Evaluate

The process of evaluation should occur throughout the learning experience, allowing the teacher to determine whether the learner has reached the level of understanding needed at every stage. More formal evaluation, however, can now be conducted. If at any point the teacher decides that a student has not reached the desired level, they simply go back to the appropriate stage.

The Goal of *Making Maths Accessible*

Making Maths Accessible is written to provide practical classroom tips and suggestions to strengthen the quality of classroom instruction for teachers of mathematics. The tips and suggestions are based on research and in practices and strategies that address the affective, linguistic and cognitive needs of all students including English language learners.

Although this resource centres on teaching English language learners, many of the tips and suggestions benefit all students. However, it is important to remember that while the tips and strategies we explore may benefit *all* learners, they are *necessary* for the acceleration of language and content acquisition by English language learners.

We will follow five case studies of composite student profiles throughout the book with opportunities for reflection to increase personal awareness of both the teacher's role and students' needs in the mathematics classroom, tasks to provide interaction with the content of the book, and hot tips for ideas applicable to real-world classroom situations. Sample responses to the reflections and tasks are provided in appendix B (page 129).

The first four chapters of *Making Maths Accessible* lay the foundation for working with ELLs in mathematics classrooms. In chapter 1, we will focus on the challenges facing teachers in their classrooms as they strive to ensure the success of English language learners. We will introduce the students in the case studies, whose needs will be a focus in each chapter. In chapter 2, we will look at affective supports, which show how a positive classroom environment enhances learning. Chapter 3 is designed to provide teachers with practical strategies and activities for supporting ELLs' language development while still teaching mathematics content. Chapter 4 centres on providing cognitive supports by teaching mathematics conceptually for long-term retention using a variety of practices, tools and techniques.

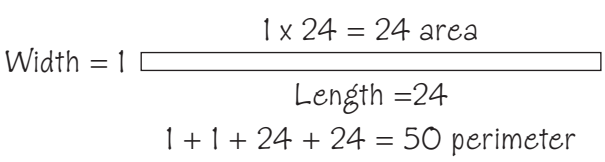
Chapters 5 and 6 are designed to connect the fundamental supports outlined in chapters 1–4 with real-life classrooms. In chapter 5, we will use a lesson developed using the Five E (5E) instructional model, a teaching sequence that meets the needs of English language learners. To summarise the description of the model given earlier, the five phases of the sequence are:

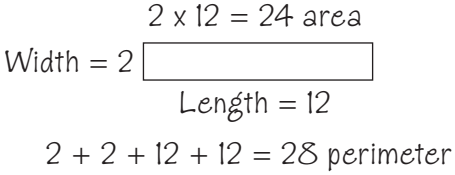
1. **Engage**—The purpose is to pique students' interest, get them involved, and connect to their prior knowledge.

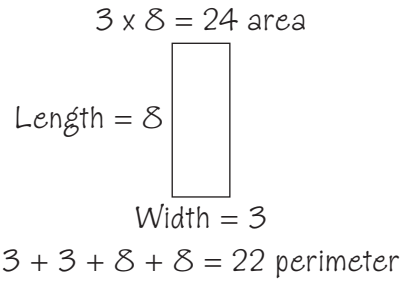
Case Study: Lin

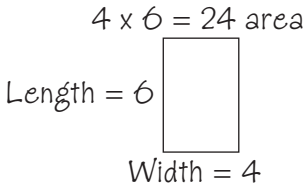
Fourteen months ago, Lin and his family left China and settled in Melbourne, where several of his relatives live. They provide encouragement and support to Lin and his parents. He relies on modified texts in reading and humanities and does well in maths despite the unavailability of a modified text. He has difficulty with contextual problems but seeks help from his teacher and fellow students.

How many different perimeters can a rectangle have if its area is equal to 24 square centimetres? Explain your thinking.









Beginning | Early Intermediate | Intermediate | Advanced | Proficient

Understanding	Participating	Communicating
☐ Smile. ☐ Pronounce the student's name correctly. ☐ Be sure the student knows your name. ☐ Establish routines so students know what to expect. ☐ Face the class when speaking. ☐ Speak slowly and distinctly. ☐ Avoid slang and explain idioms. ☐ Write legibly. ☐ Repeat important information. ☐ Allow students to audio record lessons. ☐ Label objects in the classroom, such as *recycle bin* and *overhead projector.* ☐ Create attractive, content-related display boards. ☐ Provide plenty of wait time. ☐ Be patient, kind, understanding and friendly. ☐ Teach to appeal to all five senses.	☐ Smile. ☐ Create a positive, non-threatening classroom environment. ☐ Create a nurturing environment. ☐ Find opportunities to bring the student's culture and language into class. ☐ Give frequent, genuine praise. ☐ Establish routines so students know what to expect. ☐ Post procedures and schedules. ☐ Use flexible grouping. ☐ Assign bilingual students as peer partners. ☐ Have groups present work using blank paper and textas. ☐ Highlight contributions of mathematicians from other cultures. ☐ Be patient, kind, understanding and friendly.	☐ Smile. ☐ Be patient, kind, understanding and friendly. ☐ Provide plenty of wait time. ☐ Create word walls. ☐ Use personal response boards. ☐ Ask for thumbs up/thumbs down or other physical responses.

Example 1

The table below shows the total amount of money that Jacklynn will make from selling different numbers of rolls of wrapping paper.

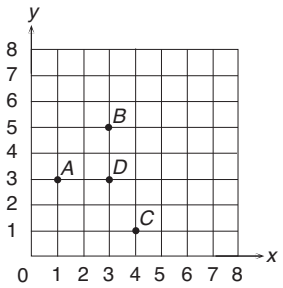
Number of Rolls of Wrapping Paper	Total Amount of Money Made
2	$14
3	$21
5	$35
8	$56

If Jacklynn sells 11 rolls of wrapping paper, how much money will Jacklynn make?

Answer: $77

Example 2

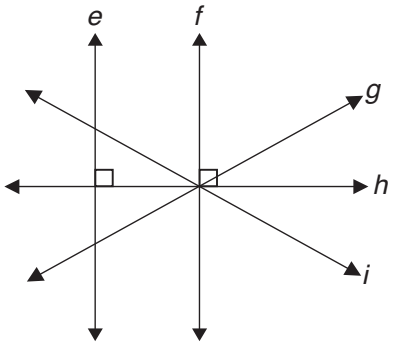
Use the table to record the coordinates of the 4 points shown on the graph.



Point	Coordinates
A	(1, 3)
B	(3, 5)
C	(4, 1)
D	(3, 3)

Example 3

Which two line segments shown here are parallel to each other?



Answer: e, f

Example 4

Tobin created a series of figures whose areas created a pattern. If the pattern continues, what could be the length and width of figure 5?

Figure	1	2	3	4
Length (centimetres)	3	5	9	5
Width (centimetres)	5	6	5	12
Area (square centimetres)				

Answer: See table 3.1, page 38, for a possible solution.

Figure 3.6: Sample maths problems.

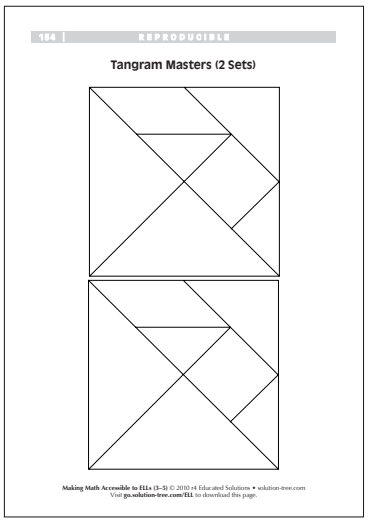
Concepts are frequently embedded in other concepts (Barton & Heidema, 2002). In example 4, for students to understand conceptually how to find the length and width of the fifth figure, they must understand the relationship between length and width and the resulting area. Only by finding the pattern in the areas of the first four figures can they determined the length and width of the fifth figure in the pattern (see table 3.1, page 38).

Since the area of the fifth figure must be 75 square centimetres, one possible solution is a length of 15 centimetres and a width of 5 centimetres. The length and width measures could be reversed. Another possible whole-number solution is a length of 25 centimetres and a width of 3 centimetres. Problems with multiple possible solutions present challenges for all students, not just English language learners.

Engage

The Engage phase of the lesson is designed to create student interest in tangrams.

1. Distribute two sets of tangrams (each set a different colour), paper and a ruler to each pair of students.
2. Prompt the students to place the ruler vertically in the middle of the piece of paper. (It does not matter if the paper is in a landscape or portrait orientation.)
3. Prompt Student One to use one set of tangrams to create a design on one side of the ruler. The design must fit on one half of the paper.
4. Prompt Student Two to use the second set of tangrams to create a mirror image of the design created by Student One on the opposite side of the ruler.



In Chinese, the tangram is called *Chi'I Ch'ae* or *wisdom board.*

Facilitation Questions: Engage Phase

Describe how you recreated your partner's design.
Answers may vary.

Are the tangram pieces on one side of the ruler in exactly the same position as the tangram pieces on the other side of the ruler? Why or why not?
No. Some pieces had to flip over or turn.

5. Prompt the students to remove the ruler and carefully push the two designs together to form one figure (see fig. 5.1).

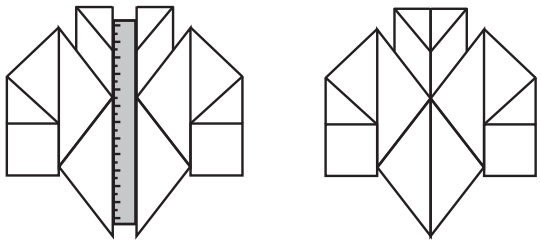
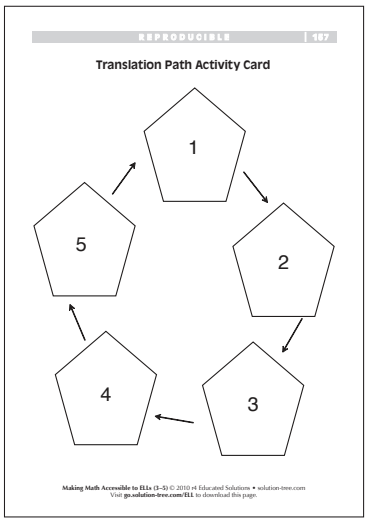


Figure 5.1: Sample tangram design.

6. Prompt the students to trace the figure carefully on the paper and cut out the entire figure in one piece.
7. Prompt the students to draw a line that represents where the two designs were joined.
8. Prompt the students to fold the figure along the line to determine whether or not the two halves of the figure are mirror images of each other.
9. Allow the students to use a mirror to check the reflection of the design created by Student One and compare it to the design created by Student Two.
10. If students' tangram designs did not create a reflection, prompt the students to repeat steps two to nine.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Translation Path Activity Card

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In the Explore phase, students work together, and the teacher asks facilitation questions. Allow time for students to problem solve through tasks. Listen to what students say as they interact.

Explain

The Explain phase of the lesson is directed by the teacher to allow students to formalise their understanding of the mathematics objectives addressed in the lesson.

1. Distribute a Transformation Path Activity Card and the Transformation Path Directions to each student.
2. Display the Transformation Path Activity Card on an overhead projector.
3. Prompt the students to move their shapes to complete step one on the activity card.
4. Model the movement of step one on the overhead.
5. Prompt the students to use a mirror to create a reflection of the first shape.
6. Prompt the students to record their answers on the Transformation Path Directions.
7. Prompt the students to move their shapes to complete step two. (Model on the overhead.)
8. Prompt the students to record their answers on the Transformation Path Directions.

All children can learn and succeed but not the same day in the same way

—James Spady

Facilitation Questions: Explain Phase

How can you describe how your piece moved to complete step one?
It flipped over.

Were you able to complete step one without picking up your shape? Why or why not?
No.

Does the image in the mirror look like the shape after completing step one?
Yes.

What do we call an image in a mirror?
Reflection

What do you think we call the new position of the shape after we moved it for step one?
Reflection

Can you describe how your piece moved to complete step two?
Answers may vary.

What is another word for *turn*?
Answers may vary. Guide students to the word rotate.

What do you think we call the new position of the shape after we moved it for step two?
Rotation