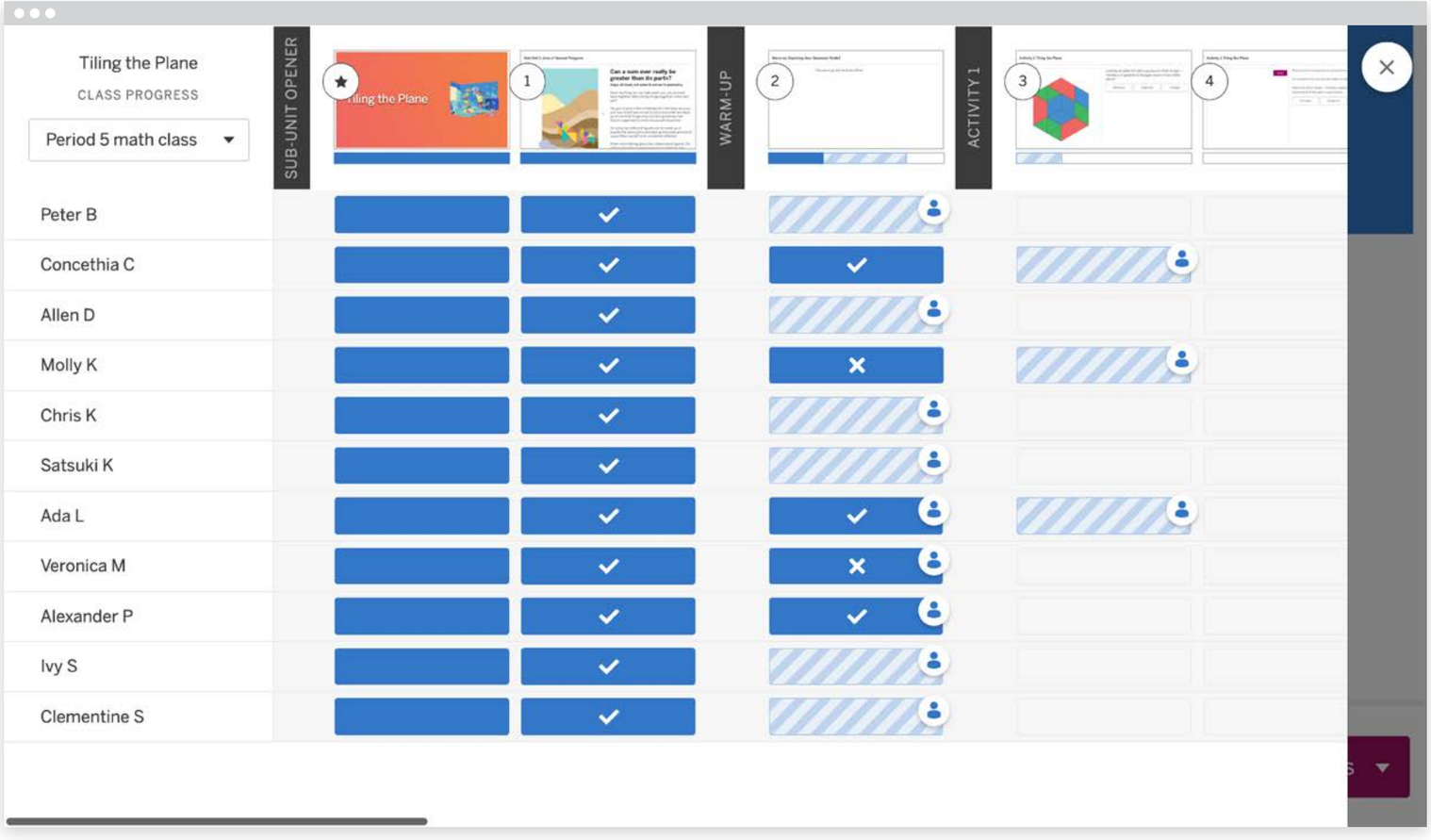


4 Here is where you'll be able to see your students' work in real time. There are two students in this class. Certain slides will let you see a composite view of student work. You can change slides by using the arrows in the upper left hand corner.

Select "**ALL SLIDES**" to view the **Class Progress View**.

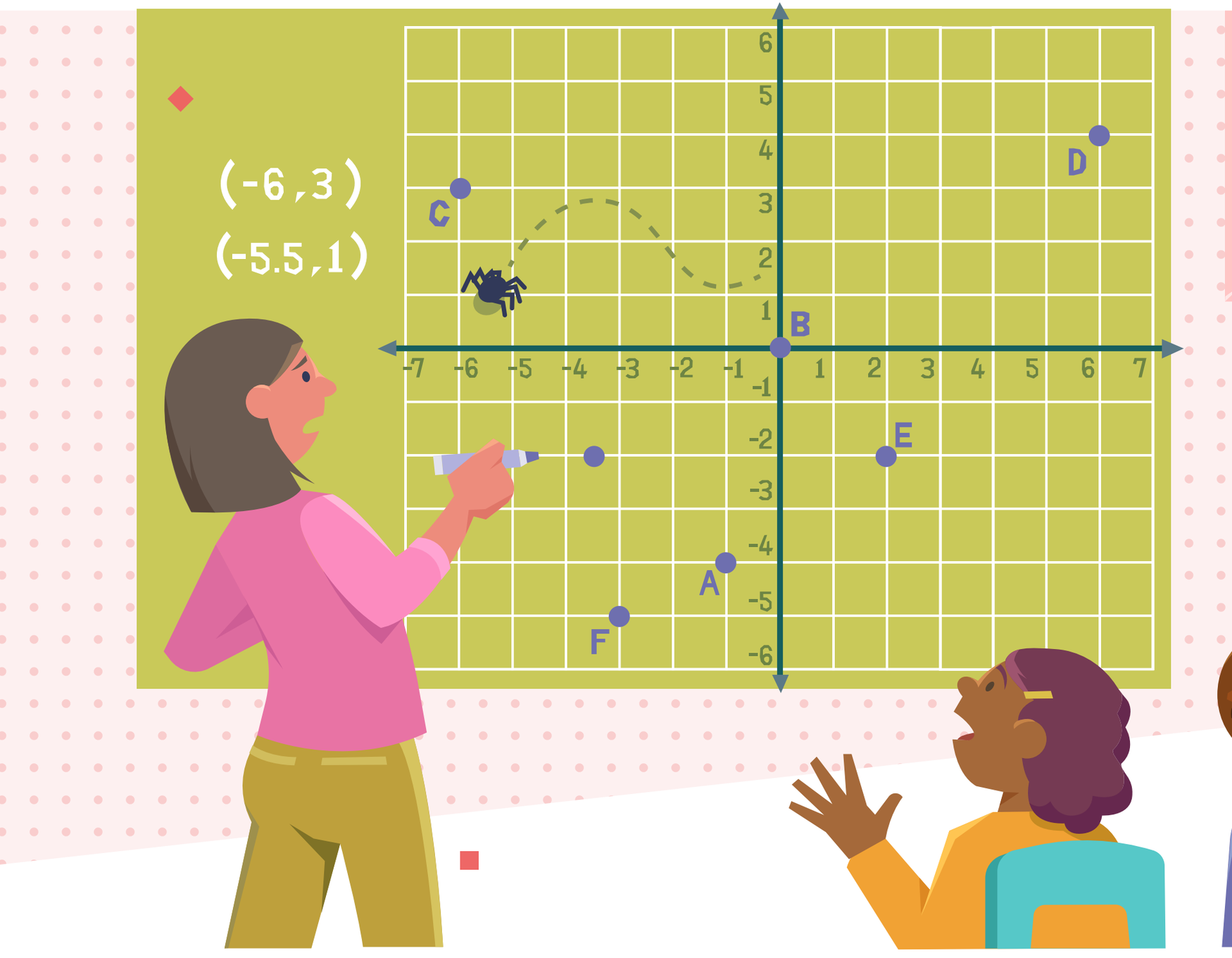
5 Here you will see all of your students and their work in the lesson. If the system can check for a right or wrong answer, you'll see an "X" or a check under that slide. Semi-shaded rectangles mean students have started work, but not finished or submitted anything.

If you're having students go into the lesson ahead of time and work, their progress will be saved and you can review it here. If you're teaching synchronously, work will populate here as it's done.



Amps
POWERED BY desmos

We've partnered with Desmos to create our complete library of Amps—social, collaborative digital lessons that recast technology from simply mirroring what can be done in a workbook to presenting captivating scenarios where students work together and see how their decisions change things in real time.


(-6,3)
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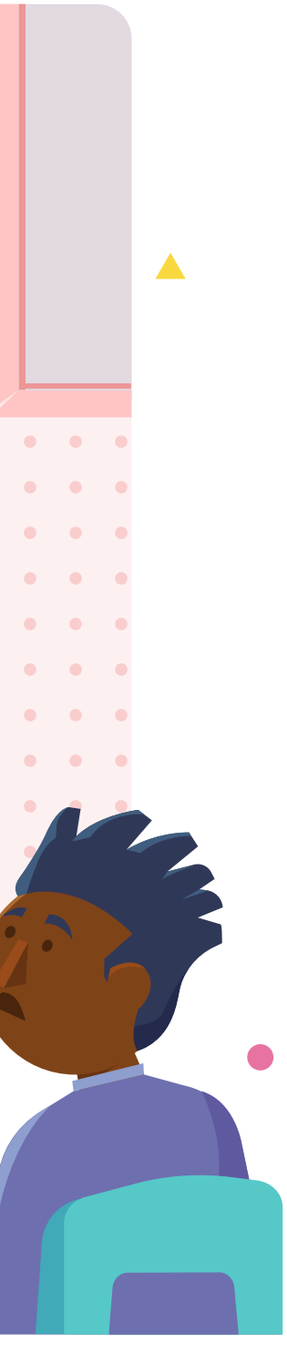
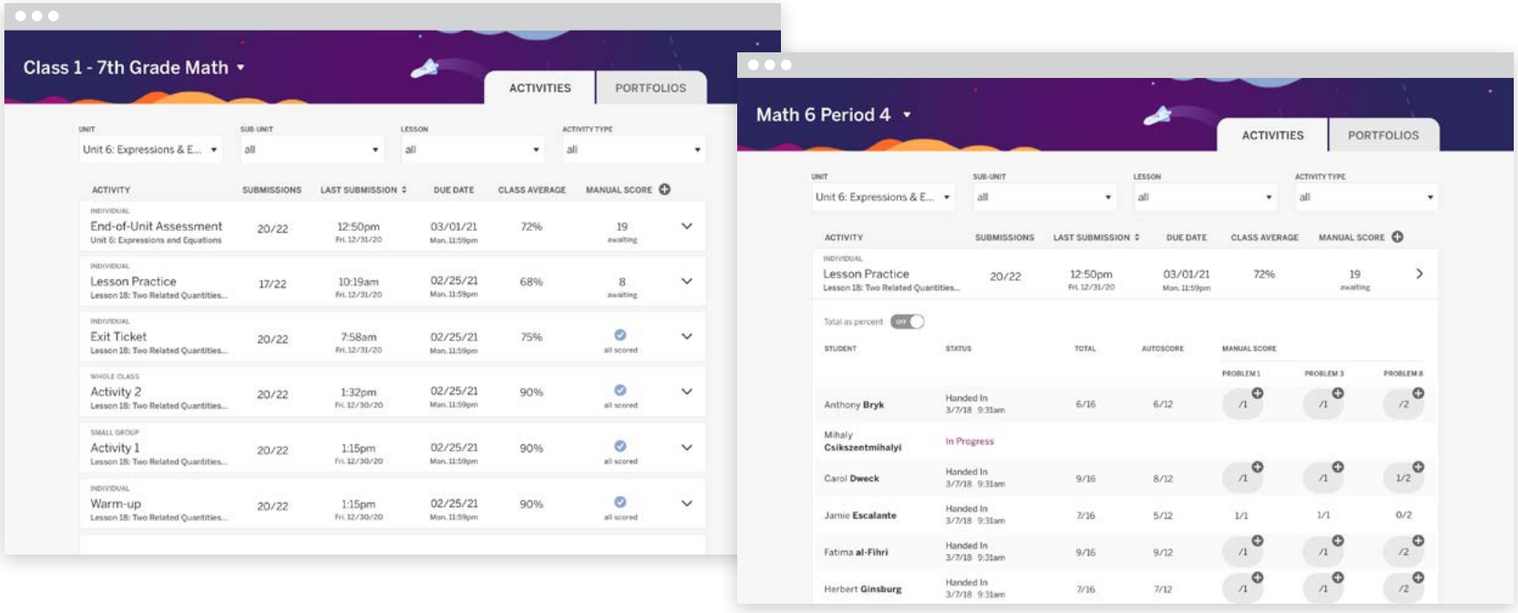


Data and reporting

Classwork

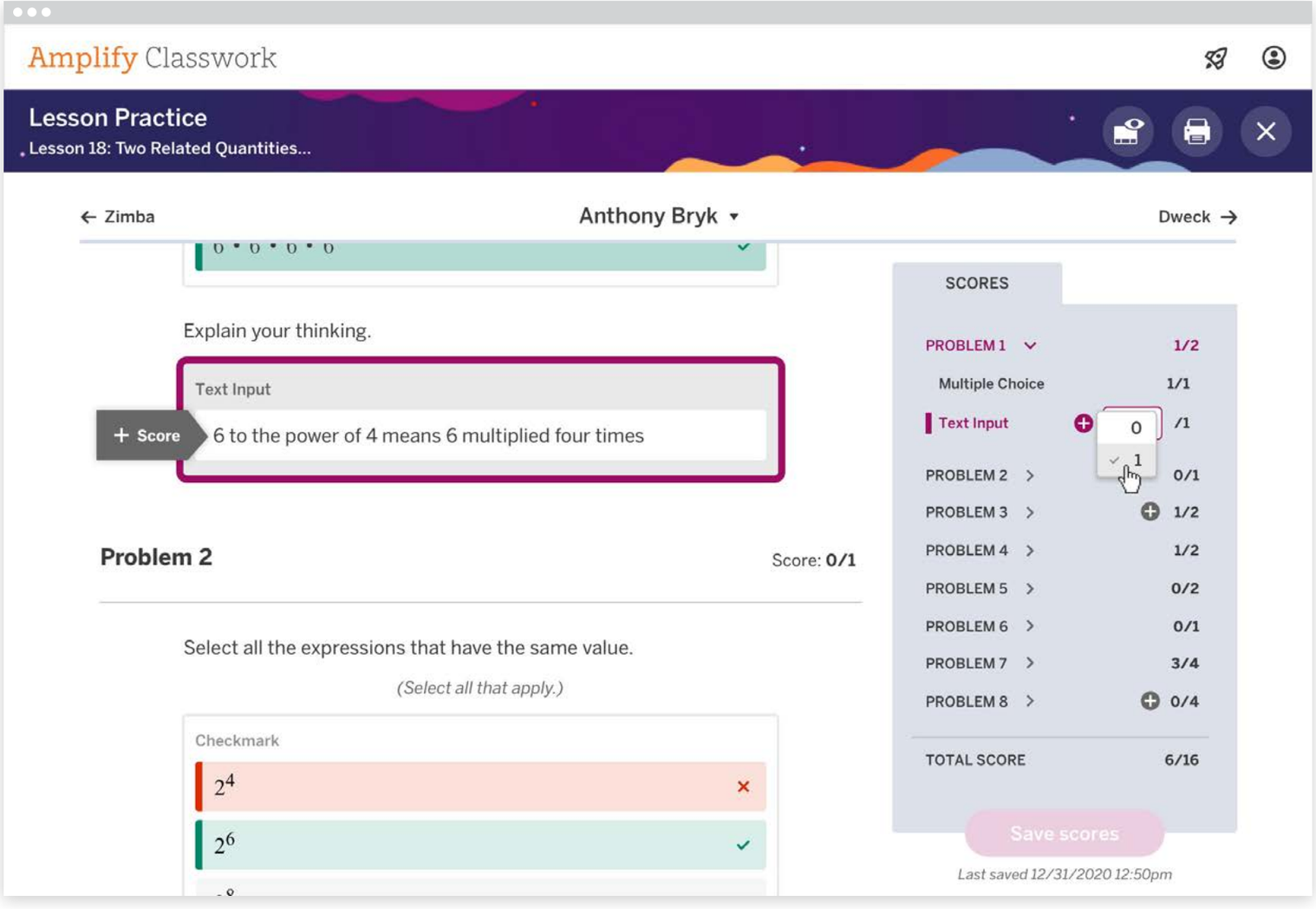
In addition to the full suite of assessments, Classwork is a space where teachers are able to view student work, review students' auto-scores for math problems, and give manual scores for any student open responses in the math curriculum.



Classwork allows teachers to:

- View and grade student work and access their students' work to better understand students progress as a class and individually.
  - Teachers can view direct student work.
  - Teachers can see overall scores for student work per class and per student.
  - Teachers can see auto-scoring and validations for various problem types per student.
  - Teachers can input manual scores for student work.
  - Teachers can print bulk or individual student work to track progress and talk about progress.
- Gain a comprehensive understanding of individual students' progress and work in order to better plan for each individual student's learning needs.

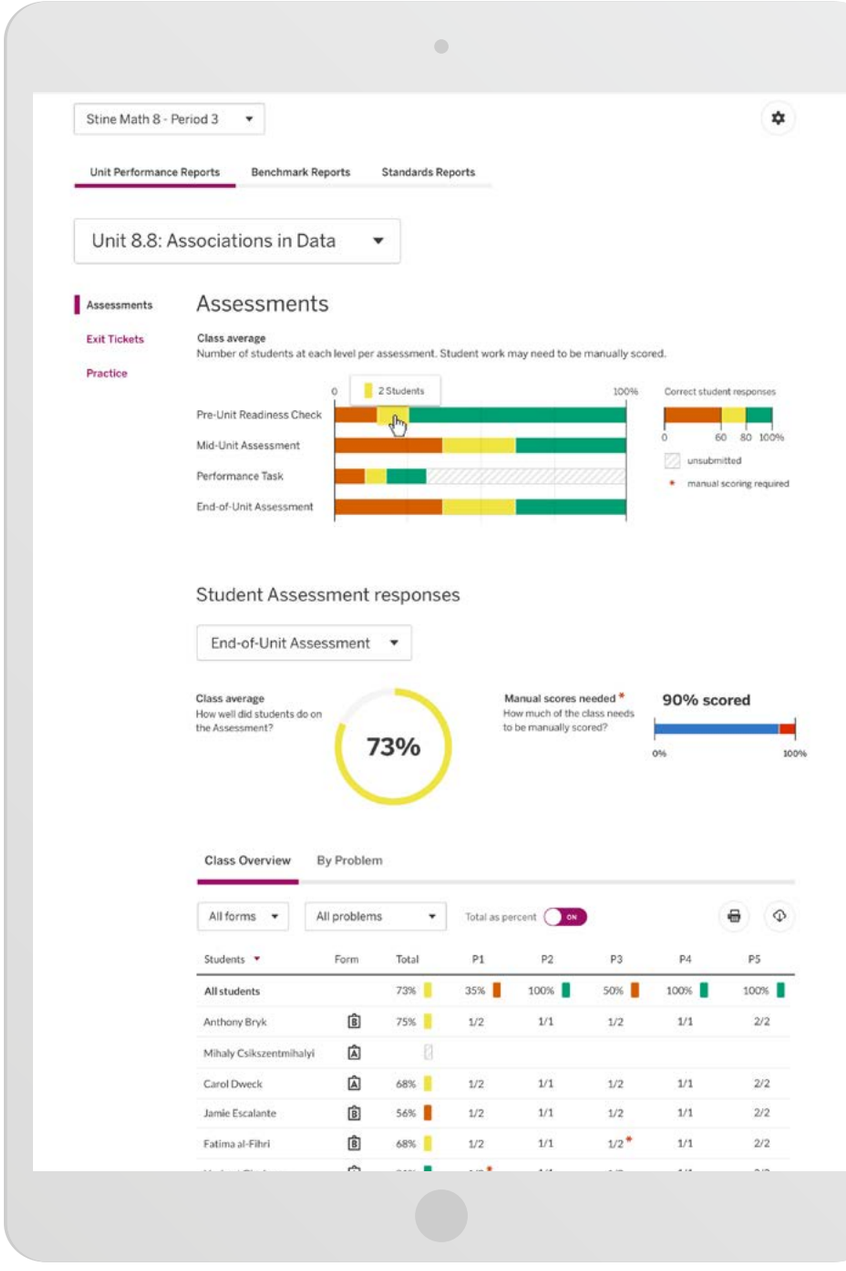
MyWork is a student version of Classwork where students can access the work they have completed, see work that has been assigned to them, and to go back and resubmit any work.



Assessments and reporting

Amplify Math offers a comprehensive suite of assessments, accessible in print and digital formats, for multiple opportunities to monitor and evaluate student learning and progress. If students take assessments in the Amplify platform, reports can be run at the student, standard, assignment, school, and district levels.

Course-level	Unit-level	Lesson-level
Diagnostic		
	Pre-Unit Readiness Assessment	
Formative		
Interim assessments		Exit Tickets Lesson practice Additional practice
Summative		
End-of-Course Cumulative	Mid-Unit and End-of-Unit Assessments Performance tasks	



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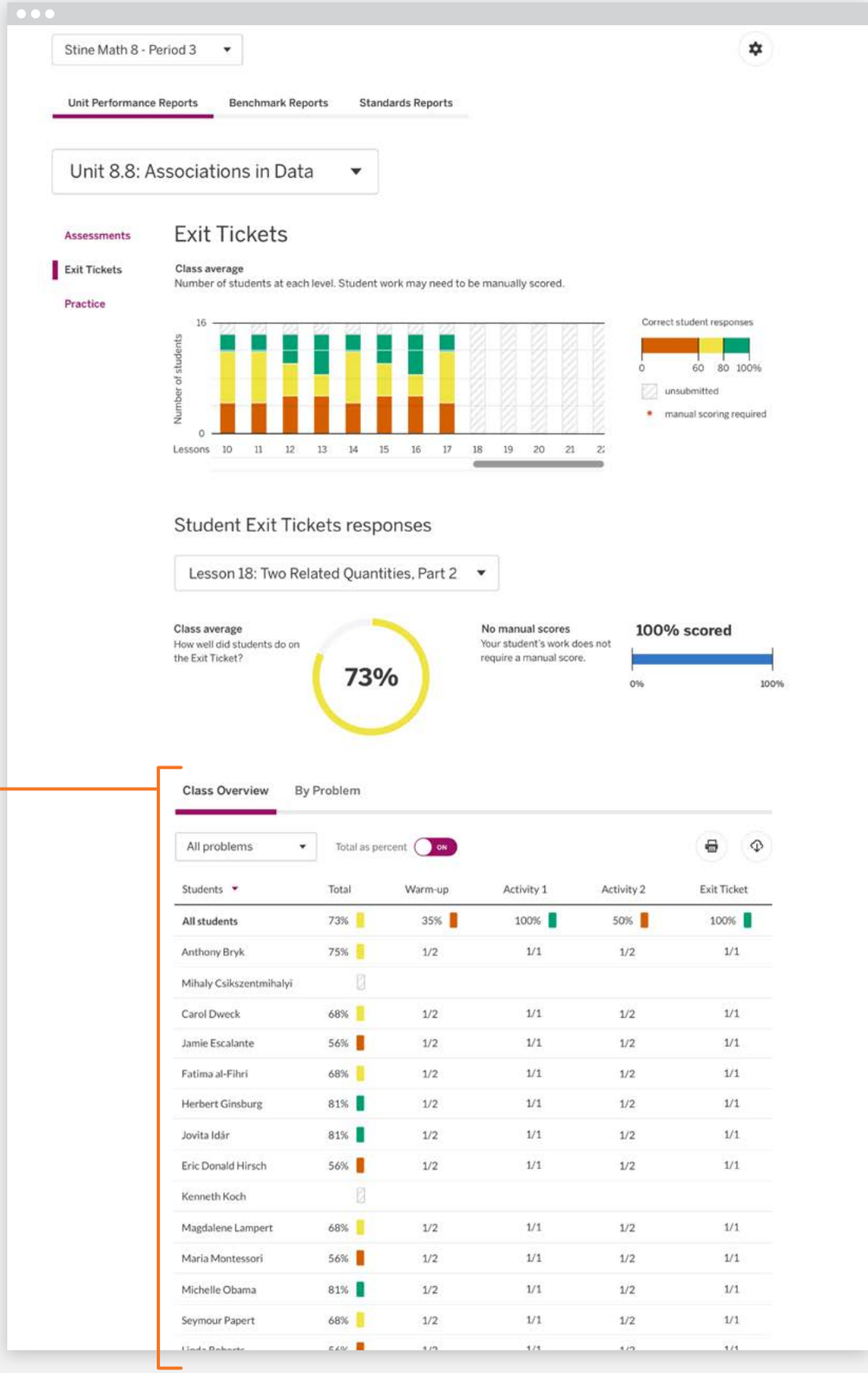
Performance reports include:

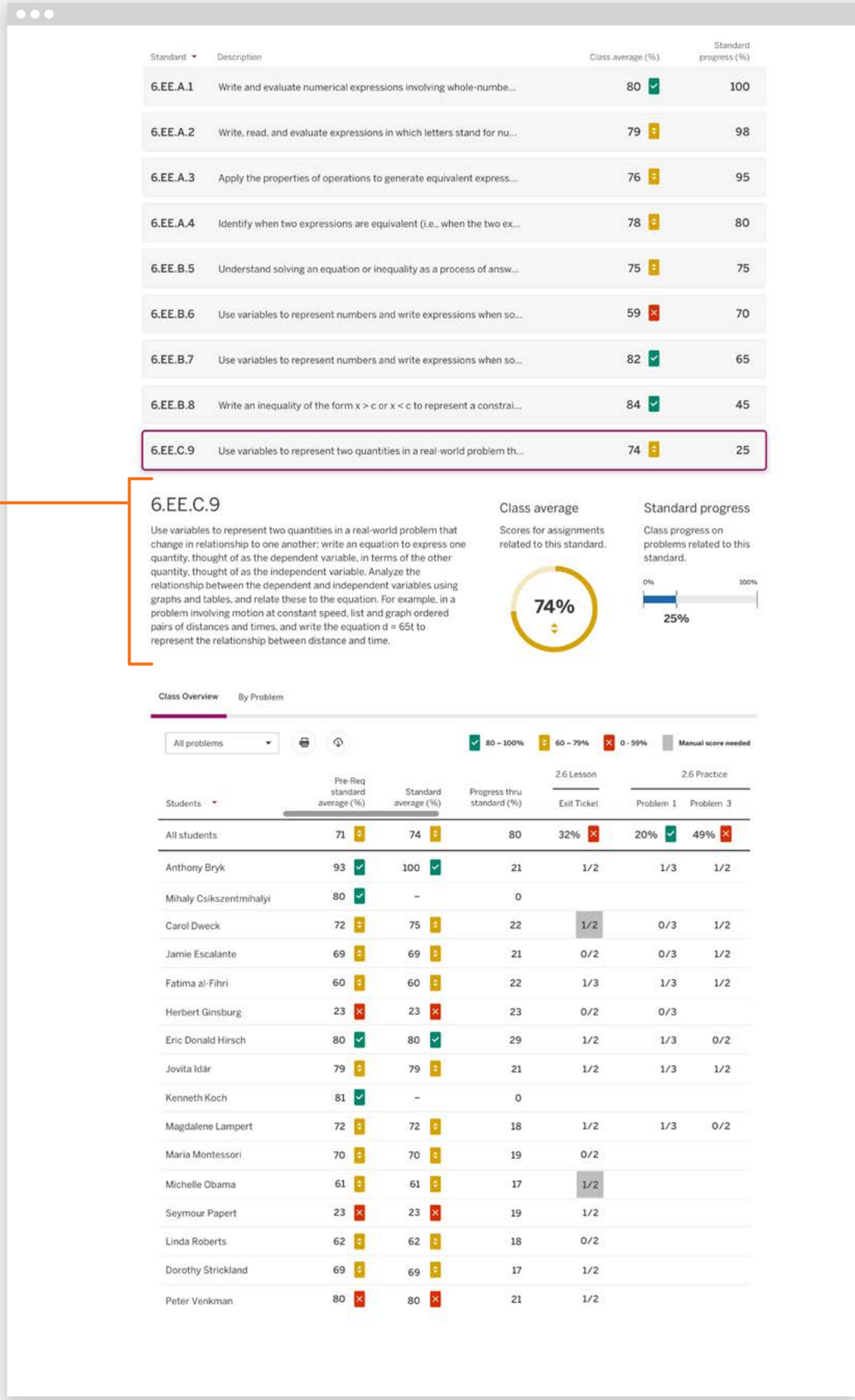
1. An overview of class performance on unit assessments, exit tickets, and practice sets.
2. Performance by class, student, and problem.
3. Item-level analysis to illuminate class-wide misconceptions and to see individual student work on every problem.



Standards mastery reports* include:

1. Student- and class-level performance at the standard, cluster, or domain level.
2. Student growth on individual standards, with data from specific activities and problems for each student, and the entire class.
3. Progress toward mastery with detail on how students performed against the standard in the past, and where they will encounter it in the future.

* CCSS standards shown. State-specific reporting will be available for non-CCSS states.



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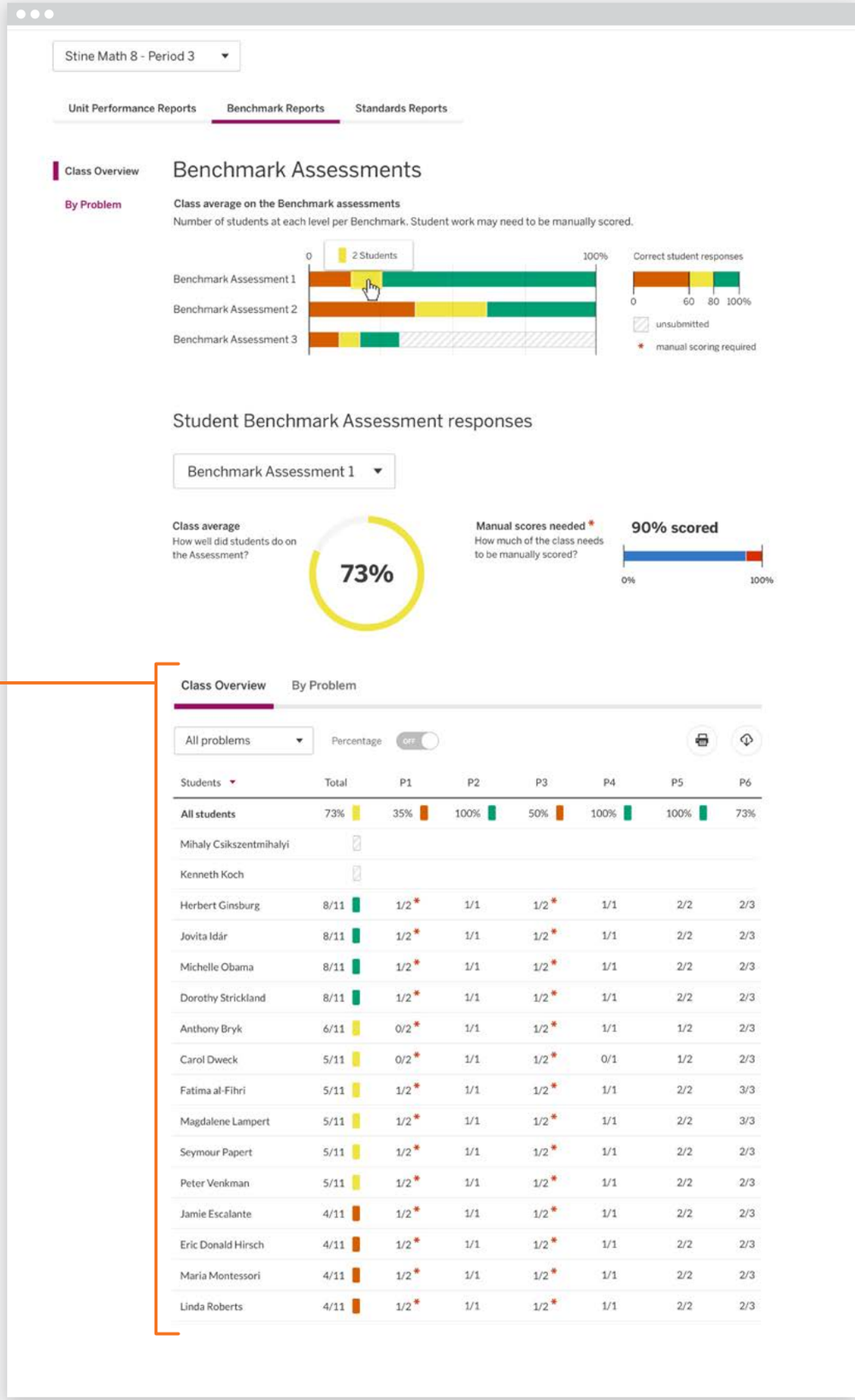
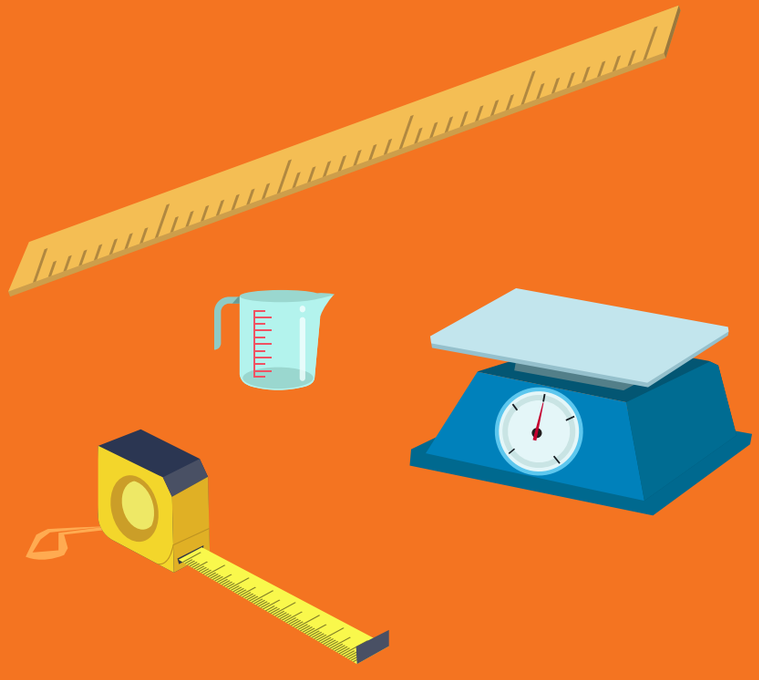
Interim assessment reports include:

1. Progress toward mastery and preparation for high-stakes assessments.

2. Student- and class-level performance data from interim assessments to help teachers diagnose student needs and administrators see school-wide trends.



For more information on Amplify Math, visit **amplify.com/math**.



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