

Area – Single Square Unit, Array.

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Measure area - single square unit, marking and moving, array structure, joining any parts of squares to form further squares	page 3
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Differentiate and Assess

Not every student will be ready to investigate this concept at this Level and so we will need to differentiate to ensure every student is learning at their leading edge. Select the Differentiate button on this screen.

Integrate

Every mathematical concept is integrally related to other mathematical concepts. Teaching and learning related concepts simultaneously develops deep relational understanding. Select the Integrate button on this screen.

Intervene

Some students may not yet be ready to investigate this concept at any Level, and so we will need to provide some intervention. Select the Intervention button on this screen.

AREA – SINGLE SQUARE UNIT, ARRAY.

EXPLICIT TEACHING PLAN OVERVIEW PAGE

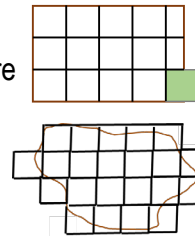
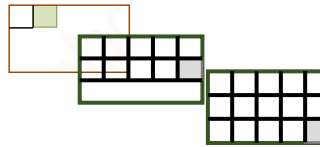
THIS PAGE IS A SUMMARY OF THE EXPLICIT TEACHING PLAN, INCLUDING STRATEGIC QUESTIONS, AND DESCRIBING THE SEQUENCE WHICH WILL OCCUR OVER MULTIPLE LESSONS.

RESOURCES: RECTANGULAR AND NON-RECTANGULAR SHAPES, SQUARES, PENCIL, PAPER

WHAT COULD WE DO?

Children:

- measure the area of a rectangular shape or surface by marking and moving a single square unit
- rhythmic and skip count to find the total number of squares, for example, 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 and 5 10 15
- explain total number of squares is the area, for example, area = 15 squares
- multiply the number of rows by the number squares in each row to work out area, for example 3 rows of 5 = 15
- use the multiplication sign to mean equal rows, for example, $3 \times 5 = 15$
- measure the area of a rectangular shape or surface whose dimensions are not whole squares, by marking and moving a single square unit, for example, area = 12 squares + 1 and a half squares = 13 and a half squares
- measure the area of a non-rectangular, non-geometric shape by marking and moving a single square unit, for example,
- count the total number of full squares, then join parts of squares to form full squares, for example, 10 full squares + 4 full squares constructed by joining parts into full squares = 14 squares
- compare the area of shapes, order shapes by their areas



WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

Children

- ask one another questions about measuring area using single square units, for example:
 - ▶ How could we measure the area of this shape using just 1 square unit?
 - ▶ How could we mark and move the square?
 - ▶ Have we created an array pattern?
 - ▶ How could we count the squares?
 - ▶ Could we skip or rhythmic count?
 - ▶ Could we count the number of rows, and the number of squares in each row and multiply?
 - ▶ Do we have any parts of squares left over?
 - ▶ Could we join the parts of squares to make a full square?
 - ▶ How could we place the shapes in order of their area?
- If the third rectangle's area is larger than the second rectangle's area, and the second rectangle's area is larger than the first rectangle's area, does that mean the third rectangle's area is also larger than the first rectangle's area?

AREA – SINGLE SQUARE UNIT, ARRAY.

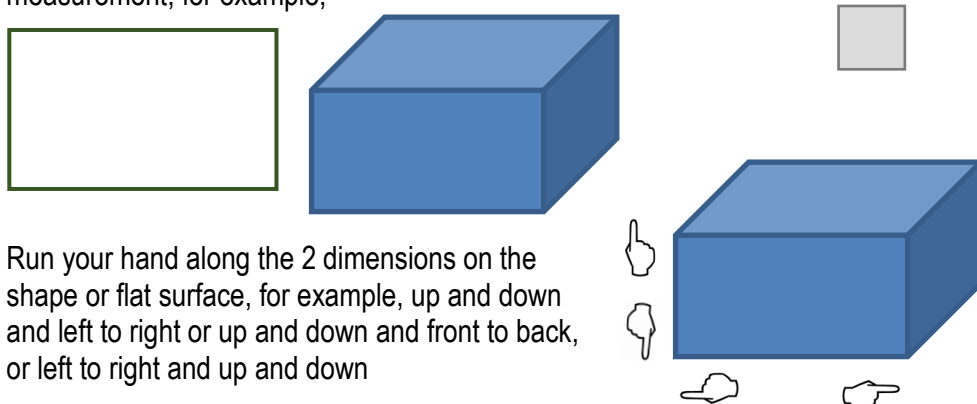
EXPLICIT TEACHING PLAN

FULL EXPLICIT TEACHING PLAN, EMBEDDING DEEP RELATIONAL UNDERSTANDING, METALANGUAGE, AND QUESTIONS THAT MAY BE USED OVER MULTIPLE LESSONS.

WHAT COULD WE DO?

Children think about, talk and listen to a friend about, then have the opportunity to share what they already know.

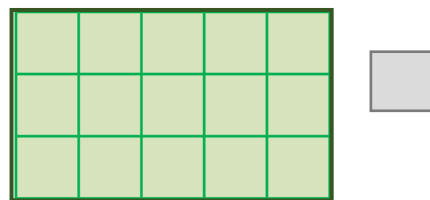
Display a rectangle, an object with rectangular surfaces and a square unit of measurement, for example,



Run your hand along the 2 dimensions on the shape or flat surface, for example, up and down and left to right or up and down and front to back, or left to right and up and down

Cover the rectangular shape in squares, for example,

Point to the rows of squares.



WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

- ▶ Today brings an investigation about area.
- ▶ What do you know about area?
- ▶ Talk about area with a friend.
- ▶ Is anyone ready to share what they are thinking about area?

- ▶ We've investigated area.
- ▶ And we found that area is the amount of space a shape or a flat surface takes up.
- ▶ We measured the area of shapes and flat surfaces by covering the shape or surface with smaller shapes.
- ▶ We found that the square is the best shape to measure area because when we changed its orientation, it took up exactly the same space.
- ▶ We've investigated shapes and flat surfaces, and we found that shapes and flat surfaces have 2 dimensions.

- ▶ When we measured the area of shapes and flat surfaces using squares, we covered the shape or surface in squares.
- ▶ How could we describe the pattern of squares?
- ▶ Are the squares in rows?

Display a rectangular shape, for example,



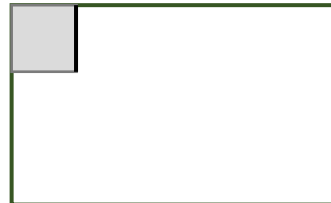
Display a square, for example,



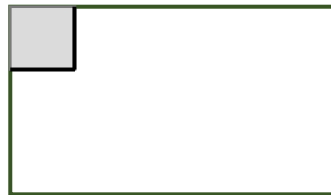
Place the square in the top left vertex of the rectangle, for example,



Place a mark where the square ends going left to right, for example,



Place a mark where the square ends going up and down, for example,



Move the square to reveal the square shape, for example,



- ▶ Today we're going to investigate measuring the area of rectangles using just one square unit of measurement.
- ▶ The shape of this surface, is a rectangle.
- ▶ Could we measure the area of the rectangle using one square? Let's investigate!

- ▶ Where could we place the square unit of measurement?
- ▶ Could we line up the vertex of the square with a vertex of the rectangle?
- ▶ Let's line up the vertex of the square with the top left vertex of the rectangle.

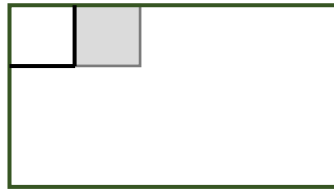
- ▶ When we used one unit of measurement to measure length, we made a mark where the unit of measurement ended, and then moved the unit of measurement.
- ▶ Do you think we could mark where the square ends, then move it?
- ▶ Because the square has 2 dimensions, will we need to make a mark on each dimension?
- ▶ Does the square end here going left to right? Let's make a mark.

- ▶ Where does the square end going up and down?
- ▶ Does the square end here going up and down? Let's make a mark.

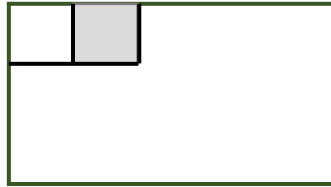
- ▶ Let's move the square.
- ▶ And we have a square shape!

- ▶ Where could we place the square now to continue measuring the area of the

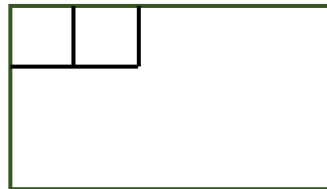
Move the square so the start of the square lines up with the end of the first square, for example,



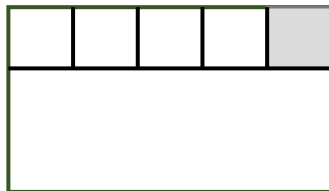
Place a mark where the square ends going left to right and going up and down, for example,



Move the square to reveal the square shape, for example,



Continue marking and moving along the top row, for example,



rectangle?

► Could we place the square so the start of the square lines up with the end of the first square?

► Do you think we could mark where the square ends, then move it again?

► Because the square has 2 dimensions, will we need to make 2 marks?

► Let's make a mark where the square ends going left to right, and where the square ends going up and down.

► Let's move the square.

► And we have a square shape!

► Could we keep marking and moving the square along the top row?

► Let's move.

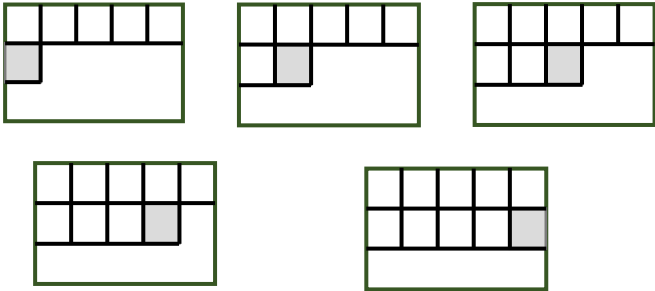
► Let's mark.

► Let's move.

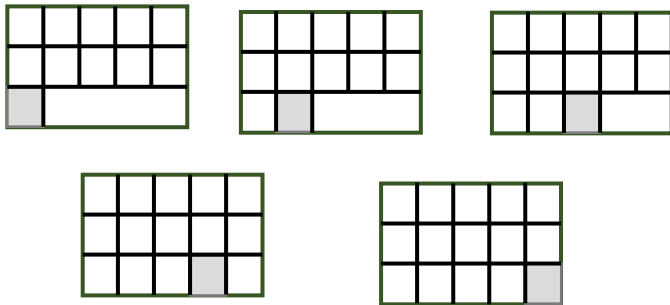
► Let's mark.

► So we've made one row of squares by marking and moving the square.

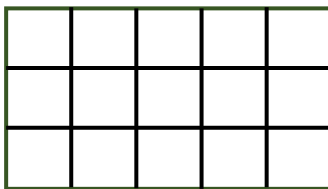
Continue marking and moving along the 2nd row, for example,



Continue marking and moving along the 3rd row, for example,



Display the rectangle with the squares drawn inside, for example,



Count the squares by ones.

Record the count, for example, 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

► Could we make another row of squares by marking and moving the square?

► So we've made two rows of squares by marking and moving the square.

► Could we make another row of squares by marking and moving the square?

► Let's look at the squares we have drawn on the rectangle.

► How could we work out the area of the rectangle now that we have drawn the squares on it?

► Could we count the squares by ones? Let's try! 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

► How could we record this?

► Could we record our count?

► Could we record the area as 15 squares?

Record, for example, Area = 15 squares

Rhythmic count the squares.

Record the rhythmic count, for example,

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Record, for example, Area = 15 squares

Skip count the squares.

Record the skip count, for example, 5 10 15

Area = 15 squares

- ▶ Is our unit of measurement, squares?

- ▶ How could we describe the way the squares are arranged?
- ▶ We've been investigating arrays.
- ▶ Are the squares arranged in an array?

- ▶ How could we count the squares in an array?
- ▶ Could we rhythmic count?
- ▶ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
- ▶ How could we record this?
- ▶ Could we record our rhythmic count?
- ▶ Could we record the area as 15 squares?
- ▶ Is our unit of measurement, squares?

- ▶ How else could we count the squares in an array?
- ▶ Could we skip count?
- ▶ 5 10 15
- ▶ How could we record this?
- ▶ Could we record our skip count?
- ▶ Could we record the area as 15 squares?
- ▶ Is our unit of measurement, squares?

- ▶ How could we describe the array?

Record, for example, 3 rows

Record, for example, 3 rows of 5

Record, for example, 3 rows of 5 = 15

Record, for example, Area = 15 squares

Record a multiplication symbol, for example, x

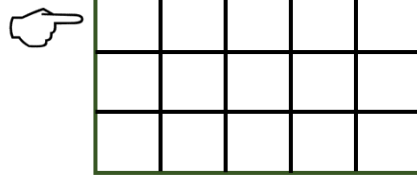
Record, for example, $3 \times 5 = 15$

- ▶ How many rows?
- ▶ Are there 3 rows?
- ▶ How many squares in each row?
- ▶ Are there 5 squares in each row?
- ▶ How could we record this?
- ▶ Could we record 3 rows of 5?
- ▶ If we have 3 rows of 5, how many do we have?
- ▶ If we have 3 rows of 5, do we have 15?
- ▶ If we have 3 rows of 5 squares, is the area 15 squares?
- ▶ Let's record this!

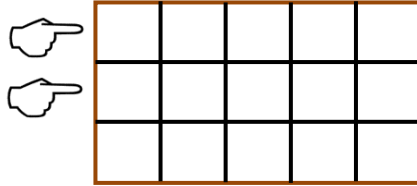
- ▶ We've been investigating using symbols in maths.
- ▶ We found that not everyone can read 'rows of' because not everyone in the world speaks English.
- ▶ But everyone in the world uses the same mathematical symbols.
- ▶ So when we use the symbols, everyone around the whole world can read our number sentences.
- ▶ We've been investigating using a symbol to describe equal rows.
- ▶ We found that the symbol looks like this.
- ▶ We found that when we record a number sentence using the symbol, it says 'times'.
- ▶ What does this number sentence say?
- ▶ Does this number sentence say 3 times 5 equals 15?
- ▶ Why does the symbol say times?
- ▶ Let's look at our array.

Display the array, for example,

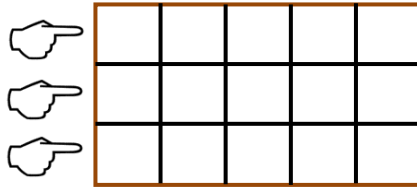
Point to 5 one time, for example,



Point to 5 two times, for example,



Point to 5 three times, for example,



► Do we have 5, 1 time?

► Do we have 5, 2 times?

► Do we have 5, 3 times?

► How many times do we have 5?

► Do we have 5, 3 times?

► Do we have 3 times 5?

► Does the symbol say times, because it tells us how many times we have an amount?

► Let's measure the area of another rectangle using a single square.

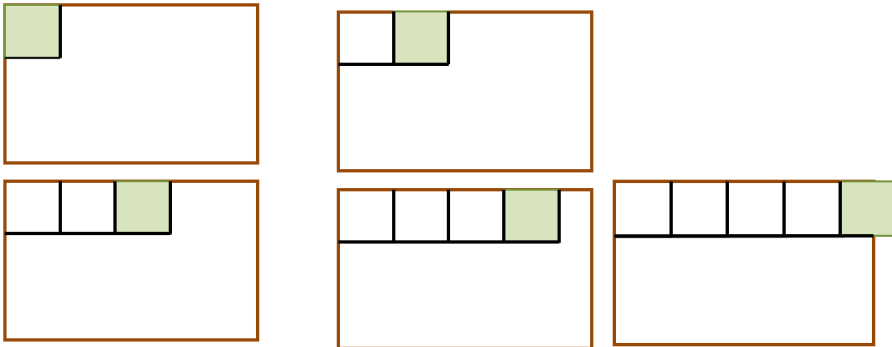
Display a rectangular shape that is not a whole number of squares in length, for example,

$4\frac{1}{2}$ squares \leftarrow \rightarrow

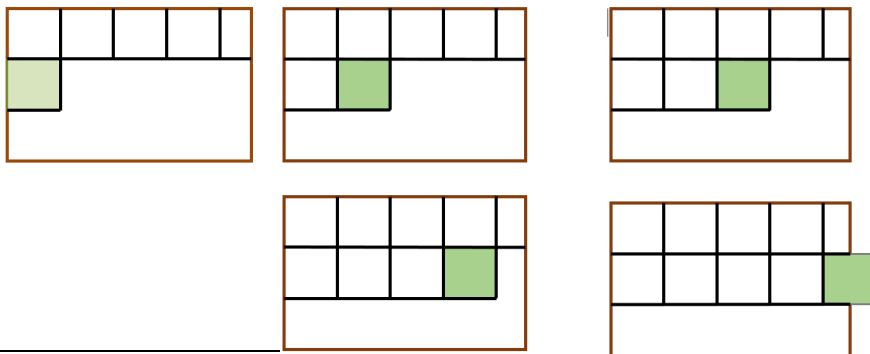
Display a square, for example,



Measure the area using one square, by marking and moving in 2 dimensions, for example,

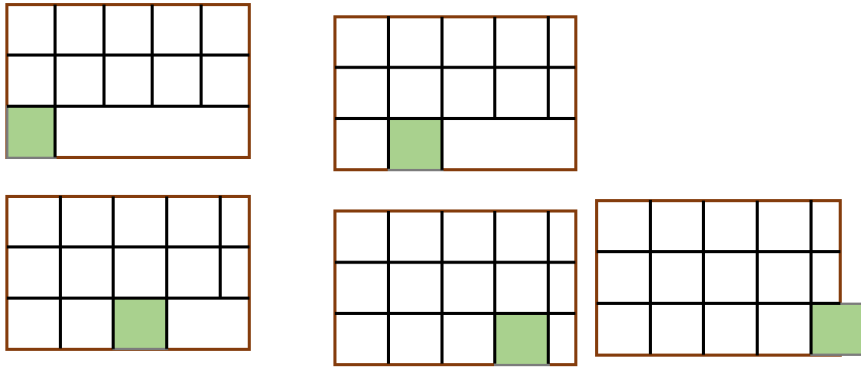


Mark and move the square along the second row, for example,



- ▶ How could we measure the area of the shape using this one square shape?
- ▶ Could we start in the top left vertex of the rectangle?
- ▶ Could we mark where the square ends going left to right?
- ▶ Could we mark where the square ends going up and down?
- ▶ Could we move the square so the beginning of the second square is lined up with the end of the first square?
- ▶ Could we mark where the square ends going left to right?
- ▶ Could we mark where the square ends going up and down?
- ▶ Could we continue marking and moving the square along the top row?
- ▶ What happened when we got to the end of the first row?
- ▶ Did we have part of the square left over?
- ▶ Let's mark and move the square along the second row.
- ▶ What happened when we got to the end of the second row?
- ▶ Did we have part of the square left over again?
- ▶ Let's mark and move the square along the third row.

Mark and move the square along the third row, for example,



Count the whole squares by ones, for example, 1 2 3 4 5 6 7 8 9 10 11 12

Rhythmic count the whole squares, for example, 1 2 3 4 5 6 7 8 9 10 11 12

Skip count the whole squares, for example, 4 8 12

► What happened when we got to the end of the third row?

► Did we have part of the square left over again?

► How could we count how many whole squares we needed to measure the area of the rectangle?

► Could we count the whole squares by ones?

► Are the whole squares arranged in an array?

► Could we rhythmic count the whole squares?

► Could we skip count the whole squares?

► How many rows do we have?

► Do we have 3 rows?

► How many whole squares in each row?

► Are there 4 whole squares in each row?

► Do we have 3 rows of 4 whole squares?

► Does that equal 12 whole squares?

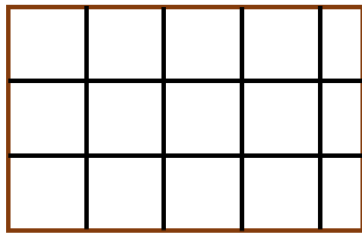
► How could we record this?

► Could we record that we have 3 rows of 4 squares, and that equals 12 squares?

Record, for example, 3 rows of 4 = 12

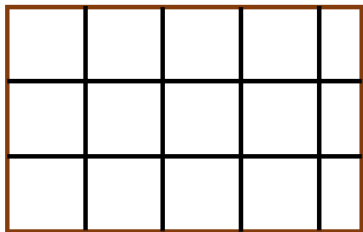
Record, for example, $3 \times 4 = 12$

Display the rectangle, for example,



Point to the half squares, for example,

Point to 2 of the half squares, for example,



► Could we record our number sentence using the multiplication symbol so everyone can read it?

► What does our number sentence say?

► Does our number sentence say 3 times 4 equals 12?

► Do we have 4, 3 times?

► Do we have 3 times 4?

► So the area of the rectangle is 12 whole squares.

► But are all of the squares in our rectangle, whole squares?

► Do we have some parts of squares?

► What fraction are the parts of squares?

► Do the parts of squares look like they are about half a square?

► How many half squares do we have?

► Do we have a half square at the end of every row?

► Do we have 3 half squares?

► Could we imagine 2 of the half squares are joined to make one more whole square?

► Will we have one half square left over?

► So will we have 12 whole squares, plus one more whole square, plus one half square?

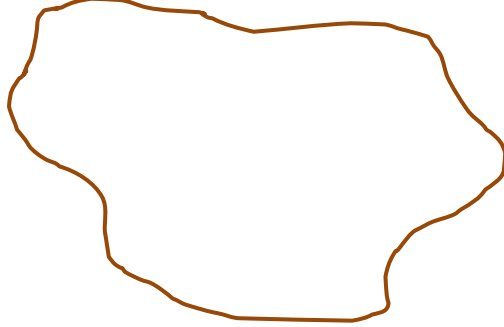
Record, for example, $12 + 1 + \text{a half} = 13 \text{ and a half}$

Record, for example, Area = 13 and a half squares

- ▶ Will we have 13 and a half squares?
- ▶ Is the area of the rectangle, 13 and a half squares?

▶ **Let's draw a non-rectangular shape.**

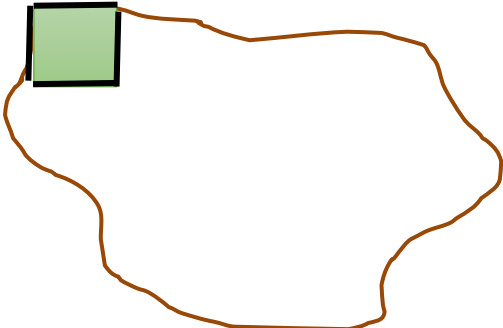
Draw a non-rectangular shape on the paper, for example,



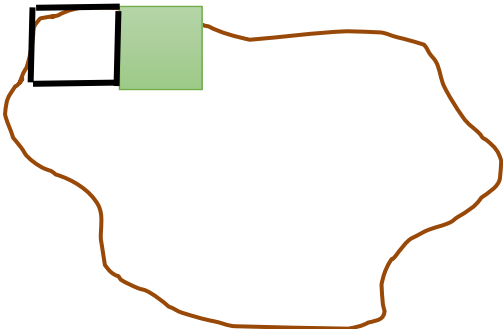
Display a square, for example,



Place the square in the top left of the shape and mark where it starts and ends going left to right and going up and down, for example,



Move the square so the beginning of the second square is lined up with the end of the first square, for example,



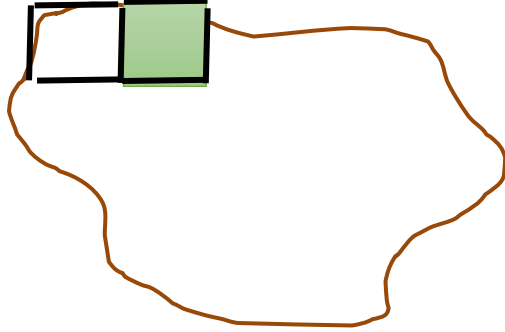
Mark where the square ends going left to right and starts and ends going up and

- ▶ How could we measure the area of the shape using this one square shape?
- ▶ Could we start in the top left of the shape?
- ▶ Could we mark where the square starts and ends going left to right?
- ▶ Could we mark where the square starts and ends going up and down?

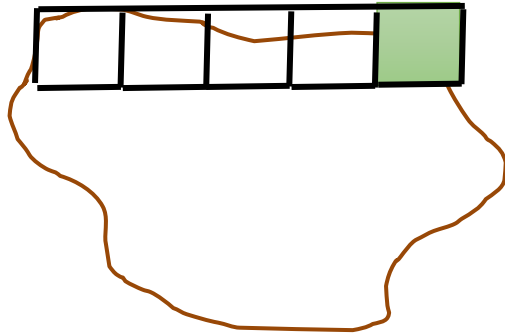
- ▶ Could we move the square so the beginning of the second square is lined up with the end of the first square?

- ▶ Could we mark where the square ends going left to right?

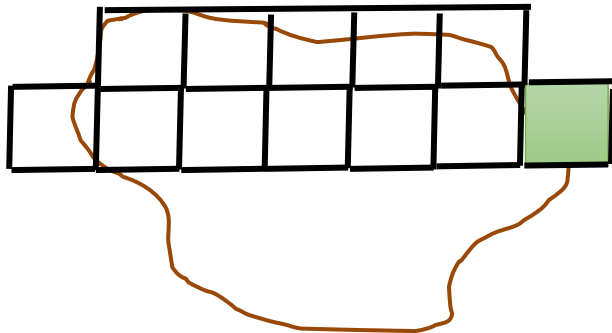
down, for example,



Continue marking and moving the square along the top row, for example,



Mark and move the square along the second row, for example,



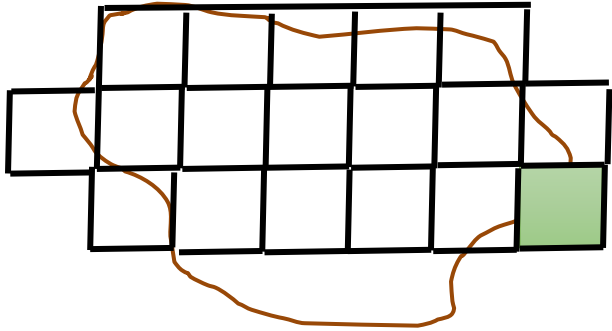
Mark and move the square along the third row, for example,

► Could we mark where the square starts and ends going up and down?

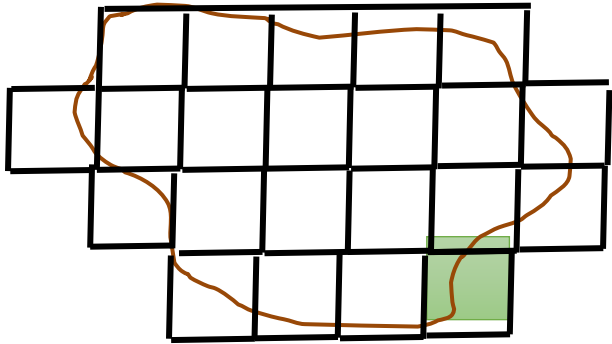
► Could we continue marking and moving the square along the top row?

► Let's mark and move the square along the second row.

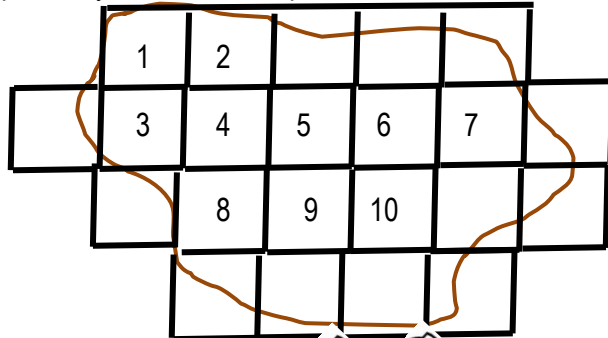
► Let's mark and move the square along the third row.



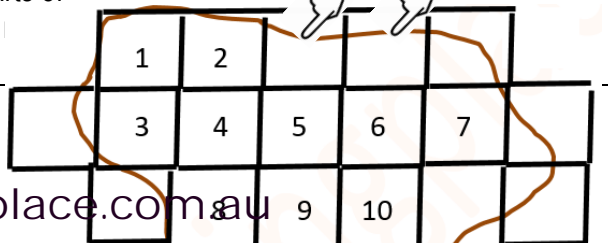
Mark and move the square along the fourth row, for example,



Count the whole squares by ones, for example, 1 2 3 4 5 6 7 8 9 10



Point to the two parts of squares in the top for example,



► Let's mark and move the square along the fourth row.

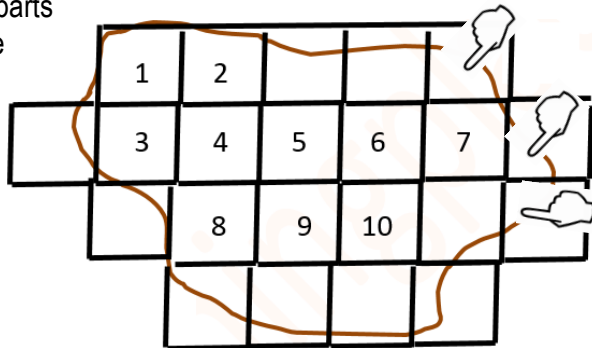
► How could we count how many whole squares we needed to measure the area of the shape?

► Could we count the whole squares?

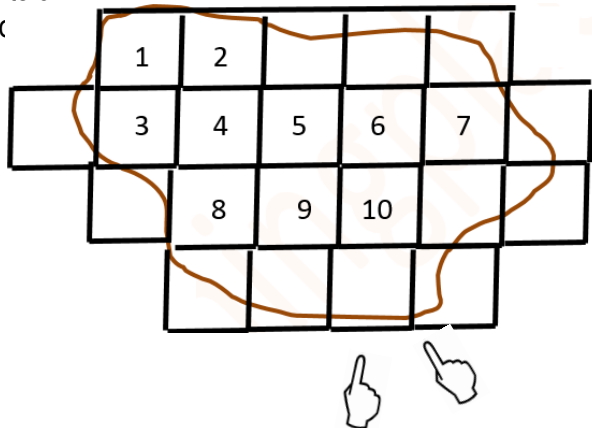
► Are there 10 whole squares?

► But are all of the squares in our shape, whole squares?

Point to the three parts of squares at the end of the top 3 rows, for example,



Point to the two parts of squares in the bottom row, for example,



Point to the other two parts of squares in bottom row, for example,



- ▶ Do we have some parts of squares?
- ▶ Could we imagine joining some of the parts of squares to make whole squares?
- ▶ Could we imagine joining together these two parts of squares in the top row to make another square?

- ▶ Could we imagine joining together these three parts of squares at the end of the top 3 rows to make another square?

- ▶ Could we imagine joining together these two parts of squares in the bottom row to make another square?

- ▶ Could we imagine joining together these other two parts of squares in the bottom row to make another square?



Record, for example, $10 + 4 = 14$

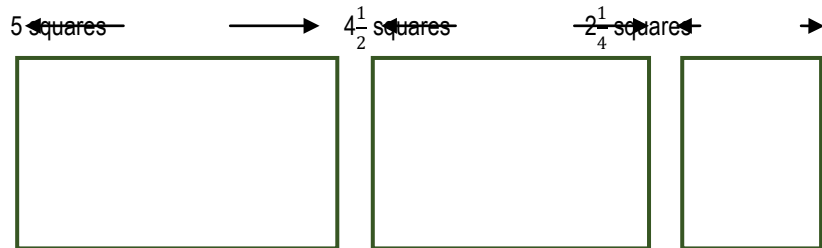
Record, for example, Area = 14 squares

Children think about, talk and listen to a friend about, then have the opportunity to share what they already know.

- ▶ So how many squares did we add?
- ▶ Did we add 4 more squares?
- ▶ So we had 10 whole squares, plus the 4 squares we made by joining parts of squares.
- ▶ How many squares altogether?
- ▶ Are there 14 squares altogether?
- ▶ Is the area of the shape, 14 squares?

- ▶ Today brings an investigation about area.
- ▶ What do you know about area?

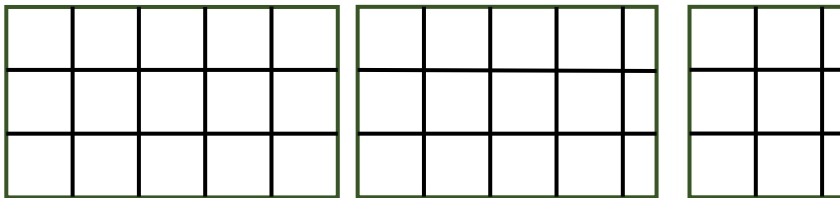
Display 3 different-sized rectangular shapes drawn on paper, one with a length that is a whole number of the squares the children will be using as their unit of measurement, one with a length that is a whole number of squares plus half a square, and one that is a whole number of squares plus a quarter of square, for example,



Display a square, for example,



Measure the area of each rectangle using one square shape, by marking and moving in rows, for example,



Rhythmic or skip count the whole squares, for example,

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 and 5 10 15

1 2 3 4 5 6 7 8 9 10 11 12 and 4 8 12

- ▶ Talk about area with a friend.
- ▶ Is anyone ready to share what they are thinking about area?

▶ **Today we're going to compare the areas of shapes.**

- ▶ Here we have 3 shapes.

- ▶ How could we measure the area of each shape using this square?

- ▶ Could we mark and move the square along each shape in rows?

- ▶ Could we rhythmic or skip count the whole squares?

1 2 3 4 5 6 and 2 4 6

Multiply the number of rows by the number of whole squares in each row, for example,

$$3 \text{ rows of } 5 = 15 \quad \text{and} \quad 3 \times 5 = 15$$

$$3 \text{ rows of } 4 = 12 \quad \text{and} \quad 3 \times 4 = 12$$

$$3 \text{ rows of } 2 = 6 \quad \text{and} \quad 3 \times 2 = 6$$

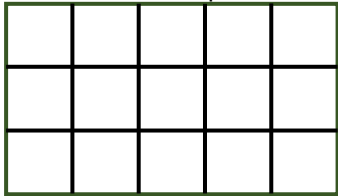
Add the fractions of squares, for example,

15

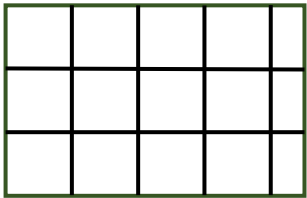
$$12 + 1 + \text{a half} = 13 \text{ and a half}$$

$$6 + 3 \text{ quarters} = 6 \text{ and } 3 \text{ quarters}$$

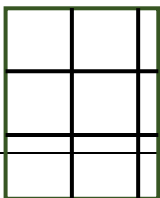
Record, for example,



Area = 15 squares



Area = 13 and a half squares



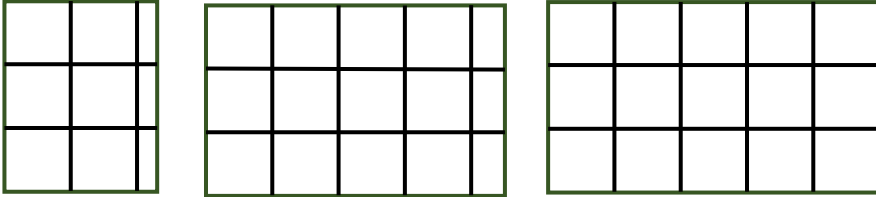
Area = 6 and 3 quarters squares

► Could we multiply the number of rows by the number of whole squares in each row?

► Could we add the fractions of squares?

► How could we record the area of each rectangle?

Place the rectangles in order of area, for example,



Point to the first rectangle, then the second rectangle, then the third rectangle, then back to the first rectangle to compare the first and second rectangles' areas, then the second and third rectangles' areas, then the third and first rectangles' areas.

Point to the third rectangle, then the second rectangle, then the first rectangle, then back to the third rectangle to compare the third and second rectangles' areas, then the second and first rectangles' areas, then the first and third rectangles' areas.

- ▶ Which rectangle has the largest area?
- ▶ Does the rectangle with an area of 15 squares have the largest area?
- ▶ Which rectangle has the second largest area?
- ▶ Does the rectangle with an area of 13 and half squares have the second largest area?
- ▶ Which rectangle has the third largest area?
- ▶ Does the rectangle with an area of 6 and 3 quarters squares have the third largest area?

- ▶ Is the first rectangle's area smaller than the second rectangle's area?
- ▶ And is the second rectangle's area smaller than the third rectangle's area?
- ▶ If the first rectangle's area is smaller than the second rectangle's area, and the second rectangle's area is smaller than the third rectangle's area, does that mean the first rectangle's area is also smaller than the third rectangle's area?

- ▶ Is the third rectangle's area larger than the second rectangle's area?
- ▶ And is the second rectangle's area larger than the first rectangle's area?
- ▶ If the third rectangle's area is larger than the second rectangle's area, and the second rectangle's area is larger than the first rectangle's area, does that mean the third rectangle's area is also larger than the first rectangle's area?