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How to Use This Addendum

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Note how your lesson objective ties to your state **Standards**

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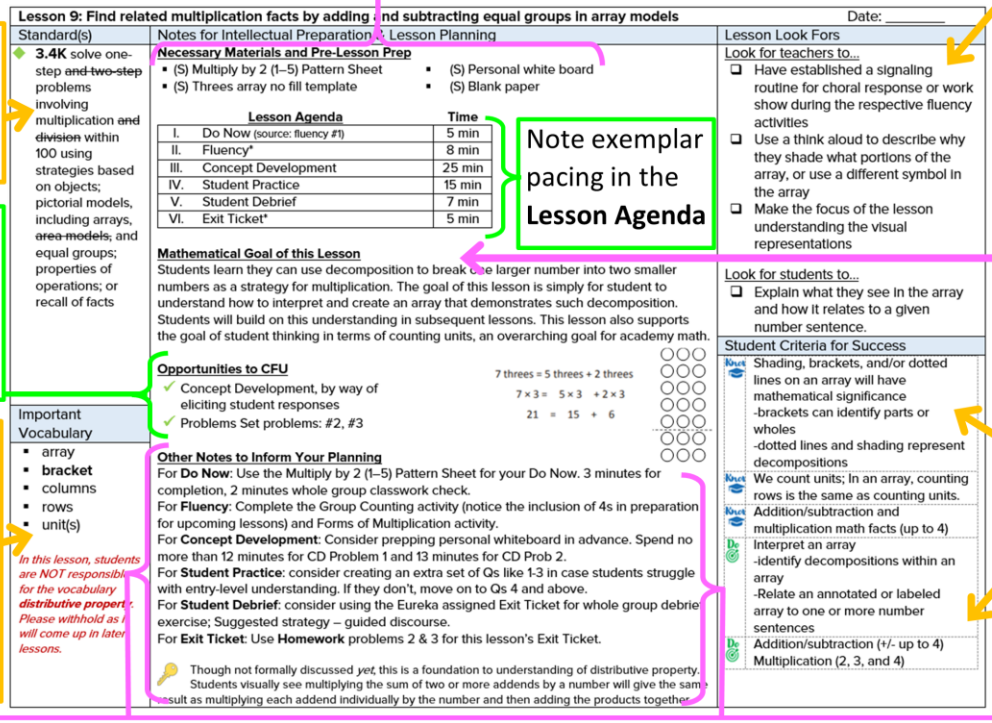
Plan purposeful questioning and responses using **Opportunities to CFU**

Plan to stress **Important Vocabulary** in the lesson. New vocab for the unit is indicated in bold

Plan instruction around what students need to Know & Do to be successful on the Exit Ticket using the identified **Student Criteria for Success**



Lesson 9: Find related multiplication facts by adding and subtracting equal groups in array models Date: _____

Standard(s)

3.4K solve one-step ~~and two-step~~ problems involving multiplication ~~and division~~ within 100 using strategies based on objects; pictorial models, including arrays, ~~area models~~, and equal groups; properties of operations; or recall of facts

Important Vocabulary

- array
- **bracket**
- columns
- rows
- unit(s)

*In this lesson, students are NOT responsible for the vocabulary **distributive property**. Please withhold as it will come up in later lessons.*

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- (S) Multiply by 2 (1–5) Pattern Sheet
- (S) Threes array no fill template
- (S) Personal white board
- (S) Blank paper

Lesson Agenda		Time
I.	Do Now (source: fluency #1)	5 min
II.	Fluency*	8 min
III.	Concept Development	25 min
IV.	Student Practice	15 min
V.	Student Debrief	7 min
VI.	Exit Ticket*	5 min

Mathematical Goal of this Lesson

Students learn they can use decomposition to break one larger number into two smaller numbers as a strategy for multiplication. The goal of this lesson is simply for student to understand how to interpret and create an array that demonstrates such decomposition. Students will build on this understanding in subsequent lessons. This lesson also supports the goal of student thinking in terms of counting units, an overarching goal for academy math.

Opportunities to CFU

- ✓ Concept Development, by way of eliciting student responses
- ✓ Problems Set problems: #2, #3

7 threes = 5 threes + 2 threes
7 × 3 = 5 × 3 + 2 × 3
21 = 15 + 6

Other Notes to Inform Your Planning

For **Do Now**: Use the Multiply by 2 (1–5) Pattern Sheet for your Do Now. 3 minutes for completion, 2 minutes whole group classwork check.
For **Fluency**: Complete the Group Counting activity (notice the inclusion of 4s in preparation for upcoming lessons) and Forms of Multiplication activity.
For **Concept Development**: Consider prepping personal whiteboard in advance. Spend no more than 12 minutes for CD Problem 1 and 13 minutes for CD Prob 2.
For **Student Practice**: consider creating an extra set of Qs like 1-3 in case students struggle with entry-level understanding. If they don't, move on to Qs 4 and above.
For **Student Debrief**: consider using the Eureka assigned Exit Ticket for whole group debrief exercise; Suggested strategy – guided discourse.
For **Exit Ticket**: Use **Homework** problems 2 & 3 for this lesson's Exit Ticket.

Though not formally discussed *yet*, this is a foundation to understanding of distributive property. Students visually see multiplying the sum of two or more addends by a number will give the same result as multiplying each addend individually by the number and then adding the products together.

Lesson Look Fors

Look for teachers to...

- ❑ Have established a signaling routine for choral response or work show during the respective fluency activities
- ❑ Use a think aloud to describe why they shade what portions of the array, or use a different symbol in the array
- ❑ Make the focus of the lesson understanding the visual representations

Look for students to...

- ❑ Explain what they see in the array and how it relates to a given number sentence.

Student Criteria for Success

Know: Shading, brackets, and/or dotted lines on an array will have mathematical significance
-brackets can identify parts or wholes
-dotted lines and shading represent decompositions

Know: We count units; In an array, counting rows is the same as counting units.

Know: Addition/subtraction and multiplication math facts (up to 4)

Do: Interpret an array
-identify decompositions within an array
-Relate an annotated or labeled array to one or more number sentences

Do: Addition/subtraction (+/- up to 4)
Multiplication (2, 3, and 4)

Find recommended lesson modifications, content knowledge boosters, and/or high-leverage instructional moves that may not be in your Teacher Edition located in **Other Notes to Inform Your Planning**

UNIT SYNOPSIS

This unit introduces students to building blocks of geometry: points, lines, line segments, and angles.

In elementary, students learned how to plot points on a number line, identify geometric terms (points, lines, line segments, rays, angles), measure angles, and draw angles to specified measures. In 6th and 7th grade, students classified angles and triangles and learned how to find the distance between positive and negative points on a number line. In Algebra 1, students learned how to graph lines and determine if lines were parallel, perpendicular, or neither.

This unit eases students into high school Geometry by building on their prior math experiences. By the end of this unit, students will be able to identify, sketch, and name points, lines, planes, line segments, rays, and angles. Additionally, they'll be able to use angle relationships to find missing values, find the midpoint of a line segment, and graph or write equations for parallel and perpendicular lines. Students will apply these foundational skills and concepts throughout the rest of this course.

CONTENT STANDARDS

Below are the standards addressed in this unit.

Readiness Standards	Supporting Standards
G.2(B) derive and use the distance, slope, and midpoint formulas to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines; **G.2(C)** determine an equation of a line parallel or perpendicular to a given line that passes through a given point **G.6(A)** verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems **G.5(A)** investigate patterns to make conjectures about geometric relationships, including angles formed by parallel lines cut by a transversal, criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles choosing from a variety of tools	**G.4(A)** distinguish between undefined terms, definitions, postulates, conjectures, and theorems

Focus on Disciplinary Literacy 	Mathematical Process Standard (F) – analyze mathematical relationships to connect and communicate mathematical ideas
	Mathematical Process Standard (G) – display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication

LEARNING SUPPORTS BY LESSON

There is a checkmark for the math support if the lesson	Lessons → Math Supports	L1	L2	L3	L4	L5	L6	L7	L8
makes a connection to prior content or from a previous unit or academic year	Access Prior Knowledge	✓		✓	✓		✓	✓	✓
uses familiar contexts or experiences to make the learning relevant to students	Real-World Connections		✓	✓		✓			
makes use of graphic organizers	Graphic Organizers							✓	
includes tools like rulers, protractors, patty paper, algebra tiles, etc.	Tools or Manipulatives	✓		✓	✓	✓			
incorporates tables, reference charts, displays, pictures, models, or color-coding	Visual Aids	✓	✓	✓	✓	✓			
includes definitions, examples vs. nonexamples, cognates, etc.	Vocabulary Supports	✓	✓	✓	✓	✓			
includes strategies that support language development	Language Supports	✓	✓	✓	✓	✓	✓		
asks students to discuss with their partner to prepare for whole class discussion	- Turn and Talk	✓	✓	✓	✓	✓	✓		
teacher facilitates a whole class discussion to debrief key learnings	- Guided Discussion	✓	✓	✓	✓	✓	✓		
asks students to think independently, test their idea with a partner, and share whole group	- Think, Pair, Share						✓		
includes sentence stems to support students with explanations	- Sentence Stems								
provides opportunities for students to work with a partner or a group	Peer Collaboration	✓	✓	✓	✓	✓	✓	✓	✓
uses mnemonics such as SohCahToa	Mnemonics								
includes websites or equipment that enhances the lesson	Technological Support								
content can be presented in different forms	Different Modalities								
uses hands-on tools or manipulatives to represent the math	- Concrete								
uses drawings to represent the math	- Pictorial	✓	✓	✓	✓	✓	✓	✓	✓
uses numbers and number sentences to represent the math	- Abstract	✓	✓	✓	✓	✓	✓	✓	✓

The EFFL Model

Experience First, Formalize Later (EFFL) Model

Opening

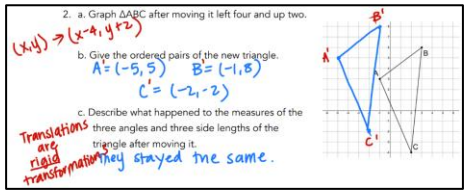
For every new lesson, the teacher begins by making the goals of the lesson crystal clear. The teacher does more than simply read the objective to the class. They make connections to previous learning, share how this learning fits into a bigger picture, or explain why this learning is important for future learning.

Activity / Interaction With New Material (INM)

For this part of the lesson, students work in pairs or groups of four to experience new content through an activity. Students might be discussing a proposed scenario, working with other groups, or doing a simulation. The student activity is designed for students to be able to do without the help of the teacher. Of course, the teacher is watching and listening in to conversations in order to formatively assess student understanding. The teacher provides questions, cues, and prompts (not answers!) to help push groups forward when they are stuck or have made a mistake. As students begin to finish the activity, the teacher identifies students to write their work on the board. Most often, the teacher selects student work that will easily allow them to connect the experience to formal learning. Students write their work on the whiteboard in a single-color marker.

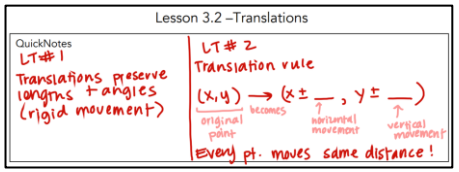
Debrief Activity

Once students have recorded their responses in their workbook (see blue writing to the right), the teacher calls the whole group back together for a debrief. It is in this discussion that the teacher will help students formalize the learning. The teacher connects the student activity experience to new vocabulary, definitions, formulas, and algorithms. The formal learning is attached specifically to the experiences of the activity so that students can enhance their constructed understanding of the new content. The teacher writes all of the formal learning in a different color in the margins of the activity **(see red writing to the right).** The students add these ideas in the margins on their activity page and often think of this as the formal "notes" of the lesson. In all of the answer keys we provide on Math Medic, the teacher formal learning points are provided in the margins in a **different color.**



QuickNotes

In this part of the lesson, the teacher uses the whole experience of the activity and the formalization in the debrief to summarize the learning from the lesson. Notice that we use the box to constrain the amount of formal "notes" that the teacher can provide.



Student Practice

Now that students have arrived at some new learning, they need to be able to apply it in new contexts. Most often we have students complete these questions in pairs and occasionally we select one question to use as an exit ticket. If we have time, we have students write solutions on the whiteboard.

Extra Practice

We typically give students around 3-5 "Extra Practice" problems for each lesson. We choose problems that are closely aligned with the Learning Objectives of the lesson. It is our belief that "less is more" here. We would rather students spend their Extra Practice time thinking deeply about just a few problems, rather than surface level thinking on many problems. When possible, we provide the answers at the bottom of the page, so they can immediately assess their understanding.

Slightly modified version of: https://www.calc-medic.com/post/experience-first-formalize-later#:~:text=%E2%80%9CExperience%20First%2C%20Formalize%20Later%E2%80%9D,at%20formal%20definitions%20and%20formulas.

Before You EFFL!

Here are helpful resources that you guide you in the right direction before your first EFFL lesson!

Why Should We EFFL?

The article advocates for the Experience First, Formalize Later (EFFL) teaching model, emphasizing its effectiveness in fostering deep understanding and flexible thinking in students. The author compares traditional teaching to a game of "Simon Says," where students merely mimic instructions without grasping underlying concepts. In contrast, EFFL encourages students to engage actively with problems, enhancing their ability to understand and apply calculus concepts creatively.

Tips for Lesson Planning

The article offers practical advice for effective lesson planning beyond the exhaustive and overly detailed approaches often emphasized during teacher training. It underscores the importance of thoughtful preparation but rejects the notion that teachers need to script every minute or detail of a class session.

Making the Most of Your EFFL Lesson Debrief

The article discusses the significance of the debriefing phase in the Experience First, Formalize Later (EFFL) lesson model, emphasizing its role in reinforcing learning and highlighting student contributions. The debrief session is seen as crucial for integrating academic vocabulary, emphasizing key lesson understandings, and valuing students' mathematical insights.

While You EFFL!

While each lesson may be unique in context and skills, all lessons benefit from the following practices:

Teacher Look Fors:

- ❑ Utilizing the Do Now to spark students' interest in the Activity.
- ❑ Use questioning to promote small group discussion and exploration, guided by monitoring questions.
- ❑ Connects Experience First to formal concepts using a colored pencil/pen to take notes along the margin during the Debrief.
- ❑ Facilitates whole-class discussions for students to reflect, share insights, and provides feedback that reinforces key concepts.
- ❑ Tracks time to adapt lesson pacing and support based on student response and engagement.

Students Look Fors:

- ❑ In the Activity, students engage in group work and discourse.
- ❑ Exploring the activity, testing hypotheses and approaches (trial & error).
- ❑ Take notes on key ideas and concepts using different colored pencil/pen to take notes along the margin.
- ❑ Share thoughts and ideas that demonstrate their approach to their work.

Other considerations

- During the **Experience First** phase, if most of your students seem stuck or disengaged, take a moment to pause, reset, and provide clear instructions. Some problems of the Activity are more suitable to do a whole-class discussion as a means to save some instructional time for Student Practice or the Exit Ticket. You are encouraged to adapt the EFFL (Experience First, Formalize Later) process to meet your students' needs while maintaining a focus on student-centered instruction.

ROADMAP

AT A GLANCE: Unit 2 – Building Blocks of Geometry			
Day	Date	Lesson	Lesson Title
There are 3 flexible Success Days that you can use anywhere in the unit. • Consider using 1 day between Lessons 4 and 5 to give optional Topic Quiz 2. • Consider using 1 day to review before the Unit 2 Exam. • If you don't need to use all 3 success days, you can/should save them for later.			
1		1	Points, Lines, Segments, and Rays
2		2	Coordinate Connection: Midpoint
3		3	Naming and Classifying Angles
4		4	Vertical Angles and Linear Pairs
5			Success Day (Ideal time to administer **optional** Unit 2 Topic Quiz)
6		5	Angles on Parallel Lines
7		6	Coordinate Connection: Parallel vs. Perpendicular (Day 1)
8		7	Coordinate Connection: Parallel vs. Perpendicular (Day 2)
9		CR	Cumulative Review | Success Day
10			Unit 2 Exam
11			Success Day

Lesson 1: Points, Lines, Segments, and Rays Date: _____

Standard(s)

- **G.4(C)** distinguish between undefined terms, definitions, ~~postulates, conjectures, and theorems~~

Important Vocabulary

- **bisect**
- **congruent**
- **line**
- **parallel**
- **perpendicular**
- **point**
- **ray**
- **segment**

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- pre-cut sets of Matching Cards (1 per pair of students)
- Class set of red pens

Lesson Structure:

- Do Now (15 min)
- INM (10 min)
- Debrief (7 min)
- Student Practice (13 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to use precise terminology and notation to refer to points, segments, lines, and rays. They should be able to use this notation to draw geometric figures. Further, they should be able to define congruent segments and solve for missing segment lengths. They will continue to use this vocabulary and notation throughout the unit and the rest of this course.

Opportunities to CFU

✓ INM: 2, 3

✓ Student Practice: 1, 2, 3

Other Notes to Inform Your Planning

For **Do Now:** This is a special Do Now! You'll need to give clear directions before releasing students to complete it. It will also take longer than a usual Do Now. Once you have released students to work, you can do what you'd normally do during a silent 5 minute Do Now and use the rest of the time to circulate and monitor. (Note: Consider having student volunteers pre-cut class sets Matching Cards and put each set in its own envelope or sandwich bag for use throughout the day.)

Focus on Disciplinary Literacy

Debrief

Lesson Look Fors

Look for teachers to…

- ❑ Set clear expectations and give clear directions for the Match Mine Activity (Do Now)
- ❑ stamp the difference between lines, line segments, and rays (their notation as well as what they represent)

Look for students to…

- ❑ engage in the Match Mine activity, meeting the expectations set by their teacher.
- ❑ use their prior knowledge and their experience playing "Match Mine" to figure out what ⊥, ∥ and ≅ means and how to interpret line, line segment, point, and ray notation.

Student Know/Do Chart

Do: Students can identify and use correct notation for a line segment, ray, and line.

Do: Students can identify two intersecting objects.

Know: A line is an infinitely long collection of points that extends in both directions, named by any two points on the line like so: $\overleftrightarrow{AB}$.

Know: A line segment is a portion of a line with two endpoints, named by its two endpoints under an overbar, like so: $\overline{CD}$.

Know: A ray is a portion of a line with one endpoint that extends infinitely in one direction, named by the endpoint and another point on the ray, like so: $\overrightarrow{EF}$.

Know: To intersect is to cross.

Lesson 2: Coordinate Connection: Midpoint | Date: _____

Standard(s)

- **G.2(B)** derive and use the ~~distance, slope, and~~ midpoint formulas to verify geometric relationships, including congruence of segments ~~and parallelism or perpendicularity of pairs of lines.~~

Important Vocabulary

- **endpoint**
- **equidistant**
- **midpoint**

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- Class set of red pens

Lesson Structure:

- Do Now (7 min)
- INM (20 min)
- Debrief (8 min)
- Student Practice (10 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to find the coordinates of a midpoint given two endpoints, or find an endpoint given a midpoint and the other endpoint. The goal of this lesson is NOT to memorize a formula, but to understand that a midpoint divides a segment into two congruent parts.

Opportunities to CFU

- ✓ INM: 2, 3, 4
- ✓ Student Practice: 1, 2, 3

Other Notes to Inform Your Planning

In General: Although this lesson discusses the "formula" for finding the midpoint by looking for patterns in the coordinates of the endpoints and midpoint, we tend to avoid using it with students. We find that students find it much more intuitive to think about finding a distance (by subtracting two coordinates) and then halving it, rather than adding two coordinates and dividing by 2, even if they are told this represents the average. When students have a strong conceptual grasp of what a midpoint is, they are unlikely to use the halved distance as the actual coordinates of the midpoint and forget to add this distance from the endpoint (usually a common error among Geometry students). (Source: MathMedic)

Focus on Disciplinary Literacy

Debrief

Lesson Look Fors

Look for teachers to…

- ❑ alternate between releasing students to work with their partners and bringing them back to discuss their findings. This should happen for Q2, Q3, and Qs 4-5, for a total of 3 "cycles."
- ❑ avoid forcing students to use a formula or giving them a formula to use at the beginning of the lesson – this can prevent students from developing an understanding of what a midpoint really is.

Look for students to…

- ❑ use the coordinate plane to justify their thinking, especially during INM #s 2 and 3.

Student Know/Do Chart

Do	Students can plot two points and connect them to form a line segment.
Do	Identify the midpoint of a line segment.
Know	A midpoint is a point that is exactly halfway between two endpoints.
Know	You can find the midpoint of a line segment by considering how far away the two points are from each other horizontally AND vertically.

Lesson 3: Naming and Classifying Angles Date: _____

Standard(s)

- **G.6(A)** verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, ~~and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector~~ and apply these relationships to solve problems;

Important Vocabulary

- **acute**
- **adjacent angles**
- **angle bisector**
- **obtuse**
- **right**
- **straight**

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- Patty paper (at least 1 per student)
- random number generator queued up on your laptop
- Class set of red pens
- Class set of straightedges and protractors
- Intro activity slide deck
- Small prizes for winners

Lesson Structure:

- Do Now (7 min)
- INM (20 min)
- Debrief (5 min)
- Student Practice (13 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to define, name, and measure angles. They should also be able to determine angle measurements without a protractor (i.e. by interpreting congruence markings and or using angle addition or angle bisectors).

Opportunities to CFU

✓ INM: 2, 4

✓ Student Practice: 1, 2, 3

Other Notes to Inform Your Planning

For **INM:** This INM has two parts – the opening activity, and a patty paper "competition." There is nothing for students to write down for the first part – carefully read TE p25 for details and a vignette. For the Angle Competition activity, ensure you set very clear expectations for the whole thing, but ESPECIALLY for #4, which is when students will be walking around looking for a partner to form adjacent angles with to try to win the competition.

Focus on Disciplinary Literacy

Debrief

Lesson Look Fors

Look for teachers to…

- ❑ anticipate "groans" - and be silly about it! - when later student volunteers get to use the 2nd image of the intro activity slide deck (because the early volunteers only got to use the 1st image)
- ❑ be energetic and bring the hype for the angle competition (see TE p26 for vignette)

Look for students to…

- ❑ try their very best during the intro activity, even if it's frustrating.
- ❑ meet teachers' expectations during the patty paper activity, especially during INM #4 when they walk around the room searching for a partner.

Student Know/Do Chart

Do	Students can sketch a bisected right angle.
Do	Students can find the angle measure of one of a pair of angles created by an angle bisector.
Know	Right angles measure exactly 90°.
Know	To bisect is to cut in half. When an angle is bisected, the two newly created angles are congruent.

Lesson 4: Vertical Angles and Linear Pairs Date: _____

Standard(s)

- **G.6(A)** verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, ~~and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector~~ and apply these relationships to solve problems;

Important Vocabulary

- **linear pair**
- **supplementary**
- **vertical angles**

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- 1 poster-sized paper per class
- Class set of red pens
- Class set of rulers and protractors

Lesson Structure:

- Do Now (7 min)
- INM (18 min)
- Debrief (5 min)
- Student Practice (15 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to discover vertical angle and linear pair relationships and apply these relationships to solve problems.

Opportunities to CFU

- ✓ INM: 6, 8
- ✓ Student Practice: 1, 2, 3

Other Notes to Inform Your Planning

Before class: Today's activity has students use inductive reasoning to explore relationships among vertical angles and linear pairs. Students will need protractors and rulers. Before class, prepare a piece of poster paper to collect the class data. There should be four columns to record the four angles students measured. You may wish to have students designate one student from each group to fill in the data for all four group members so fewer students are up at the board.

Focus on Disciplinary Literacy

Debrief

Lesson Look Fors

Look for teachers to…

- ❑ have prepared a poster paper for each class (to collect data during the INM activity).
- ❑ Clearly set expectations for how students should contribute information to class poster (INM #5).

Look for students to…

- ❑ draw conclusions from the class poster paper (after enough groups have contributed their data)
- ❑ do their best to come up with a convincing argument for INM #7

Student Know/Do Chart

Do	Students can identify vertical angles and linear pairs.
Do	Students can sketch intersecting lines and use them to find angle measures.
Know	Vertical angles are a pair of non-adjacent congruent angles formed by the intersection of two lines.
Know	A linear pair is a pair of adjacent angles that share a ray and add up to 180°.

Lesson 5: Angles on Parallel Lines Date: _____

Standard(s)

- **G.5(A)** investigate patterns to make conjectures about geometric relationships, including angles formed by parallel lines cut by a transversal, ~~criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments~~ and angles of circles choosing from a variety of tools

Important Vocabulary

- **alternate exterior angles**
- **alternate interior angles**
- **corresponding angles**
- **same side interior angles**
- **transversal**

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- Class set of colored pencils/highlighters in at least two different colors
- Class set of red pens
- Class set of protractors

Lesson Structure:

- Do Now (7 min)
- INM (10 min)
- Debrief (10 min)
- Student Practice (18 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to identify corresponding, same side interior, alternate interior, and alternate exterior angles on a transversal, and apply these relationships to find missing values. They should also be able to apply this knowledge to write informal proofs about parallel lines.

Opportunities to CFU

✓ INM: 3, 4

✓ Student Practice: 1, 2, 3

Other Notes to Inform Your Planning

For **Do Now:** In #2 students are "eyeballing" a set of lines to determine which are parallel. It is okay if they get it wrong – the point of Q2 is not to be right, but to set up the rest of the INM.

For **INM:** There are a LOT of vocabulary words in this lesson! Know that the vocabulary is not nearly as important as understanding the angle relationships (i.e., whether two angles are congruent or supplementary). Given enough information in a diagram, students should be able to determine this relationship.

Focus on Disciplinary Literacy

Debrief

Lesson Look Fors

Look for teachers to…

- ❑ model the use of colored pencils or highlighters to indicate congruent angles formed when parallel lines are cut by a transversal.

Look for students to…

- ❑ use colored pencils and/or highlighters to indicate congruent angles formed when parallel lines are cut by a transversal.
- ❑ be able to identify if a pair of angles formed by parallel lines cut by a transversal are congruent or supplementary.

Student Know/Do Chart

Do	Students can identify all angle measures formed by parallel lines cut by a transversal given only TWO angle measures.
Do	Determine if two lines cut by a transversal are parallel given two angle measures.
Know	When two parallel lines are cut by a transversal, multiple sets of congruent angles are formed.
Know	Vertical angles, corresponding angles, alternate interior, and alternate exterior angles are congruent.
Know	Same side interior angles are supplementary.

Lesson 6: Coordinate Connection: Parallel vs. Perpendicular (Day 1) Date: _____

Standard(s)

- **G.2(B)** derive and use the ~~distance,~~ slope~~, and midpoint~~ formulas to verify geometric relationships, including ~~congruence of segments and~~ parallelism or perpendicularity of pairs of lines.
- **G.2(C)** determine an equation of a line parallel or perpendicular to a given line that passes through a given point

Important Vocabulary

- **opposite reciprocal**
- **parallel**
- **perpendicular**
- **slope**

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- Class set of red pens

Lesson Structure:

- Do Now (7 min)
- INM (15 min)
- Debrief (7 min)
- Student Practice (16 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to graph equations of lines, write equations of lines in slope-intercept form, and use the coordinate grid to reason about parallel and perpendicular slopes. Students learned all of these things in Algebra 1, but we are revisiting it here to set us up for success in future units. (Also, students may have forgotten how to determine if lines are parallel or perpendicular.) This is the first of two days spent on this topic.

Opportunities to CFU

- ✓ INM: 3, 6
- ✓ Student Practice: 1, 2, 4

Other Notes to Inform Your Planning

For **INM:** Students learned about the different forms of linear equations in Algebra 1. Most equations in this lesson are in slope-intercept form. When they are in standard form, students should be able to manipulate them to easily identify the slope (usually in slope-intercept form). It is not beneficial to just tell students that the slope of lines in standard form is $-\frac{a}{b}$ because they are unlikely to recall that information when they need it. Most students will develop this shortcut for themselves once they manipulate equations from standard to slope-intercept form enough times.

Focus on Disciplinary Literacy

Debrief

Lesson Look Fors

Look for teachers to…

- ❑ do their best to get students to use what they learned in Algebra 1 to explain their responses during the Do Now and INM.
- ❑ emphasize that parallel lines have the same slope, and parallel lines have slopes that are opposite reciprocals.
- ❑ build the understanding that two numbers are opposite reciprocals if their product is -1

Look for students to…

- ❑ sketch their lines on the grid provided in the Do Now.
- ❑ be able to explain what it means for lines to be parallel, perpendicular, or neither.

Student Know/Do Chart

Do	Students can determine if two lines in slope-intercept form are parallel, perpendicular, or neither.
Know	Two lines are parallel if they have the same slope.
Know	Two lines are perpendicular if their slopes are opposite reciprocals.

Lesson 7: Coordinate Connection: Parallel vs. Perpendicular (Day 2) Date: _____

Standard(s)

- **G.2(B)** derive and use the ~~distance,~~ slope~~, and midpoint~~ formulas to verify geometric relationships, including ~~congruence of segments and~~ parallelism or perpendicularity of pairs of lines.

Important Vocabulary

- opposite reciprocal
- parallel
- perpendicular
- slope

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Unit 2 Student Edition
- Class set of red pens

Lesson Structure:

- Do Now (7 min)
- INM (38 min)
- Debrief (10 min)
- Student Practice (0 min)
- Exit Ticket (10 min)

Mathematical Goal of this Lesson

By the end of this lesson, students should be able to graph equations of lines, write equations of lines in slope-intercept form, and use the coordinate grid to reason about parallel and perpendicular slopes. Students learned all of these things in Algebra 1, but we are revisiting it here to set us up for success in future units. This is the second of two days spent on this topic.

Opportunities to CFU

✓ INM: Throughout! ✓ Student Practice: N/A

Other Notes to Inform Your Planning

For **INM:** This is an Open Middle problem! There are two tasks to choose from with some possible extensions. You can assign one or both of the puzzles, or have groups choose. In Open Middle tasks, there is generally some constraint about what numbers can be used to fill in the blanks. In the first task, students can use the digits 1-9 and in the second task they can use 0-9. They cannot repeat digits, so once they use a 3, they cannot use it again in another blank. Open middle tasks are a great avenue to reinforce the norms that math requires perseverance and multiple attempts are expected. For example, working systematically, looking for structure, reflecting on what didn't work, careful recording, and identifying constraints are all valuable skills that can be highlighted. Look for opportunities to acknowledge diverse student contributions to the task.

Focus on Disciplinary Literacy

Debrief

For **ET:** No new Exit Ticket is provided for this lesson, as it is a continuation of the previous lesson. Consider using the data from the Lesson 6 ET to shape your instructional choices during Lesson 7.

Lesson Look Fors

Look for teachers to…

- ❑ clearly set expectations for this first Open Middle problem of the year.
- ❑ actively circulate and monitor, listening for group discussions to share with the whole class.
- ❑ be aware that answers will vary! When students offer an answer, the teacher will need to verify that it is correct.

Look for students to…

- ❑ persevere through one or both challenges.
- ❑ use trial and error to arrive at solutions.

Student Know/Do Chart

Do Students can determine if two lines in slope-intercept form are parallel, perpendicular, or neither.

Know Two lines are parallel if they have the same slope.

Know Two lines are perpendicular if their slopes are opposite reciprocals.

Recommended Unit 2 Success Day Material and Resources

Date: _____

To review or practice identifying points, lines, segments, and rays **(G.4A)**, use…

- Page 2 of this review from 22/23
- Points, Lines, and Planes Lesson (MCR 22/23): SE | TE
- Worksheet on lines, line segments, rays, midpoints, and protractor use
- Worksheet #2: lines, line segments, rays, and angles
- Kuta Software Protractor Practice
-

To review or practice finding the midpoint **(G.2B)**, use…

- Page 6 of this review from 22/23
- Locating Points and Midpoint Lesson (MCR 22/23): SE | TE

To review or practice naming and classifying angles and/or angles formed by a transversal **(G.6A)**, use…

- Transversal stations practice page
- Kahoot: Angle Pairs #1
- Kahoot: Angle Pairs #2
- Kahoot: Parallel Lines and Transversals #1
- Kahoot: Parallel Lines and Transversals #2
- Better Lesson: Parallel Lines and Transversals
- Khan Academy: Unknown Angle Problems
- Carnegie: Skills Practice | Lesson Student Workbook | Lesson Teacher Workbook

To review or practice parallel and perpendicular lines **(G.2C)**, use…

- Practice: Linear Equations
- Practice: Parallel and Perpendicular Lines
- Practice: Proving Lines Parallel
- Practice: Slope
- Carnegie: Skills Practice | Lesson Student Workbook | Lesson Teacher Workbook

For a review of multiple topics relevant to unit two, use…

- Practice: Unit 2 in General

Cumulative Review | Success Day Date: _____

Standard(s)

- **G.2(B)** derive and use the distance, slope, and midpoint formulas to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines;
- **G.2(C)** determine an equation of a line parallel or perpendicular to a given line that passes through a given point
- **G.6(A)** verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems
- **G.5(A)** investigate patterns to make conjectures about geometric relationships, including angles formed by parallel lines cut by a transversal, criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles choosing from a variety of tools
- **G.4(A)** distinguish between undefined terms, definitions, postulates, conjectures, and theorems

Notes for Intellectual Preparation & Lesson Planning

Necessary Materials and Pre-Lesson Prep

- Review students' Unit 2 exit ticket data to determine what to prioritize during review
- Internalize Review Lesson 2.8 if you choose to use it.

Lesson Structure:

- Do Now (7 min)
- INM (38 min)
- Debrief (10 min)
- Student Practice (0 min)
- Exit Ticket (0 min)

Mathematical Goal of this Lesson

By the end of this class period, students should get the opportunity to review major concepts from Unit 2.

Other Notes to Inform Your Planning

You should use this Success Day to review however you see fit. An optional review activity has been provided in the Teacher Edition called "Connect 4" (Review Lesson 2.8). It is a group task in which students will work on one problem at a time, bring it to you for a quick check, and get a new problem. If a group is correct, they get to place a sticky note on the Connect 4 board. Just like in the traditional Connect 4, sticky notes obey the laws of gravity and can't flat, meaning they have to be placed on the ground level or on top of another sticky note.(See p87 of TE for detailed directions and resources.)

Focus on Disciplinary Literacy
C & D

Lesson Look Fors

Look for teachers to…

- ❑ facilitate a review session that prioritizes what students need based on previous exit ticket and/or quiz data.

Look for students to…

- ❑ review Unit 2 topics in preparation for the Unit 2 exam.

Student Know/Do Chart

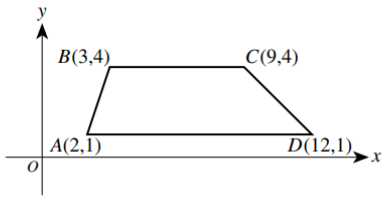
Do — Students can prepare for the Unit 2 Exam by reviewing Unit 2 content.

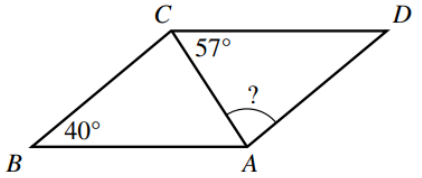
Unit 2 Exam	Date: _____
Standard(s)	Notes for Intellectual Preparation & Lesson Planning
◆ **G.2(B)** derive and use the distance, slope, and midpoint formulas to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines; ◆ **G.2(C)** determine an equation of a line parallel or perpendicular to a given line that passes through a given point ◆ **G.6(A)** verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems ◆ **G.5(A)** investigate patterns to make conjectures about geometric relationships, including angles formed by parallel lines cut by a transversal, criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles choosing from a variety of tools ◆ **G.4(A)** distinguish between undefined terms, definitions, postulates, conjectures, and theorems	**Necessary Materials and Pre-Lesson Prep** ▪ Ensure you can access UE2 on EdCite. **Notes to Inform Your Planning** Review the Unit 2 Exam on Curriculum Corner. Internalize and create an exemplar for the assessment prior to teaching the unit as part of unpacking the unit. Use your exemplar to spar with the solutions provided in the Assessment Companion on Curriculum Corner. The scanning deadline for the Unit 2 Exam is **September 25, 2025**. Consider administering the exam 1-3 school days BEFORE September 25th to allow sufficient time for grading the FRQ. Refer to the scoring guide to score the FRQ.

UNPACKED STANDARDS

Focus standards for this unit.

Standards Clarification		
Standards	**Specificity**	**Notes/Explanations/Examples**
G.6A Verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems.	<u>Content</u>: • **Corresponding Angles Postulate**: If two parallel lines are cut by a transversal, then each pair of corresponding angles is congruent. • **Alternate Interior Angles Theorem**: If two parallel lines are cut by a transversal, then each pair of alternate interior angles is congruent. • **Consecutive Interior Angles Theorem**: If two parallel lines are cut by a transversal, then each pair of consecutive interior angles is supplementary. • **Alternate Exterior Angles Theorem**: If two parallel lines are cut by a transversal, then each pair of alternate exterior angles is congruent. <u>Including but not limited to</u>: • Explaining how angles are related in a diagram • Finding missing angle measures using angle pair relationships • Finding missing values algebraically using angle relationships • Justifying whether or not two lines are parallel or perpendicular • Listing angle pairs • Defining relationships between angle pairs	**17.** In a plane, the distinct lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at A, where A is between C and D. The measure of $\angle BAC$ is $47°$. What is the measure of $\angle BAD$? **A.** $43°$ **B.** $47°$ **C.** $94°$ **D.** $133°$ **E.** $137°$

Standards Clarification		
Standards	**Specificity**	**Notes/Explanations/Examples**
G.2B derive and use the distance, slope~~, and midpoint formulas~~ to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines	**Content:** • The idea of slope as the ratio of the change in y to the change in x • Parallel lines have the same slope. • Perpendicular lines have slopes that are opposite reciprocals. • Perpendicular Postulate: If given a line and a point not on the line, then there exists exactly one line through the point that is perpendicular to the given line • The shortest distance between two parallel lines is the length of the perpendicular between them. **Including but not limited to:** • Graphing a line when given its equation in Standard Form, Point-Slope Form, or Slope-Intercept Form • Writing an equation in Standard Form, Point-Slope Form, or Slope-Intercept Form when given a graph of a line • Writing an equation Standard Form, Point-Slope Form, or Slope-Intercept Form when given a point and a slope OR a point and an equation of a parallel or perpendicular line. • Rewriting an equation given in Standard Form, Point-Slope Form, or Slope-Intercept Form in a different form	**17.** In the standard (x,y) coordinate plane, what is the slope of the line given by the equation $4x = 7y + 5$? **A.** $-\frac{4}{7}$ **B.** $\frac{4}{7}$ **C.** $\frac{7}{4}$ **D.** 4 **E.** 7 Trapezoid $ABCD$ is graphed in the standard (x,y) coordinate plane below.  **39.** What is the slope of $\overline{CD}$? **A.** -3 **B.** -1 **C.** 1 **D.** $\frac{5}{21}$ **E.** $\frac{3}{2}$

Standards Clarification		
Standards	**Specificity**	**Notes/Explanations/Examples**
G.5A investigate patterns to make conjectures about geometric relationships, **including angles formed by parallel lines cut by a transversal**, ~~criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles~~ choosing from a variety of tools	Content: • Parallel lines are coplanar lines that do not intersect • Skew lines are lines that do not intersect and are not coplanar • Parallel planes are planes that do not intersect. • A transversal is a line that interests two or more coplanar lines at two different points • Angle pair relationships Including but not limited to: • Using angle pair relationships to find missing angle measures • Finding missing values algebraically using angle relationships	**ACT:** **7.** In parallelogram $ABCD$ below, $\overline{AC}$ is a diagonal, the measure of $\angle ABC$ is 40°, and the measure of $\angle ACD$ is 57°. What is the measure of $\angle CAD$? **A.** 40° **B.** 57° **C.** 77° **D.** 83° **E.** 97° 

VERTICAL STANDARDS

This section details the **progression** of key student expectations/standards** in the courses **before** and **after** this course. This will help you understand what **prior knowledge skills to build upon** and guide you in knowing what **skills you are preparing your students** for in the subsequent course.

6th and 7th Grade

7.7A represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form $y = mx + b$

7.4B calculate unit rates from rates in mathematical and real-world problems

7.11C write and solve equations using geometry concepts, including the sum of the angles in a triangle, and angle relationships

Algebra I

A.2B write linear equations in two variables in various forms, including $y = mx + b$, Ax + By = C, and y - y1 = $m(x$ - x1), given one point and the slope and given two points

A.2E write the equation of a line that contains a given point and is parallel to a given line

A.2F write the equation of a line that contains a given point and is perpendicular to a given line

A.2G write an equation of a line that is parallel or perpendicular to the X or Y axis and determine whether the slope of the line is zero or undefined

Geometry

G.2B derive and use the distance, slope~~, and midpoint formulas~~ to verify geometric relationships, including congruence of segments and parallelism or perpendicularity of pairs of lines

G.2C determine an equation of a line parallel or perpendicular to a given line that passes through a given point

G.5A investigate patterns to make conjectures about geometric relationships**, including angles formed by parallel lines cut by a transversal**, ~~criteria required for triangle congruence, special segments of triangles, diagonals of quadrilaterals, interior and exterior angles of polygons, and special segments and angles of circles~~ choosing from a variety of tools

G.6A Verify theorems about angles formed by the intersection of lines and line segments, including vertical angles, and angles formed by parallel lines cut by a transversal and prove equidistance between the endpoints of a segment and points on its perpendicular bisector and apply these relationships to solve problems

Algebra II

A2.2A graph the functions $f(x)=\sqrt{x}$, $f(x)=1/x$, $f(x)=x3$, $f(x)= 3\sqrt{x}$, $f(x)=bx$, $f(x)=|x|$, and $f(x)=\log b\ (x)$ where b is 2, 10, and e, and, when applicable, analyze the key attributes such as domain, range, intercepts, symmetries, asymptotic behavior, and maximum and minimum given an interval

Pre-Calculus

P.2G the student is expected to graph functions, including exponential, logarithmic, sine, cosine, rational, polynomial, and power functions and their transformations, including $af(x)$, $f(x) + d$, $f(x - c)$, $f(bx)$ for specific values of a, b, c, and d, in mathematical and real-world problems