Area –Extend to Hectares, Square Kilometres.

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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

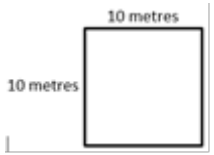
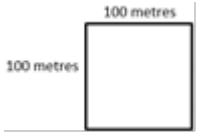
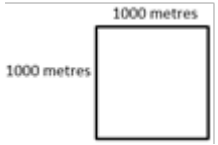
Some students may not yet be ready to investigate this concept at any Level, and so we will need to provide some intervention. Select the Intervention button on this screen.

AREA –EXTEND TO HECTARES, SQUARE KILOMETRES.

EXPLICIT TEACHING PLAN OVERVIEW PAGE

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

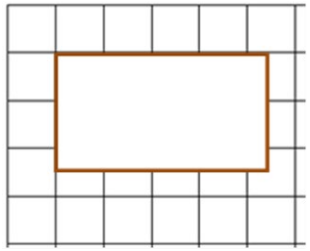
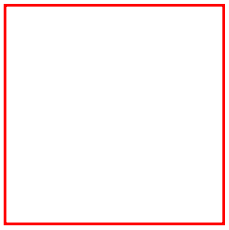
RESOURCES: 30 CM (12 INCH) RULERS, 1 METRE RULERS, TRUNDLE WHEELS. STREET MAP OF LOCAL AREA, CONES, PENCIL, PAPER

WHAT COULD WE DO?	WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?
Children: • distinguish between square cm / m and cm / m square/d. • identify square decametres as 10 metres by 10 metres = 100 square metres, for example,  • identify square hectometres as hectares as 100 metres by 100 metres = 10 000 square metres, for example,  • identify square kilometres as 1000 metres by 1000 metres = 1 000 000 square metres, for example,  • calculate areas in square centimetres, square metres, hectares and square kilometres by multiplying the length of the adjacent sides 'length' x 'width', for example, one side is 14 metres long and the adjacent side is 8 metres long. 14 x 8 = 10 + 4 10 x 8 = 80 4 x 8 = 32 80 + 32 = 112 Record, for example, Area = 112 m^2 • compare the metric and imperial systems of measurement.	Children • ask one another questions about area in hectares and square kilometres, for example: ▸ How could we add a dimension to a decametre / a hectometre / a kilometre to create a square decametre / square hectometre (hectare) / square kilometre? ▸ What is the area of a square decametre / square hectometre (hectare) / square kilometre? ▸ How are square kilometres and kilometres square/d different? ▸ How can we calculate area of a rectangle? ▸ Why can we multiply the lengths of adjacent sides? ▸ What are 'length' and 'width'? ▸ How could we multiply the rectangle's length by its width? ▸ What are imperial units of measurement for area?

AREA –EXTEND TO HECTARES, SQUARE KILOMETRES.

EXPLICIT TEACHING PLAN

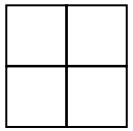
FULL EXPLICIT TEACHING PLAN, EMBEDDING DEEP RELATIONAL UNDERSTANDING, METALANGUAGE, AND QUESTIONS THAT MAY BE USED OVER MULTIPLE LESSONS.

WHAT COULD WE DO?	WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?
Children think about, talk and listen to a friend about, then have the opportunity to share what they already know.	▸ 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?
Display a shape on a square centimetre grid, for example, 	▸ **We've investigated area.** ▸ And we found that area is the amount of space a shape or a flat surface takes up in 2 dimensions. ▸ We found that the square is the best shape to measure area because when we changed its orientation, it takes up exactly the same space. ▸ We've investigated the metric system of measurement. ▸ We found that we could measure lengths using centimetres and metres because centimetres and metres have length. ▸ We investigated how the French mathematician turned these length units into squares to measure area. ▸ We found that we could measure area in square centimetres and square metres because square centimetres and square metres have area.
Display the square centimetre and the square metre, created by adding a dimension to the centimetre and the metre to make a square, for example, x 10 x 10 x 10x 10 x 10 x 10 kilometre hectometre decametre metre decimetre centimetre millimetre ÷ 10 ÷ 10 ÷ 10 ÷ 10 ÷ 10 ÷ 10 	

Display 2 square centimetres, for example, 

Record, for example,  Area = 2 square centimetres

Make a model that is 2 centimetres square/d, for example, 

Record, for example,  2 centimetres square/d
Area = 4 square centimetres

Record, for example, square centimetres = cm^2

Record, for example, 1 square centimetre = 1 cm^2

Record, for example, 1^2 cm

Record a line through the incorrect recording, for example, ~~1^2 cm~~

Display, for example, 1 square centimetre = 1 cm^2

- We found that a square centimetre is a square with its dimensions 1 centimetre long.
- And a square metre is a square with its dimensions 1 metre long.
- We found that a square centimetre and a square metre are units of measurement for area.
- And a centimetre square/d and a metre square/d are descriptions of shapes.
- We found that 2 centimetre square/d is a square with dimensions of 2 centimetres and an area of 4 square centimetres.
- We found that 2 metre square/d is a square with dimensions of 2 metres and an area of 4 square metres.

- In mathematics we have symbols for everything so that everyone around the world can read it.
- Not everyone can read 'square centimetres'.
- So we have a symbol that says square centimetres.
- The symbol is cm^2
- The cm means centimetres.
- And the small 2 means squared.
- So 1 square centimetre looks like this.

- Are you thinking it looks like it says centimetres square/d?
- Are you thinking the small 2 that says squared should be before the cm?

- Let's see what 1 square centimetre would look like if we recorded the square symbol and then the centimetre symbol.
- Does it look like the symbol for the square is on the 1 not the centimetre?
- So the symbol cm^2 says square centimetre, and not centimetre square/d.

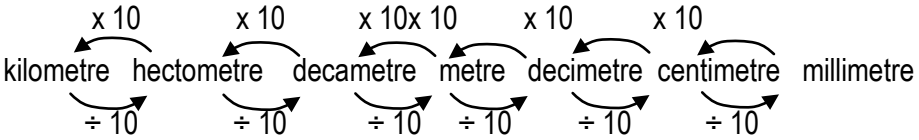
Children record 3 square centimetres as 3 cm^2

- How would we record 3 square centimetres?
- When you are ready to explain what the symbol says, you can start to record square centimetres using the symbol instead of the words.

Children record 3 square metres as 3 m^2

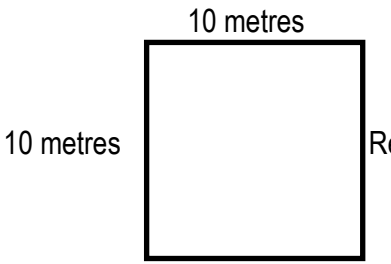
- How could we record 3 square metres?

Display the metric measurement chart for length, for example,



- So we've investigated how the French mathematicians turned these length units into squares to measure area.
- **Do you think they also added a dimension to a decametre, a hectometre and a kilometre to change them into squares to measure areas of even larger shapes and flat surfaces?**
- If we add a dimension to a decametre to make a square, what would be the dimensions of the square?
- Would the dimensions of the square be 10 metres by 10 metres?
- Would the unit of measurement be a square decametre?
- Do we use square decametres to measure area?
- We don't use square decametres to measure area, but we could!

Record a square labelled 10 metres by 10 metres, for example,

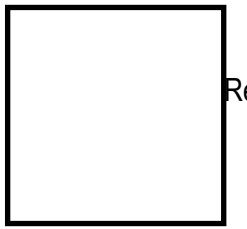


Record, for example, square decametre

- If we add a dimension to a hectometre to make a square, what would be the

Record a square labelled 100 metres by 100 metres, for example,

100 metres

100 metres  Record, for example, hectare

Record, for example, square hectometre

Underline the ‘are’ and the ‘hect’, for example, squarehectometre

dimensions of the square?

- Would the dimensions of the square be 100 metres by 100 metres?

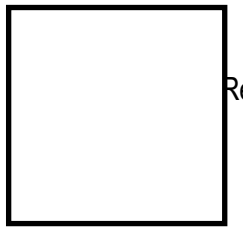
- Would the unit of measurement be a square hectometre?
- That would make sense!
- But instead it’s called a hectare.

- Does the word ‘hectare’ look a little like the words ‘square hectometre’?
- Do we use hectares to measure area?
- We do use hectares to measure area!
- We measure land for houses and farms in hectares.

- If we add a dimension to a kilometre to make a square, what would be the dimensions of the square?

Record a square labelled 1000 metres by 1000 metres, for example,

1000 metres

1000 metres  Record, for example, square kilometre

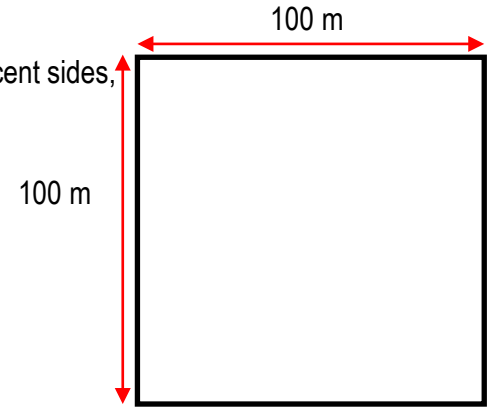
- Would the dimensions of the square be 1000 metres by 1000 metres?
- Would the unit of measurement be a square kilometre?

- Do we use square kilometre to measure area?
- We do use square kilometre to measure area!
- We measure cities in square kilometres.

- **Let’s investigate the size of a hectare.**

Children identify that a hectare has 100 square metres in each row. Children identify each square metre is 1 metre long. Children identify that the length of the row is 100 metres. Children identify that a hectare has 100 rows. Children identify that each row is 1 metre long. Children identify that the total length of the rows is 100 metres. Children multiply the number of square metres in each row, by the number of rows, for example, 100 x 100.	► How many square metres does a hectare have in each row? ► Does a hectare have 100 square metres in each row? ► What is the length of a square metre? ► Is the length of a square metre, 1 metre? ► If we have 100 square metres in a row, what is the length of the row? ► Is the length of the row, 100 metres? ► How many rows of square metres does a hectare have? ► Does a hectare have 100 rows? ► Is the length of each row, 1 metre? ► If the length of each row is 1 metre, what is the total length of the rows? ► Is the total length of the rows, 100 metres? ► So we have 100 rows, of 100 square metres. How many square metres altogether? ► What is 100 times 100? ► When we multiply by 100, what happens to the digits? ► Do the digits move 2 places to the left? ► Is 100 times 100, 10 000? ► Is the area of a hectare, 10 000 square metres? ► If there are 100 square metres in the row, is the length of the side, 100 metres?

Display the length of the adjacent sides, for example,



Record, for example, 100 x 100 = 10 000

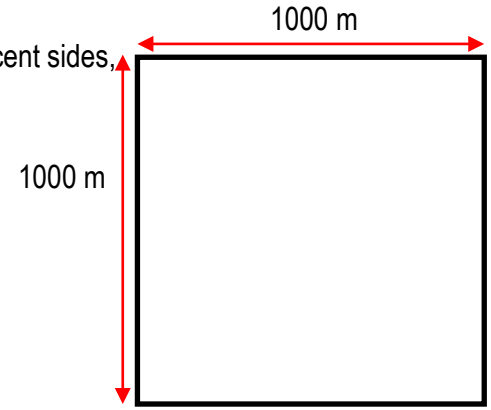
Record, for example, Area of a hectare = 10 000 square metres

Record, for example, Area = length x width

- If there are 100 rows of square metres, is the length of the side, 100 metres?
- To work out the area of the hectare, could we multiply the length of one side by the length of the adjacent side?
- What is 100 times 100?
- When we multiply by 100, what happens to the digits?
- Do the digits move 2 places to the left?
- Is 100 times 100, 10 000?
- Is the area of a hectare, 10 000 square metres?
- When we work out the area of the hectare, by multiplying the length of one side by the length of the adjacent side, what could we call each side?
- Could we call one side the length of the square?
- Does it matter which side we call ‘length’?
- Could we call the adjacent side, the width of the square?
- Does it matter which side we call ‘width’?
- Did we calculate the area by multiplying the length of the square by the width of the square?
- Did we multiply length by width to find the area?
- **Let’s investigate the size of a square kilometre.**
- How many square metres does a square kilometre have in each row?

Children identify that a square kilometre has 1000 square metres in each row. Children identify each square metre is 1 metre long. Children identify that the length of the row is 1000 metres. Children identify that a square kilometre has 1000 rows. Children identify that each row is 1 metre long. Children identify that the total length of the rows is 1000 metres. Children multiply the number of square metres in each row, by the number of rows, for example, 1000 x 1000.	► Does a square kilometre have 1000 square metres in each row? ► What is the length of a square metre? ► Is the length of a square metre, 1 metre? ► If we have 1000 square metres in a row, what is the length of the row? ► Is the length of the row, 1000 metres? ► How many rows of square metres does a square kilometre have? ► Does a square kilometre have 1000 rows? ► Is the length of each row, 1 metre? ► If the length of each row is 1 metre, what is the total length of the rows? ► Is the total length of the rows, 1000 metres? ► So we have 1000 rows, of 1000 square metres. How many square metres altogether? ► What is 1000 times 1000? ► When we multiply by 1000, what happens to the digits? ► Do the digits move 3 places to the left? ► Is 1000 times 1000, 1 000 000? ► Is the area of a square kilometre, 1 000 000 square metres? ► If there are 1000 square metres in the row, is the length of the side, 1000 metres? ► If there are 1000 rows of square metres, is the length of the side, 1000 metres? ► To work out the area of the square kilometre, could we multiply the length of one

Display the length of the adjacent sides, for example,



Record, for example, 1000 x 1000 = 1 000 000

Record, for example, Area of a square kilometre = 1 000 000 square metres

Record, for example, Area = length x width

Record, for example, Area of a square kilometre = 1 000 000 m^2

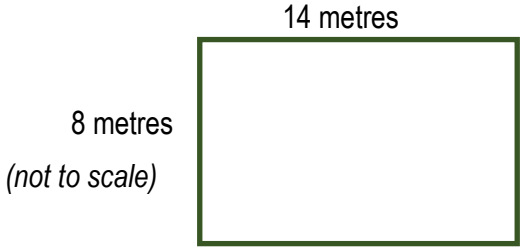
side by the length of the adjacent side?

- What is 1000 times 1000?
- When we multiply by 1000, what happens to the digits?
- Do the digits move 3 places to the left?
- Is 1000 times 1000, 1 000 000?
- Is the area of a square kilometre, 1 000 000 square metres?

- When we work out the area of the square kilometre, by multiplying the length of one side by the length of the adjacent side, what could we call each side?
- Could we call one side the length of the square?
- Does it matter which side we call 'length'?
- Could we call the adjacent side, the width of the square?
- Does it matter which side we call 'width'?
- Did we calculate the area by multiplying the length of the square by the width of the square?
- Did we multiply length by width to find the area?
- How would we record square kilometres using a symbol?
- Would we record square kilometres as km^2

- **What if we wanted to find the area of a rectangle with sides 14 metres by 8 metres?**
- Drawing a rectangle 14 metres by 8 metres would be VERY large!

Display a rectangle labelled 14 m by 8 m, for example,



Record, for example, Area = length x width

Record, for example, length = 14 metres

Record, for example, width = 8 metres

Record, for example, 14 x 8 =

10 + 4

10 x 8 = 80

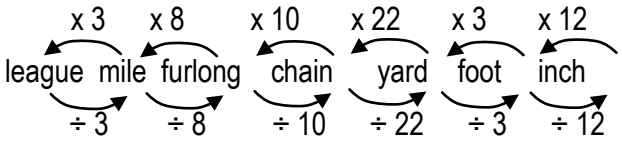
4 x 8 = 32

80 + 32 = 112

Record, for example, Area = 112 m^2

- Could we work out the area without drawing the rectangle? Let's investigate!
- Could we multiply the number of square metres in each row by the number of rows?
- If we multiply the number of square metres in each row by the number of rows, are we multiplying the lengths of the adjacent sides?
- Could we call the length of one side, length?
- Could we call the adjacent side, width?
- Does it matter which side we call 'width' and which side we call 'length'?
- Could we multiply the 'length' by the 'width' to calculate the area of the rectangle?
- What is the length of the rectangle?
- Is the length 14 metres?
- What is the width of the rectangle?
- Is the width 8 metres?
- Could we multiply 14 by 8?
- What is 14 times 8?
- Could we use the distributive property to multiply 14 by 8?
- Is 14 times 8, 10 times 8 plus 4 times 8?
- Is 14 times 8, 80 plus 32?
- Is 14 times 8, 112?

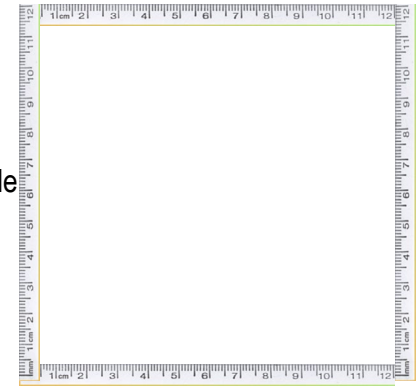
Is the area of the rectangle, 112 square metres?



Record, for example, foot 

Display a foot long ruler, for example,

Record, for example, square foot

Demonstrate the area of a square foot by making a square using 4 rulers, for example 

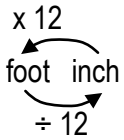
- We've investigated the metric systems units of measurement for area.
- And we found that the French mathematician who invented it about 300 years ago, based the metric system on place value which creates values by multiplying and dividing by 10.
- The French mathematician started with a metre, which he then multiplied and divided by 10 to get larger and smaller units of measurement.
- The French mathematician added a dimension to the units of measurement for length to create squares.

- We've investigated the units of measurement that the metric units of measurement for length replaced.
- **And we found that the measurement system was called the Imperial system because its units were created over many centuries by different empires.**
- We found that the Imperial system was difficult to use because it multiplied and divided by different numbers.

- Today we're going to investigate the units of measurement in the Imperial system for measuring area.
- We know that the Imperial system had a unit of length called a foot.
- We know that a foot is about the length of your ruler.
- We know that some countries still measure things in feet.
- We know that we can buy a 'foot long' sub at Subway!
- We know that squares are the best shape to measure area.
- So the foot was turned into a square, and called a square foot.

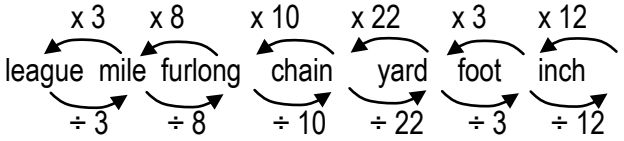
Display an inch on the ruler, for example, 

Record, for example,

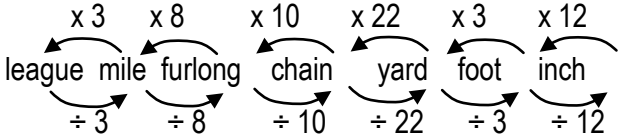


Record, for example, square inch, 

Display, for example,



Display, for example,



Record, for example, chain x furlong = acre

Chain = 22 yards

Furlong = 220 yards

Acre = chain x furlong = 22 yards x 220 yards =

Use a calculator to work out the area of an acre in square yards.

Acre = = chain x furlong = 22 yards x 220 yards = 4840 square yards

- We know that the Imperial system had a unit of length called an inch to measure shorter lengths.
- We know that the foot was divided into 12 parts to create an inch.
- And if we have 12 inches, we have a foot.
- We know that we can buy a ‘’six inch’ sub at Subway which is half of a foot!
- To measure the area of smaller shapes and surfaces, people just turned the inch into a square and called it square inch.

- We know that the Imperial system had a unit of measurement called a yard. A yard is 3 feet long.
- To measure area, the yard was turned into a square, to make a square yard.
- We know that the Imperial system had units of measurement called chains and furlongs.
- To measure the area of larger shapes and surfaces, the imperial system multiplied a chain by a furlong.
- They called this unit of measurement an acre.
- You may have heard of acres, for example, Winnie the Pooh lived in the ‘Hundred Acre Wood’.
- So an acre is a chain times a furlong.
- A chain is 22 yards.
- And a furlong is 10 chains, so 220 yards.
- So an acre is 22 yards times 220 yards which equals 4840 square yards.

Record, for example, an acre = about $\frac{4}{10}$ hectare	► A square yard is a little smaller than a square metre, so an acre is about 4000 square metres. ► A hectare is 10 000 square metres, so an acre is less than half a hectare. ► So an acre is about 4 tenths of a hectare. ► You don't have to remember any of this! ► You just need to be aware that there is another system of measurement. ► And that the metric system is much more efficient because it is based on place value!