DESCRIBE PATTERNS WITH NUMBERS AND IDENTIFY MISSING ELEMENTS.

1. Read and plan first Investigation

The first Guided, Independent, and Extension Investigation follows the Explicit Teaching Plan and Video.

2. Plan to differentiate the first lesson

See Differentiate and Intervention for children who, in your Professional Teacher Judgement, may be unable to access the Investigation.

3. Guide children through the Investigation

Guide children through the Investigation until they can follow the Investigation process to Investigate independently.

In this step, children are simply learning how they will investigate – they may not be learning any maths yet.

4. Children Investigate Independently

Children begin to investigate independently when they can follow the Investigation process.

In this step children begin to demonstrate their current Level of understanding, which may be at, below or above the Level of this Investigation.

5. Collect books, place in Levels

At the end of every lesson, collect children's books and place them in piles of demonstrated Levels of understanding.

These Levels will inform how you differentiate the Explicit Teaching and Investigation in the next lesson.

6. Plan to differentiate next lesson

Identify children who are ready to investigate Intervention, a lower Level, current Independent Level, the Extension Level, or an Enrichment Level in the next lesson.

See Differentiate, Intervention, Enrichment for advice on how to differentiate to ensure every child is investigating independently at their leading edge.

7. Children Investigate – Guided, then Independent

In every lesson, children continue to Investigate, increasing their Levels of understanding and metalanguage to explain.

Children are guided, then begin to investigate independently when they can follow the Investigation process.

8. Repeat steps 5 - 7

Planning, Implementing, and Evaluating Quality Differentiated Maths Lessons Embedding Assessment

During investigation, because every child is investigating independently at their leading edge, you are free to:
– Roam, Guide, Observe, Listen to and Question every child;
- Provide just enough support to children who are experiencing productive struggle;
- Guide children to move between levels, both up and down, as appropriate to their developing understanding.

Because you have Differentiated, and provided Intervention, even the children with the lowest Levels of understanding do not need an adult sitting with them, because they, like every child, are investigating at their leading edge. Because you have Differentiated and provided Enrichment, the children with the highest Levels of understanding are able to investigate at their leading edge.

The first Investigation follows the Explicit Teaching Plan and Video. Guide children through the Investigation until they are ready to investigate independently.

AREA OF TRIANGLES.

INVESTIGATION AND REFLECTION OVERVIEW PAGES

Use your professional teacher judgement to select an Investigation that will deepen your children's relational understanding and increase their metalanguage.

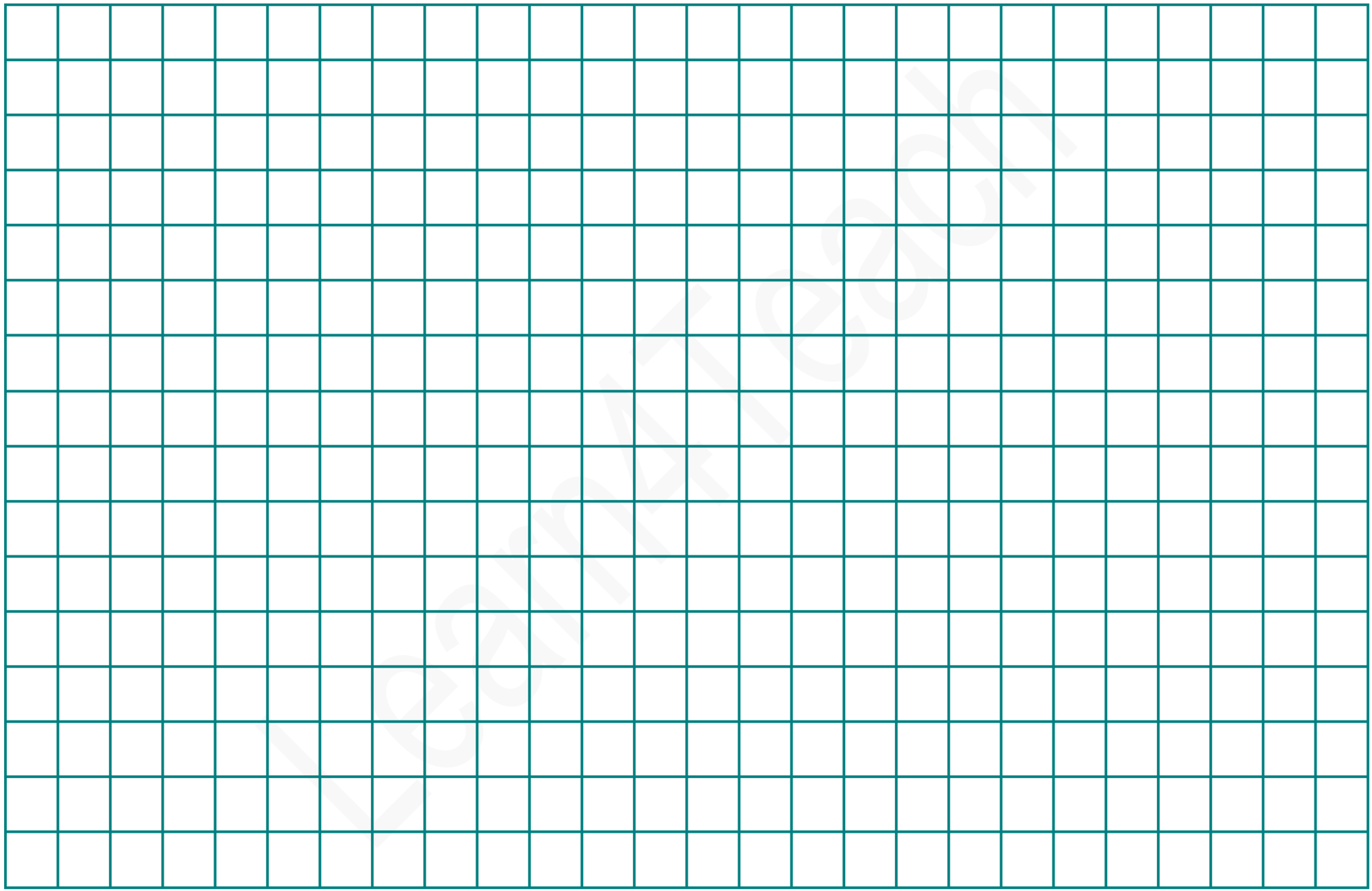
Creating triangles by folding a square in half.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a square. They work out the area of the square. They fold the square in half along one diagonal, from one vertex to the opposite vertex. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the square. They cut out the triangles and superimpose them to show they are equal halves of the square. Reflection: Why is the area of a triangle half of the area of the square it was formed from?
Creating triangles by folding rectangles in half.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a rectangle. They work out the area of the rectangle. They fold the rectangle in half along one diagonal, from one vertex to the opposite vertex. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the rectangle. They cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the rectangles. Reflection: Why is the area of a triangle half of the area of the rectangle it was formed from?
Calculating the area of triangles formed by folding a square in half.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a square. They work out the area of the square. They explain the area of the square can be worked out by multiplying the number of square centimetres in 1 row, by the number of rows. They explain that the length of one side in centimetres, is the same as the number of square centimetres in the row, and that the length of one adjacent side in centimetres, is the same as the number of rows of square centimetres. They record how they calculated the area of the square by multiplying the lengths of the adjacent sides together, naming the length of one side 'length', and the length of the adjacent side 'width'. They record that they calculated the area of the square by multiplying 'length' by 'width'. They fold the square in half along one diagonal, from one vertex to the opposite vertex. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the square. They name the length of the square the 'base' of the triangle, and the width of the square the height of the triangle. They explain that because the area of a square is length times width, and the triangle is half of the square, the area of the triangle is half of the base times the height. They cut out the triangles and superimpose them to show they are equal halves of the square. Reflection: How can we use what we know about calculating area of a square to calculate the area of a triangle?

Calculating the area of triangles formed by folding a rectangle in half.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a rectangle. They work out the area of the rectangle. They explain the area of the rectangle can be worked out by multiplying the number of square centimetres in 1 row, by the number of rows. They explain that the length of one side in centimetres, is the same as the number of square centimetres in the row, and that the length of one adjacent side in centimetres, is the same as the number of rows of square centimetres. They record how they calculated the area of the rectangle by multiplying the lengths of the adjacent sides together, naming the length of one side 'length', and the length of the adjacent side 'width'. They record that they calculated the area of the rectangle by multiplying 'length' by 'width'. They fold the rectangle in half along one diagonal, from one vertex to the opposite vertex. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the rectangle. They name the length of the rectangle the 'base' of the triangle, and the width of the rectangle the height of the triangle. They explain that because the area of a rectangle is length times width, and the triangle is half of the rectangle, the area of the triangle is half of the base times the height. They cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the rectangle. Reflection: How can we use what we know about calculating area of a rectangle to calculate the area of a triangle?
Creating triangles by drawing lines from base vertices to a point on the opposite side of a square.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a square. They work out the area of the square. They create a triangle by ruling a line from one vertex at the end of a side of the square to a point on the opposite side of the square, and a line from the vertex at the other end of the same side of the square to the same point on the opposite side of the square. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the square. They cut out the remaining 2 triangles, place them together to form a triangle that is exactly the same as the triangle they measured the area of, and superimpose them to show they are equal halves of the square. They repeat by placing the third vertex of the triangle on a different point on the square's opposite side. Reflection: Why is the area of a triangle half of the area of the square it was formed from?
Creating triangles by drawing lines from base vertices to a point on the opposite side of a rectangle.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a rectangle. They work out the area of the rectangle. They create a triangle by ruling a line from one vertex at the end of a side of the rectangle to a point on the opposite side of the rectangle, and a line from the vertex at the other end of the same side of the rectangle to the same point on the opposite side of the rectangle. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the rectangle. They cut out the remaining 2 triangles, place them together to form a triangle that is exactly the same as the triangle they measured the area of, and superimpose them to show they are equal halves of the rectangle. They repeat by placing the third vertex of the triangle on a different point on the rectangle's opposite side. Reflection: Why is the area of a triangle half of the area of the rectangle it was formed from?

Calculating the area of triangles formed by drawing lines from base vertices to a point on the opposite side of a square.	• In pairs, children each have a sheet of square centimetre grid paper. They each cut out a square. They work out the area of the square. They explain the area of the square can be worked out by multiplying the number of square centimetres in 1 row, by the number of rows. They explain that the length of one side in centimetres, is the same as the number of square centimetres in the row, and that the length of one adjacent side in centimetres, is the same as the number of rows of square centimetres. They record how they calculated the area of the square by multiplying the lengths of the adjacent sides together, naming the length of one side 'length', and the length of the adjacent side 'width'. They record that they calculated the area of the square by multiplying 'length' by 'width'. They create a triangle by ruling a line from one vertex at the end of a side of the square to a point on the opposite side of the square, and a line from the vertex at the other end of the same side of the square to the same point on the opposite side of the square. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the square. They name the length of the square the 'base' of the triangle, and the width of the square the height of the triangle. They explain that because the area of a square is length times width, and the triangle is half of the square, the area of the triangle is half of the base times the height. They cut out the remaining 2 triangles, place them together to form a triangle that is exactly the same as the triangle they measured the area of, and superimpose them to show they are equal halves of the square. They repeat by placing the third vertex of the triangle on a different point on the square's opposite side. Reflection: How can we use what we know about calculating area of a square to calculate the area of a triangle?
Calculating the area of triangles formed by drawing lines from base vertices to a point on the opposite side of a square.	• In pairs, children each have a sheet of rectangle centimetre grid paper. They each cut out a rectangle. They work out the area of the rectangle. They explain the area of the rectangle can be worked out by multiplying the number of square centimetres in 1 row, by the number of rows. They explain that the length of one side in centimetres, is the same as the number of square centimetres in the row, and that the length of one adjacent side in centimetres, is the same as the number of rows of square centimetres. They record how they calculated the area of the rectangle by multiplying the lengths of the adjacent sides together, naming the length of one side 'length', and the length of the adjacent side 'width'. They record that they calculated the area of the rectangle by multiplying 'length' by 'width'. They create a triangle by ruling a line from one vertex at the end of a side of the rectangle to a point on the opposite side of the rectangle, and a line from the vertex at the other end of the same side of the rectangle to the same point on the opposite side of the rectangle. They work out the area of the resulting triangle. They explain that the area of the triangle is half of the area of the rectangle. They name the length of the rectangle the 'base' of the triangle, and the width of the rectangle the height of the triangle. They explain that because the area of a rectangle is length times width, and the triangle is half of the rectangle, the area of the triangle is half of the base times the height. They cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the rectangles. They repeat by placing the third vertex of the triangle on a different point on the rectangle's opposite side. Reflection: How can we use what we know about calculating area of a rectangle to calculate the area of a triangle?

Explaining that the placement of the third vertex of the triangle along the rectangles opposite side, does not affect the triangle's base length, height or area. Calculating the area of triangle by constructing a rectangle around it.	• In pairs, each child draws a rectangle with the same dimensions. Each child creates a triangle from the rectangle by ruling a line from one vertex at the end of a side of the rectangle to a point on the opposite side of the rectangle, and a line from the vertex at the other end of the same side of the rectangle to the same point on the opposite side of the rectangle. Each child chooses a different point on the opposite side of the rectangle – including the ends or vertex of the rectangle. They each work out the area of the triangle. They identify that the placement of the third vertex of the triangle along the rectangle's opposite side does not affect the triangle's base length, height or area. Reflection: Why does the placement of the third vertex of the triangle along the rectangle's opposite side not affect the triangle's base length, height or area? • In pairs, children draw a triangle on grid paper. They create a rectangle around the triangle so that 2 of the triangle's vertices lie on 2 adjacent vertices of the rectangle, and the triangle's 3rd vertex lies on the opposite side of the rectangle. They use the length and width of the rectangle to work out the base length and height of the triangle. They calculate the area of the triangle by multiplying the base length by the height, then halving. Reflection: How can we use the area of a rectangle to calculate area of a triangle?

MEASUREMENT AND GEOMETRY 61 – INVESTIGATING AREA OF TRIANGLES



Investigating Area of Triangles

Sit with a friend.

Each of you have a sheet of square centimetre grid paper.

Each of you cut out a square.

Each of you work out the area of your square.

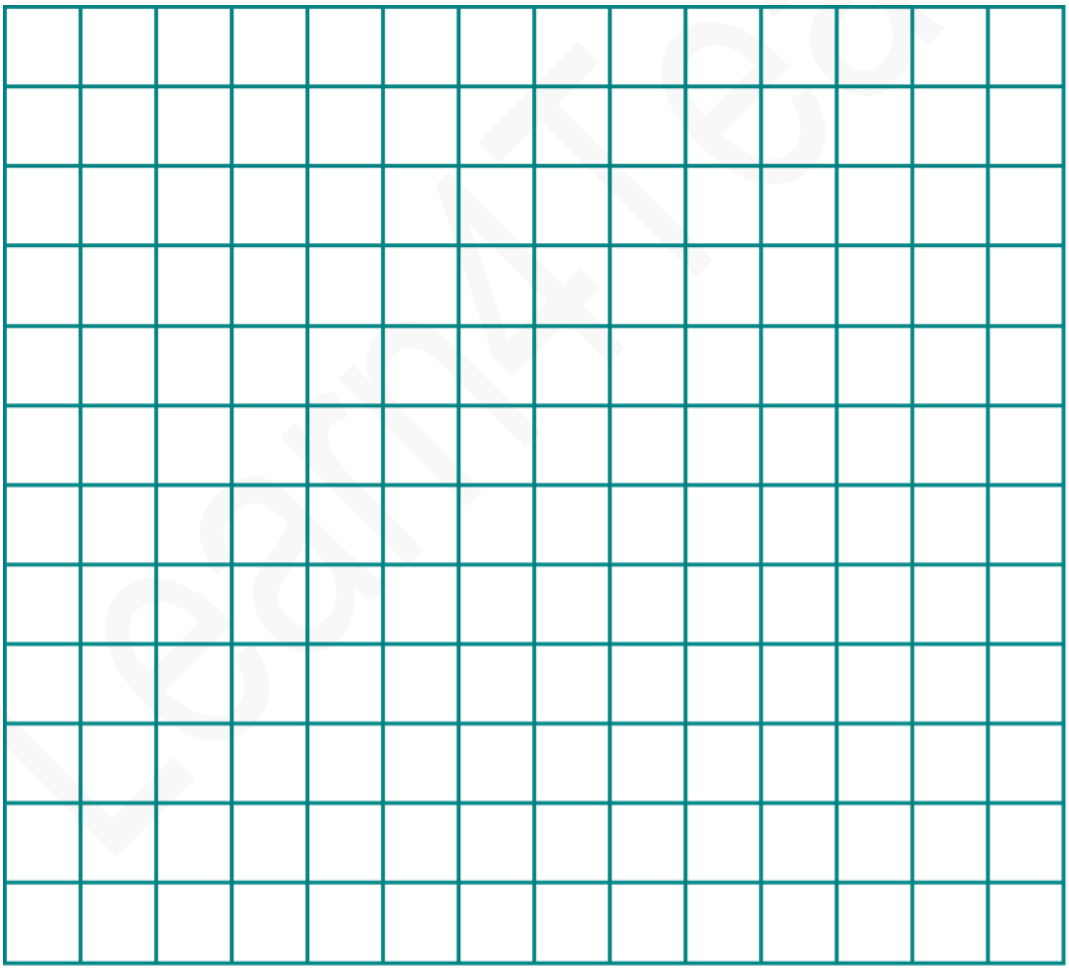
Fold the square in half along one diagonal, from one vertex to the opposite vertex.

Work out the area of the resulting triangle.

Explain that the area of the triangle is half of the area of the square.

Cut out the triangles and superimpose them to show they are equal halves of the square.

Reflection: Why is the area of a triangle half of the area of the square it was formed from?



Investigating Area of Triangles

Sit with a friend.

Each of you have a sheet of square centimetre grid paper.

Each of you cut out a rectangle.

Each of you work out the area of your rectangle.

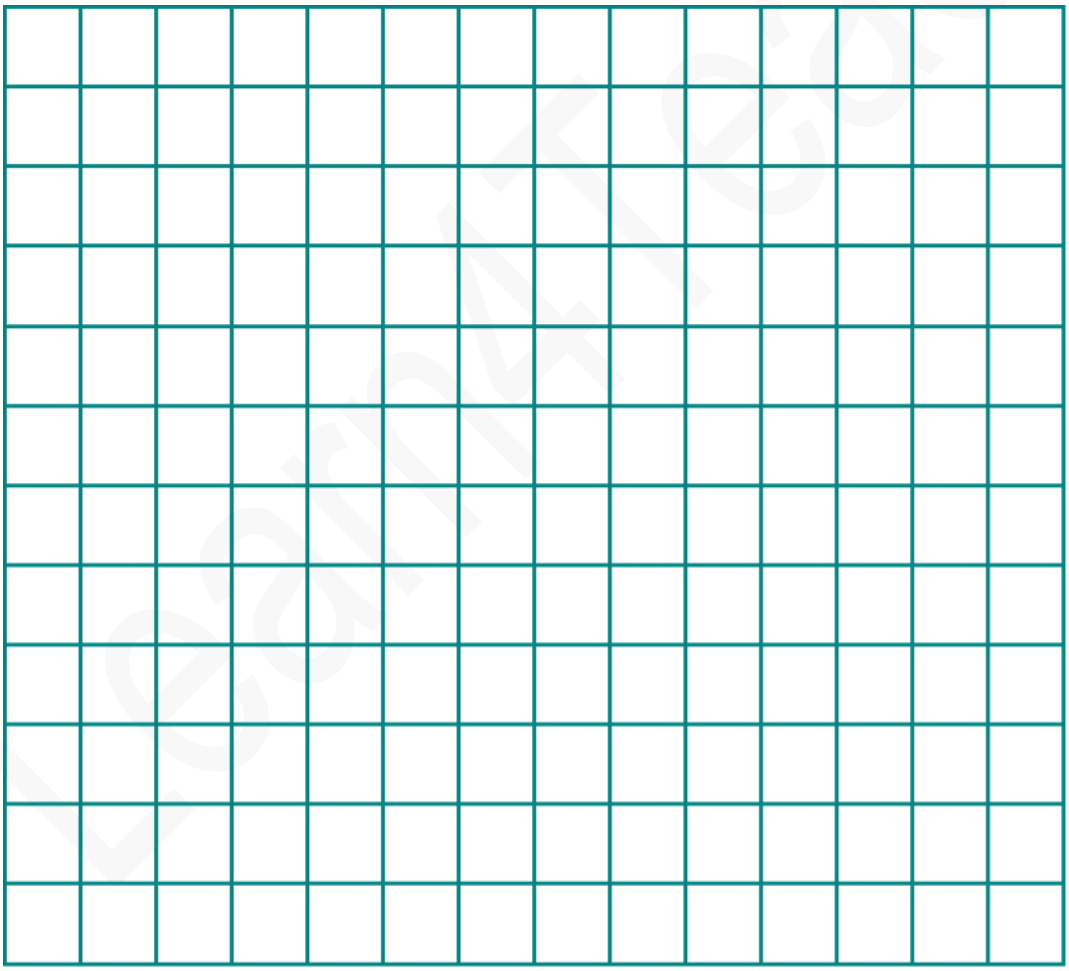
Fold the rectangle in half along one diagonal, from one vertex to the opposite vertex.

Work out the area of the resulting triangle.

Explain that the area of the triangle is half of the area of the rectangle.

Cut out the triangles and superimpose them to show they are equal halves of the rectangle.

Reflection: Why is the area of a triangle half of the area of the rectangle it was formed from?



Investigating Area of Triangles

Sit with a friend. Each of you have a sheet of square centimetre grid paper.

Each of you cut out a square.

Each of you work out the area of your square.

- How can the area of the square be worked out by multiplying the number of square centimetres in 1 row, by the number of rows?
- Is the length of one side in centimetres, the same as the number of square centimetres in the row?
- Is the length of one adjacent side in centimetres, the same as the number of rows of square centimetres?
- Why can we calculate the area of the square by multiplying the lengths of the adjacent sides together?
- If we name the length of one side 'length', and the length of the adjacent side 'width', why could we record that we calculate the area of the square by multiplying 'length' by 'width'?

Fold the square in half along one diagonal, from one vertex to the opposite vertex.

Work out the area of the resulting triangle.

- Explain why the area of the triangle is half of the area of the square.

Name the length of the square the 'base' of the triangle, and the width of the square the height of the triangle.

- Why can we calculate the area of the triangle by multiplying the base times the height and then halving?

Cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the square.

Reflection: How can we use what we know about calculating area of a square to calculate the area of a triangle?

Investigating Area of Triangles

Sit with a friend. Each of you have a sheet of square centimetre grid paper.

Each of you cut out a rectangle.

Each of you work out the area of your rectangle.

- How can the area of the rectangle be worked out by multiplying the number of square centimetres in 1 row, by the number of rows?
- Is the length of one side in centimetres, the same as the number of square centimetres in the row?
- Is the length of one adjacent side in centimetres, the same as the number of rows of square centimetres?
- Why can we calculate the area of the rectangle by multiplying the lengths of the adjacent sides together?
- If we name the length of one side 'length', and the length of the adjacent side 'width', why could we record that we calculate the area of the rectangle by multiplying 'length' by 'width'?

Fold the rectangle in half along one diagonal, from one vertex to the opposite vertex.

Work out the area of the resulting triangle.

- Explain why the area of the triangle is half of the area of the rectangle.

Name the length of the rectangle the 'base' of the triangle, and the width of the rectangle the height of the triangle.

- Why can we calculate the area of the triangle by multiplying the base times the height and then halving?

Cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the square.

Reflection: How can we use what we know about calculating area of a square to calculate the area of a triangle?

Investigating Area of Triangles

Sit with a friend.

Each of you have a sheet of square centimetre grid paper.

Each of you cut out a square.

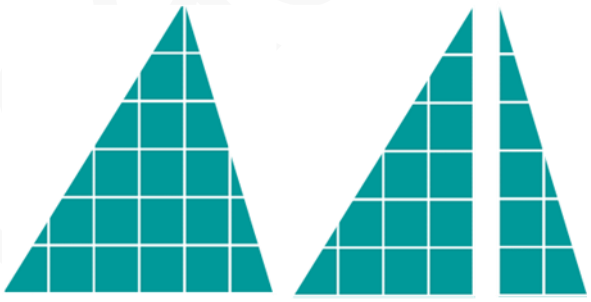
Each of you work out the area of your square.

Create a triangle by ruling a line from one vertex at the end of a side of the square to a point on the opposite side of the square, and a line from the vertex at the other end of the same side of the square to the same point on the opposite side of the square, for example,

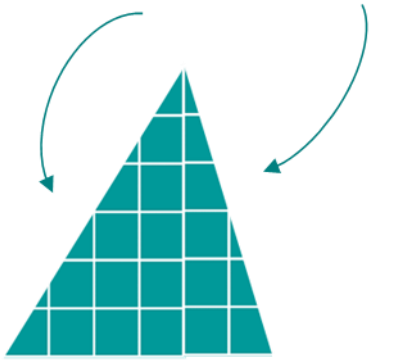
Work out the area of the resulting triangle.

Explain that the area of the triangle is half of the area of the square.

Cut out the other 2 triangles, for example,



Rotate and reflect one of them to create a triangle, and superimpose them on the original triangle, to show they are equal halves of the square, for example,



Reflection: Why is the area of a triangle half of the area of the square it was formed from?

Investigating Area of Triangles

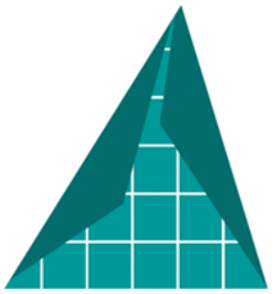
Sit with a friend.

Each of you have a sheet of square centimetre grid paper.

Each of you cut out a rectangle.

Each of you work out the area of your rectangle.

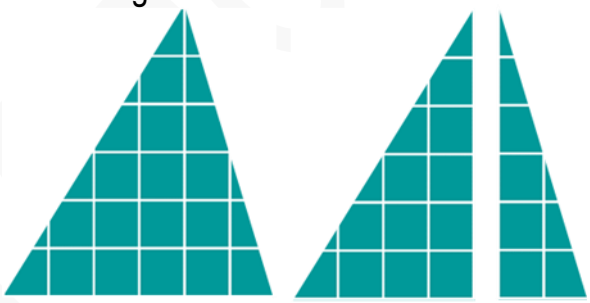
Create a triangle by ruling a line from one vertex at the end of a side of the rectangle to a point on the opposite side of the rectangle, and a line from the vertex at the other end of the same side of the rectangle to the same point on the opposite side of the square, for example,



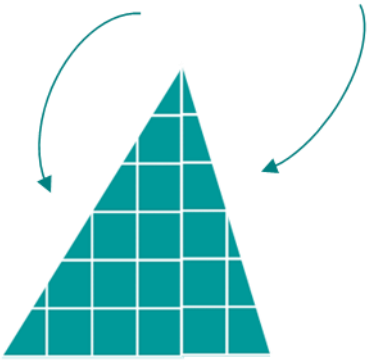
Work out the area of the resulting triangle.

Explain that the area of the triangle is half of the area of the rectangle.

Cut out the other 2 triangles, for example,



Rotate and reflect one of them to create a triangle, and superimpose them on the original triangle, to show they are equal halves of the rectangle, for example,



Reflection: Why is the area of a triangle half of the area of the rectangle it was formed from?

Investigating Area of Triangles

Sit with a friend. Each of you have a sheet of square centimetre grid paper.

Each of you cut out a square. Each of you work out the area of your square.

- How can the area of the square can be worked out by multiplying the number of square centimetres in 1 row, by the number of rows?
- Is the length of 1 side in centimetres, the same as the number of square centimetres in the row?
- Is the length of one adjacent side in centimetres, the same as the number of rows of square centimetres?
- Why can we calculate the area of the square by multiplying the lengths of the adjacent sides together?
- If we name the length of one side 'length', and the length of the adjacent side 'width', why could we record that we calculate the area of the square by multiplying 'length' by 'width'?

Create a triangle by ruling a line from one vertex at the end of a side of the square to a point on the opposite side of the square, and a line from the vertex at the other end of the same side of the square to the same point on the opposite side of the square, for example,

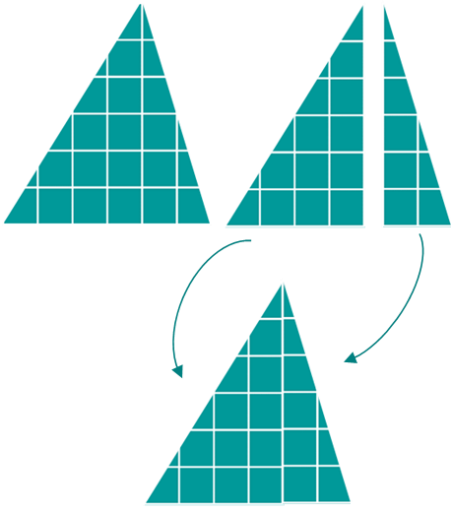
Work out the area of the resulting triangle.

- Explain why the area of the triangle is half of the area of the square.

Name the length of the square the 'base' of the triangle, and the width of the square the height of the triangle.

- Why can we calculate the area of the triangle by multiplying the base times the height and then halving?

Cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the square, for example,



Reflection: How can we use what we know about calculating area of a square to calculate the area of a triangle?

Investigating Area of Triangles

Sit with a friend. Each of you have a sheet of square centimetre grid paper.

Each of you cut out a rectangle.

Each of you work out the area of your rectangle.

- How can the area of the rectangle can be worked out by multiplying the number of square centimetres in 1 row, by the number of rows?
- Is the length of 1 side in centimetres, the same as the number of square centimetres in the row?
- Is the length of one adjacent side in centimetres, the same as the number of rows of square centimetres?
- Why can we calculate the area of the rectangle by multiplying the lengths of the adjacent sides together?
- If we name the length of one side 'length', and the length of the adjacent side 'width', why could we record that we calculate the area of the rectangle by multiplying 'length' by 'width'?

Create a triangle by ruling a line from one vertex at the end of a side of the rectangle to a point on the opposite side of the rectangle, and a line from the vertex at the other end of the same side of the rectangle to the same point on the opposite side of the rectangle, for example,

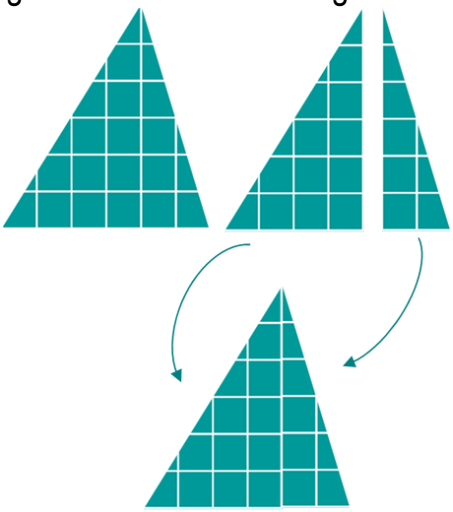
Work out the area of the resulting triangle.

- Explain why the area of the triangle is half of the area of the rectangle.

Name the length of the rectangle the 'base' of the triangle, and the width of the rectangle the height of the triangle.

- Why can we calculate the area of the triangle by multiplying the base times the height and then halving?

Cut out the triangles, rotate and reflect one of them, and superimpose them to show they are equal halves of the rectangle, for example,



Reflection: How can we use what we know about calculating area of a rectangle to calculate the area of a triangle?

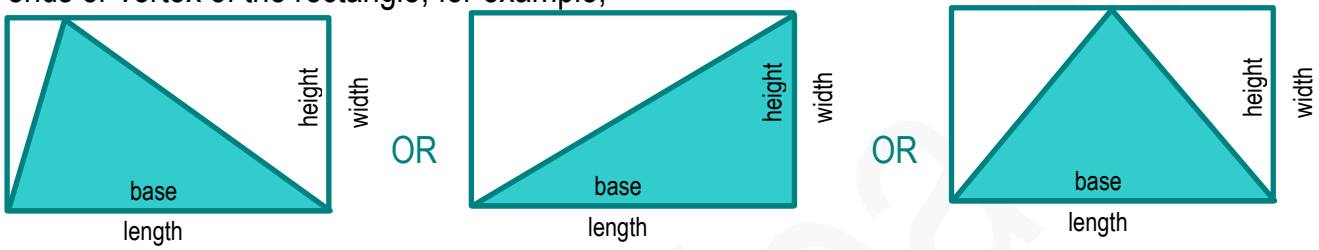
Investigating Area of Triangles

Sit with a friend.

Each of you draw a rectangle with the same dimensions.

Each of you create a triangle from the rectangle by ruling a line from one vertex at the end of a side of the rectangle to a point on the opposite side of the rectangle, and a line from the vertex at the other end of the same side of the rectangle to the same point on the opposite side of the rectangle.

Each of you chooses a different point on the opposite side of the rectangle – including the ends or vertex of the rectangle, for example,



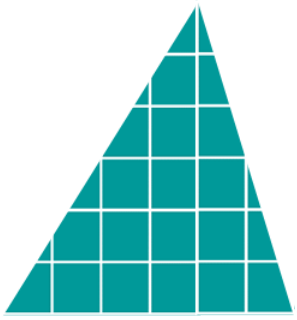
Each of you work out the area of the triangle formed from the same-sized rectangle.

Does the placement of the third vertex of the triangle along the rectangle's opposite side does not affect the triangle's base length, height or area?

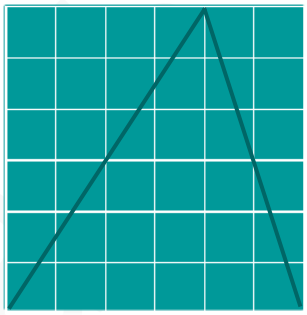
Reflection: Why does the placement of the third vertex of the triangle along the rectangle's opposite side not affect the triangle's base length, height or area?

Investigating Area of Triangles

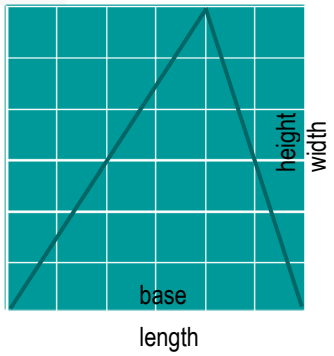
Draw a triangle on square centimetre grid paper, for example,



Create a rectangle around the triangle so that 2 of the triangle's vertices lie on 2 adjacent vertices of the rectangle, and the triangle's 3rd vertex lies on the opposite side of the rectangle, for example,



Use the length and width of the rectangle to work out the base length and height of the triangle, for example,



Calculate the area of the triangle by multiplying the base length by the height, then halving.

Reflection: How can we use the area of a rectangle to calculate area of a triangle?