

# Metric Area, Related to Metric Length.

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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.

# METRIC AREA, RELATED TO METRIC LENGTH.

## EXPLICIT TEACHING PLAN OVERVIEW PAGE

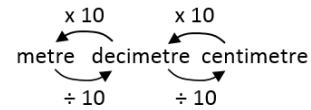
THIS PAGE IS A SUMMARY OF THE EXPLICIT TEACHING PLAN, INCLUDING STRATEGIC QUESTIONS, AND DESCRIBING THE SEQUENCE WHICH WILL OCCUR OVER MULTIPLE LESSONS.

RESOURCES: RECTANGLES, SQUARE CENTIMETRES, METRE RULERS OR TAPE MEASURES, CHALK, NEWSPAPER, MASKING TAPE, RULERS, PENCIL, PAPER

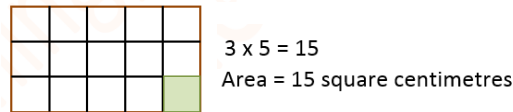
### WHAT COULD WE DO?

Children:

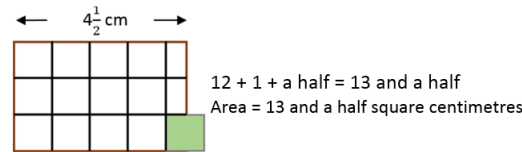
- explain square centimetres as centimetres turned into squares by adding a dimension, for example,
- explain square metres as metres turned into squares by adding a dimension, for example,



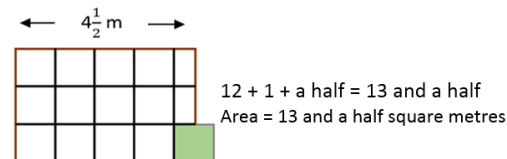
- measure the area of shapes using a square centimetre, for example,



- measure the area of shapes that are not a whole number of centimetres long, using a square centimetre, for example,



- measure the area of shapes using a square metre, for example,



### WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

Children

- ask one another questions about measuring length in square centimetres and square metres, for example:
  - ▶ How can we add a dimension to a centimetre to make a square centimetre?
  - ▶ How can we add a dimension to a metre to make a square metre?
  - ▶ How are square centimetres and centimetres square/d different?
  - ▶ How could we use a square centimetre to measure the area of this shape?
  - ▶ What is our unit of measurement?
  - ▶ What is the area of the shape in square centimetres?
  - ▶ How are square centimetres and centimetres square/d different?
  - ▶ How could we use a square metre to measure the area of this shape?
  - ▶ What is the area of the shape in square metres?

# METRIC AREA, RELATED TO METRIC LENGTH.

## EXPLICIT TEACHING PLAN

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

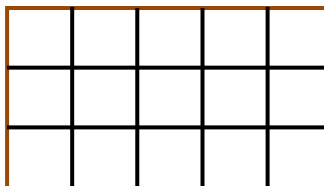
### WHAT COULD WE DO?

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

Display a rectangle and a square unit of measurement, for example,



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

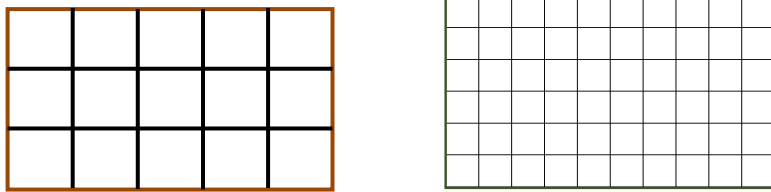


### WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

- ▶ 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.
- ▶ We measured the area of shapes and flat surfaces using just one square.
- ▶ And we found that we could mark and move the square.
- ▶ We found that this created an array pattern of rows.

Record, for example, 3 rows of 5 = 15 and  $3 \times 5 = 15$

Display the rectangle measured in large and small squares, for example,

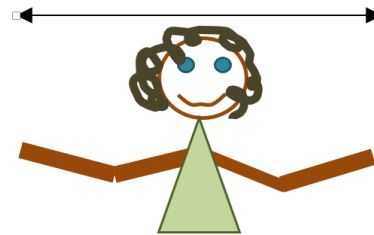


Record, for example, Area = 15 large squares or 30 small squares

Children place their finger inside the thumb and finger of their other hand, and then carefully slide out their finger, for example,



Children open their arms to show the length of a metre, for example,



► And we found that we could multiply the number of rows by the number of squares in each row.

► We measured the area of shapes and flat surfaces using different-sized squares.

► And we found that we needed more small squares than large squares to measure the same area.

► So the area of this rectangle is 15 large squares or 30 small squares.

► Why do we have a different number of squares?

► If we all measure area using different sized squares, will we all get different numbers?

► Do you think it would get confusing if we all use different-sized squares to measure area?

► Do you think it would be a good idea if we all use the same-sized square?

► Do we have units that we all use to measure length?

► Do we have centimetre?

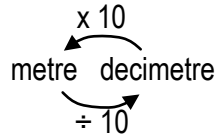
► Open your fingers a centimetre.

► Do we have a metre?

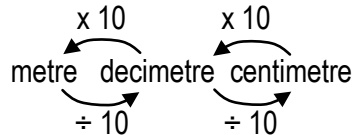
► Open your arms a metre.

Record, for example,  
metre

Record, for example,



Record, for example,

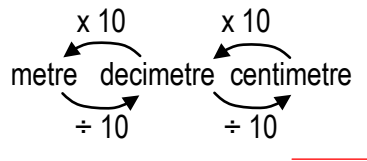


- ▶ We've investigated metres and centimetres.
- ▶ And we found that about 300 years ago, a French mathematician invented these units of measurement to measure length.
- ▶ We found that he based the units of measurement on place value because he multiplied and divided by 10.
- ▶ We found that he started with a metre.
  
- ▶ And we found that if the metre is too long, he divided the metre by 10 to get a tenth of a metre which he called a 'decimetre'.
- ▶ We found that the prefix 'deci' means tenth.
- ▶ And we found that if we had 10 decimetres, we'd have a metre.
- ▶ We found that we don't use decimetres to measure length but some countries do!
  
- ▶ We found that if the decimetre is too long, he divided the decimetre by 10 to get a hundredth of a metre which he called a 'centimetre'.
- ▶ We found a centimetre is a hundredth as big as a metre because we need 100 centimetres to make a metre.
- ▶ We found that the prefix 'centi' means hundredth.
- ▶ And we found that if we had 10 centimetres, we'd have a decimetre.
- ▶ We found that we could measure lengths using centimetres and metres because centimetres and metres have length.
- ▶ And we found that when we measure length, we are measuring one dimension of a shape or object.
- ▶ We found that centimetres and metres are standard units of measurement because they are always the same length.

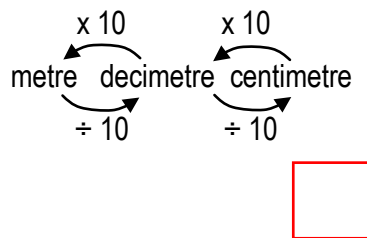
Children place their finger inside the thumb and finger of their other hand, and then carefully slide out their finger, for example,



Draw a line under the centimetre about a centimetre long, for example,



Add an up and down dimension to the 1 centimetre line to make a square, for example,



- ▶ So we have standard units of measurement for length.
- ▶ Would it be a good idea if we had standard units of measurement for area, too?
  
- ▶ The French mathematician who invented the metric measurement system, decided to make standard units of measurement to measure area.
- ▶ He knew that the best shape to measure area is a square.
- ▶ So he decided to turn the centimetre into a square.
  
- ▶ A centimetre is about this long.
- ▶ How could we turn the centimetre into a square?
  
- ▶ Our centimetre has only one dimension – left to right.
  
- ▶ Could we add a dimension going up and down?
- ▶ If we want to make a square, how long would we make the dimension that goes up and down?
- ▶ Would we make the dimension that goes up and down a centimetre long as well?
- ▶ Let's do it!
  
- ▶ Have we made a square?
- ▶ Is the square 1 centimetre left to right?
- ▶ Is the square 1 centimetre up and down?
- ▶ Because our square is 1 centimetre left to right and 1 centimetre up and down, is our square, a square centimetre?
- ▶ The shape of this surface is a square.

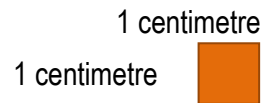
Record, for example, square centimetre

Distribute a shape with a surface that is a square centimetre to each child,

Square centimetres are available for purchase from [www.cleverpatch.com.au](http://www.cleverpatch.com.au) or cubic centimetres may be used by drawing attention to the area of one surface – 1 square centimetre.

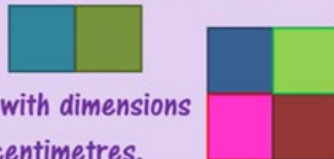


Record, for example,



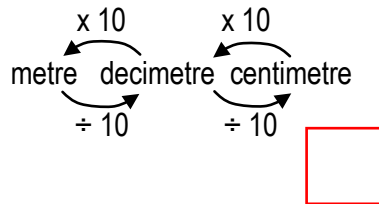
The unit of measurement for area,  $\text{cm}^2$  says 'square centimetre' and NOT centimetres square/d. A square centimetre is a unit of measurement to measure area, while a centimetre square/d is a description of a shape.

This model has an area of 2 square centimetres,



This model is 2 centimetres square/d (a square with dimensions of 2 centimetres), and has an area of 4 square centimetres.

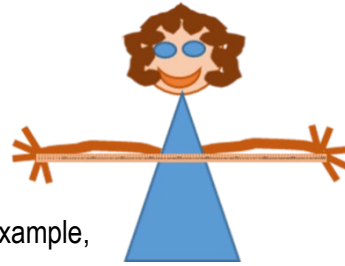
Display the centimetre turned into a square to make a square centimetre, for example,



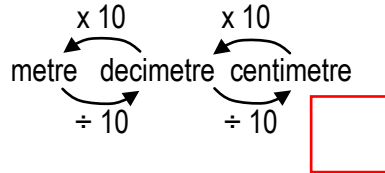
- ▶ Do you think it is a square centimetre?
- ▶ Could we measure the dimensions of the square to check if they are 1 centimetre?
- ▶ Is the square 1 centimetre up and down?
- ▶ Is the square 1 centimetre left to right?
- ▶ Because the dimensions of the square are 1 centimetre, is this a square centimetre?
- ▶ Let's record our square centimetre.

- ▶ But what if we want to measure the area of larger shapes or surfaces?
- ▶ Do we need a larger square unit of measurement?

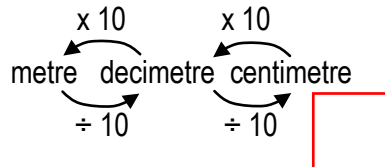
Children open their arms a metre wide, and tell their friend that their arms are open 1 metre. NB: double desks in many classrooms are about 1 metre in length.



Draw a line under the metre about a metre long, for example,



Add an up and down dimension to the 1 metre line to make a square, for example,



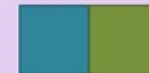
Record, for example, square metre

► **Do you think we could turn a metre into a square as well?**

- A metre is about this long.
- How could we turn the metre into a square?
- Our metre has only one dimension – left to right.
- Could we add a dimension going up and down?
- If we want to make a square, how long would we make the dimension that goes up and down?
- Would we make the dimension that goes up and down a metre long as well?
- Let's do it!
- Have we made a square?
- Is the square 1 metre left to right?
- Is the square 1 metre up and down?
- Because our square is 1 metre left to right and 1 metre up and down, is our square, a square metre?

The unit of measurement for area,  $m^2$  says 'square metre' and NOT metres square/d. A square metre is a unit of measurement to measure area, while a metre square/d is a description of a shape.

This model has an area of 2 square metres,



This model is 2 metres square/d (a square with dimensions of 2 metres), and has an area of 4 square metres,





Break children into pairs or small groups. Each group has access to a metre ruler or tape measure, newspaper and masking tape.

Children make a square metre.

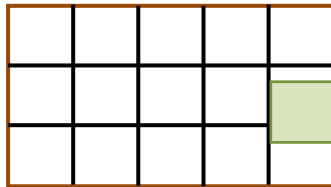
- ▶ Let's make a square metre!
- ▶ Use your metre ruler or tape measure, your newspaper and masking tape to make a square metre.
- ▶ Do you think you have constructed a square metre?
- ▶ Could we the dimensions of the square to check if they are 1 metre?
- ▶ Is the square 1 metre up and down?
- ▶ Is the square 1 metre left to right?
- ▶ Because the dimensions of the square are 1 metre, is this a square metre?
  
- ▶ Could we measure area using square centimetres?
- ▶ Could we measure area using square metres?
- ▶ If we measured the area of the same shape, which would we need more of – square metres or square centimetres?
- ▶ Would we need more square centimetres?
- ▶ If we measured the area of the same shape, which would we fewer more of – square metres or square centimetres?
- ▶ Would we need fewer square metres?

Display a rectangle and a square centimetre, for example,



Square centimetres are available for purchase from [www.cleverpatch.com.au](http://www.cleverpatch.com.au) or cubic centimetres may be used by drawing attention to the area of one surface – 1 square centimetre.

Children mark and move the square centimetre to measure the area, for example,



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

Record, for example, Area = 15 square centimetres

► **Could we use our square centimetre to measure area? Let's investigate!**

► How could we measure the area of the rectangle in square centimetres?

► Could we mark and move the square centimetre in rows?

► How could we work out the area?

► Could we multiply the number of rows by the number of square centimetres in each row?

► How many rows?

► Are there 3 rows?

► How many square centimetres in each row?

► Are there 5 square centimetres in each row?

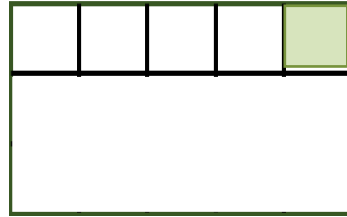
► Is the area 15 square centimetres?

► Did we work out the area by multiplying the number of rows by the number of square centimetres in each row?

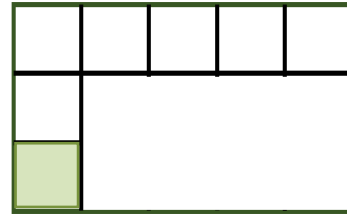
► Do we need to cover the whole rectangle with square centimetres to work out the area?

► Could we just measure the length of one row?

Children mark and move the square centimetre along the top row, for example,



Children mark and move the square centimetre down from the first square centimetre, for example,



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

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

▶ Let's mark and move the square centimetre along the top row.

▶ Could we then measure the number of rows?

▶ Let's mark and move the square centimetre down from the first square centimetre.

▶ Can we see the number of rows?

▶ How many rows?

▶ Are there 3 rows?

▶ Can we see the number of square centimetres in each row?

▶ How many square centimetres in each row?

▶ Are there 5 square centimetres in each row?

▶ Do we have 3 rows of 5 square centimetres?

▶ Do we have 15 square centimetres?

▶ Did we need to cover the whole rectangle in square centimetres?

▶ Do we just need to work out the number of rows and the number of square centimetres in each row?

example,

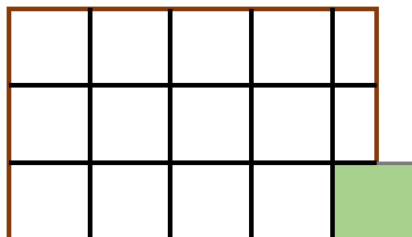
$$4\frac{1}{2} \text{ cm}$$

Display a rectangle and a square centimetre, for example,

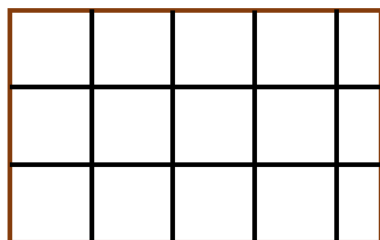


*Square centimetres are available for purchase from [www.cleverpatch.com.au](http://www.cleverpatch.com.au) or cubic centimetres may be used by drawing attention to the area of one surface – 1 square centimetre.*

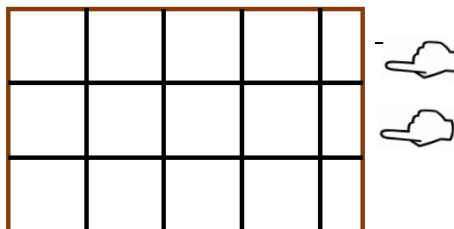
Children mark and move the square centimetre to measure the area, for example,



Display the rectangle, for example,



Point to 2 of the half square centimetres,



▶ Let's measure the area of another rectangle using our square centimetre.

▶ How could we measure the area of the rectangle in square centimetres?

▶ Could we mark and move the square centimetre in rows?

▶ How could we work out the area?

▶ Could we multiply the number of rows by the number of whole square centimetres in each row?

▶ How many rows?

▶ Are there 3 rows?

▶ How many whole square centimetres in each row?

▶ Are there 4 whole square centimetres in each row?

▶ Are all of the square centimetres, whole?

▶ Are there any fractions of square centimetres?

▶ What fraction are the parts of the square centimetres?

▶ Do the parts of the square centimetres look like they are about half a square centimetre?

▶ How many half square centimetres do we have?

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

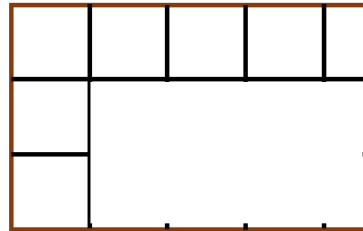
▶ Do we have 3 half square centimetres?

for example,

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

Record, for example, Area = 13 and a half square centimetres

Mark and move the square centimetre along the top row and down from the top row to measure how many rows, for example,



Record, for example, 3 rows

Record, for example, 4 whole square centimetres

Record, for example, 3 rows of 4 whole square centimetres = 12 square centimetres

Record, for example, half + half = 1

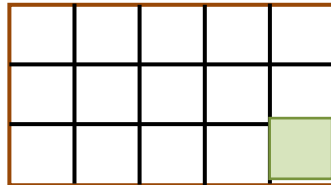
Record, for example,  $12 + 1 + \text{a half} = 13 \text{ and a half}$

- ▶ Could we imagine 2 of the half square centimetres are joined to make one more whole square centimetre?
- ▶ Will we have one half square centimetre left over?
  
- ▶ So will we have 12 whole square centimetres, plus one more whole square centimetre, plus one half square centimetre?
- ▶ Will we have 13 and a half square centimetres?
- ▶ Is the area of the rectangle, 13 and a half square centimetres?
  
- ▶ Did we need to cover the whole rectangle in square centimetres?
- ▶ Could we just mark and move the square centimetre along the top row?
- ▶ And could we mark and move the square centimetre down from the top row to measure how many rows?
- ▶ How many rows?
- ▶ Are there 3 rows?
- ▶ How many whole square centimetres in each row?
- ▶ Are there 4 whole square centimetres in each row?
- ▶ Are there 3 rows of 4 whole square centimetres?
- ▶ Are there 12 whole square centimetres?
- ▶ Are there 3 half square centimetres?
- ▶ Could we imagine joining 2 of the half square centimetres together to make 1 whole square centimetre?
- ▶ Will we have 1 half of a square centimetre left over?
- ▶ Is the area 12 square centimetres, plus 1 square centimetre plus half a square

Record, for example, Area = 13 and a half square centimetres

Take the children outside to a play court, for example, a hand ball court, a basketball court, or a netball court.

Children use chalk to mark and move the square metre to measure the area of their rectangle, for example,



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

Record, for example, Area = 15 square metres

centimetre?

► Is the area of the rectangle, 13 and a half square centimetres?

► **Could we use our square metre to measure area? Let's investigate!**

► Let's find some rectangles on the ground outside!

► How could we measure the area of the rectangle in square metres?

► Could we mark and move the square metre in rows?

► How could we work out the area?

► Could we multiply the number of rows by the number of square metres in each row?

► How many rows?

► Are there 3 rows?

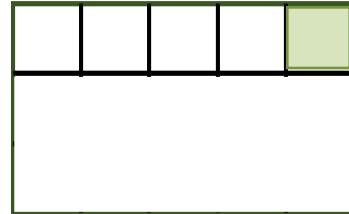
► How many square metres in each row?

► Are there 5 square metres in each row?

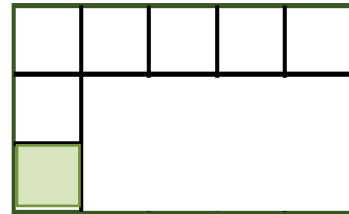
► Is the area 15 square metres?

► Did everyone cover their entire rectangle in squares?

Children mark and move the square metre along the top row, for example,



Children mark and move the square metre down from the first square metre, for example,



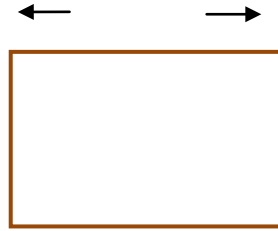
Record, for example,  $3 \times 5 = 15$

Children measure a rectangular shape that is not a whole number of metres in length, for example,

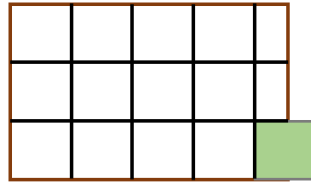
- ▶ Do we need to cover the whole rectangle with square metres to work out the area?
- ▶ Did anyone measure just the number of square metres in the row and the number of rows?
- ▶ Could we just measure the length of one row?
- ▶ Let's mark and move the square metre along the top row.
- ▶ Could we then measure the number of rows?
  
- ▶ Let's mark and move the square metre down from the first square metre.
  
- ▶ Can we see the number of rows?
- ▶ How many rows?
- ▶ Are there 3 rows?
- ▶ Can we see the number of square metres in each row?
- ▶ How many square metres in each row?
- ▶ Are there 5 square metres in each row?
- ▶ Do we have 3 rows of 5 square metres?
- ▶ Do we have 15 square metres?
- ▶ Did we need to cover the whole rectangle in square metres?
- ▶ Do we just need to work out the number of rows and the number of square metres in each row?
  
- ▶ Let's measure the area of another rectangle using our square metre.

$4\frac{1}{2} \text{ m}$

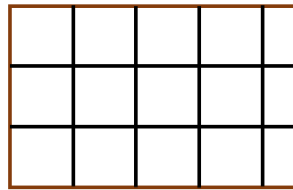
Display a square metre, for example,



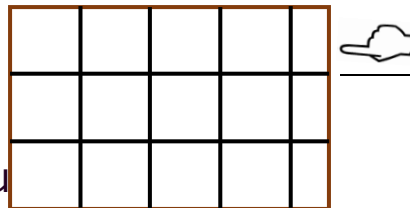
Children mark and move the square metre to measure the area, for example,



Display the rectangle, for example,



Point to 2 of the half square metres.



- ▶ How could we measure the area of the rectangle in square metres?
- ▶ Could we mark and move the square metre?
  
- ▶ How could we work out the area?
- ▶ Could we multiply the number of rows by the number of whole square metres in each row?
- ▶ How many rows?
- ▶ Are there 3 rows?
- ▶ How many whole square metres in each row?
- ▶ Are there 4 whole square metres in each row?
- ▶ Are all of the square metres, whole?
- ▶ Are there any fractions of square metres?
- ▶ What fraction are the parts of the square metres?
- ▶ Do the parts of the square metres look like they are about half a square metre?
- ▶ How many half square metres do we have?
- ▶ Do we have half a square metre at the end of every row?
- ▶ Do we have 3 half square metres?
- ▶ Could we imagine 2 of the half square metres are joined to make one more whole

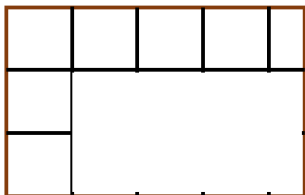




Record, for example,  $12 + 1 + \text{a half} = 13 \text{ and a half}$

Record, for example, Area = 13 and a half square metres

Mark and move the square metre along the top row and down from the top row to measure how many rows, for example,



Record, for example, 3 rows

Record, for example, 4 whole square metres

Record, for example, 3 rows of 4 whole square metres = 12 square metres

Record, for example,  $\text{half} + \text{half} = 1$

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

Record, for example, Area = 13 and a half square metres

square metre?

- ▶ Will we have one half square metre left over?
  
- ▶ So will we have 12 whole square metres, plus one more whole square metre, plus one half square metre?
- ▶ Will we have 13 and a half square metres?
- ▶ Is the area of the rectangle, 13 and a half square metres?
  
- ▶ Did we need to cover the whole rectangle in square metres?
- ▶ Could we just mark and move the square metre along the top row?
- ▶ And could we mark and move the square metre down from the top row to measure how many rows?
- ▶ How many rows?
- ▶ Are there 3 rows?
- ▶ How many whole square metres in each row?
- ▶ Are there 4 whole square metres in each row?
- ▶ Are there 3 rows of 4 whole square metres?
- ▶ Are there 12 whole square metres?
- ▶ Are there 3 half square metres?
- ▶ Could we imagine joining 2 of the half square metres together to make 1 whole square metre?
- ▶ Will we have 1 half of a square metre left over?
- ▶ Is the area 12 square metres, plus 1 square metre plus half a square metre?
- ▶ Is the area of the rectangle, 13 and a half square metres?