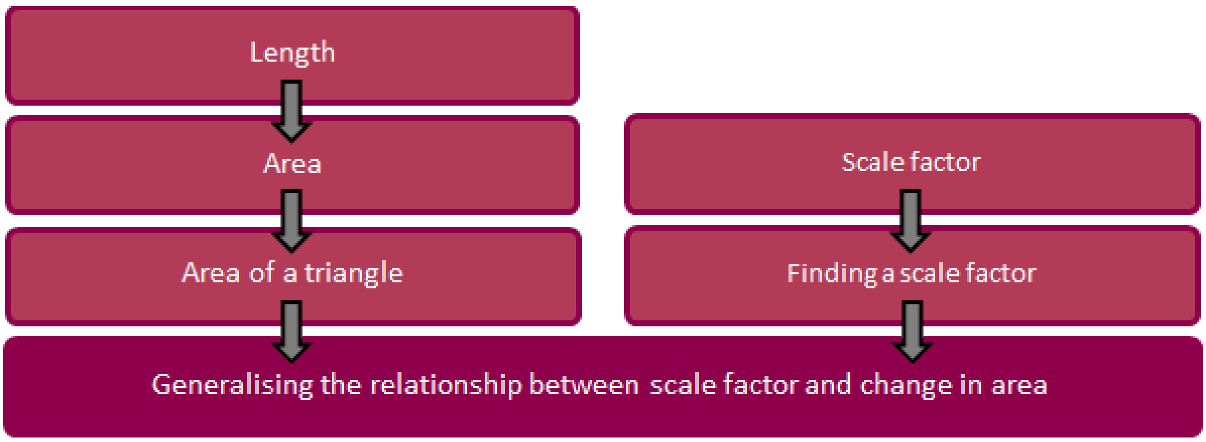
Bigger Triangles

Purpose:
The purpose of this activity is to engage students in finding a pattern from multiplying dimensions and to generalise this pattern with a rule.

Achievement Objectives:
GM4-3: Use side or edge lengths to find the perimeters and areas of rectangles, parallelograms, and triangles and the volumes of cuboids.
NA4-8: Generalise properties of multiplication and division with whole numbers.
GM4-8: Use the invariant properties of figures and objects under transformations (reflection, rotation, translation, or enlargement).

Description of mathematics:
The background knowledge and skills that need to be established before and/or during this activity are outlined in the diagram below:



Length
Measure the length of the base of this triangle in mm.

Area
Find the area of a rectangle that has a base of 20 mm and a height of 15 mm.

Area of a triangle
Find the area of a triangle that has a base of 20 mm and a height of 15 mm.

Scale factor
Construct a rectangle with base 20 mm and height 15 mm.

Finding a scale factor
Find the scale factor of the enlargement from a rectangle of 20 mm x 15 mm to a rectangle of 60 mm x 45 mm.

Solving area problems involving scale factor
Find the area of a triangle that was enlarged from a base of 20 mm and a height of 15 mm, by a scale factor of 3.

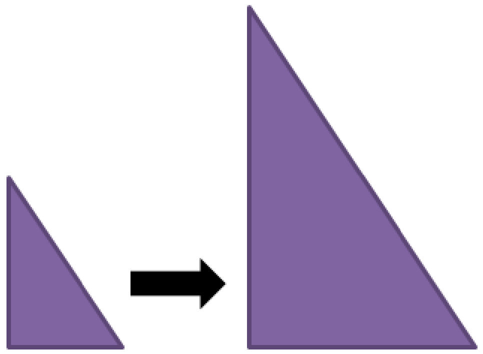
The students are encouraged to work with natural (counting) numbers for trials of scale factors. This activity may be carried out with step by step guidance, or by allowing the student to follow their own method of solution. The approach should be chosen in sympathy with students' skills and depth of understanding.

Activity:

If a triangle is enlarged by scale factor 2, what is its increase in area?

What if the scale factor was 3?

What if the scale factor was n?



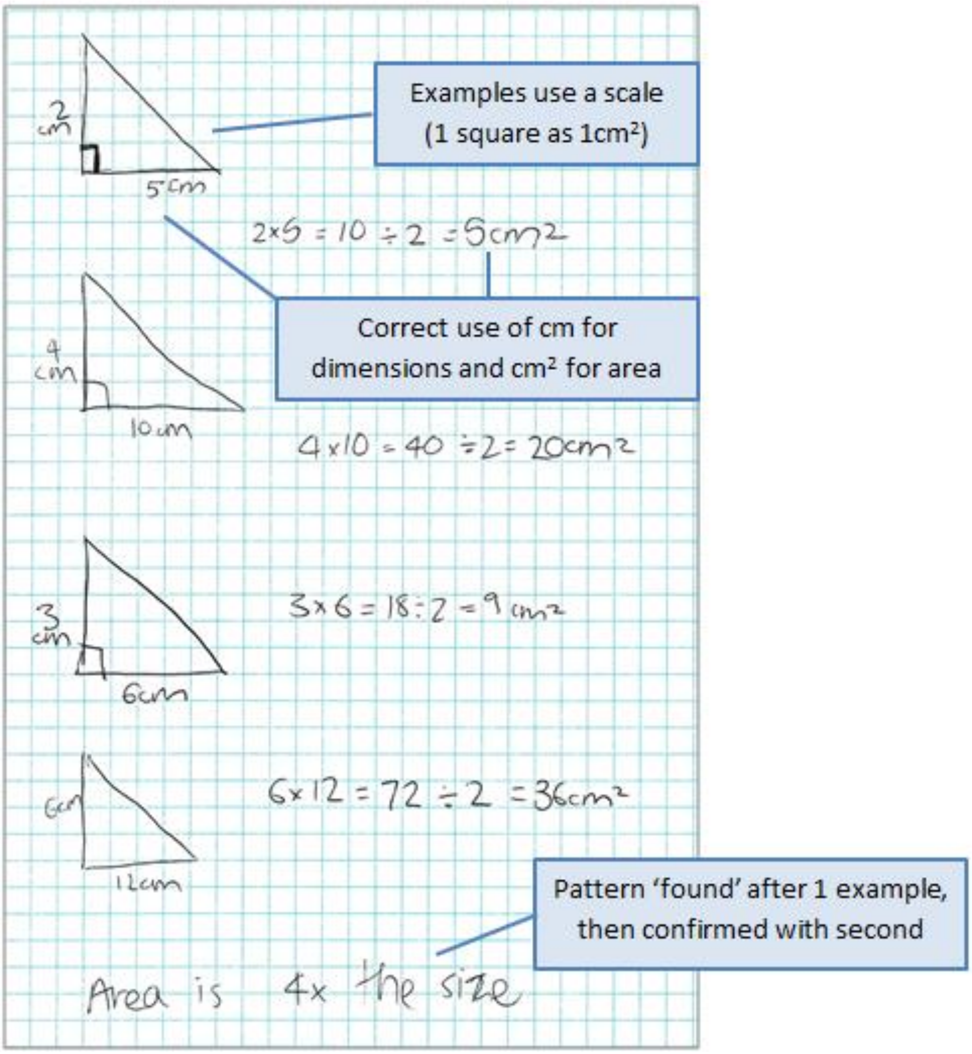
The arithmetic approach

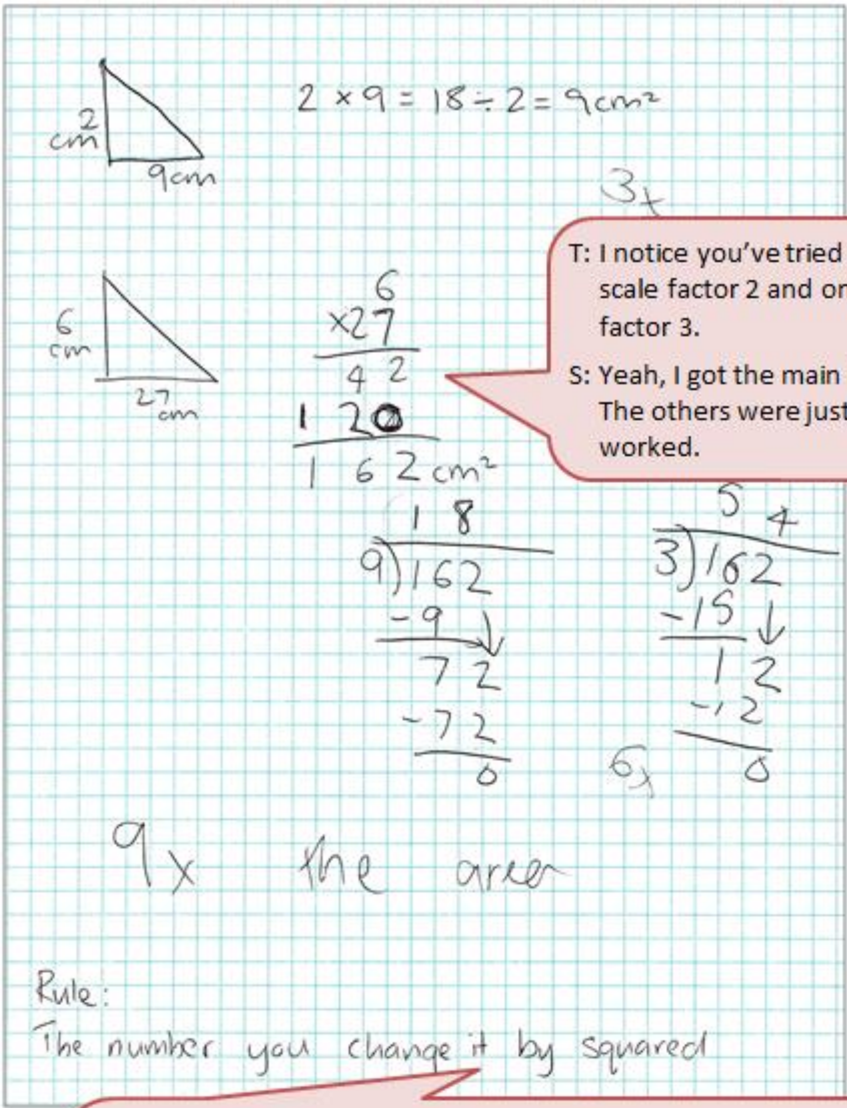
The student is able to find the areas of an original triangle and an enlarged triangle, and to relate the scale factor to the increased area of the enlarged triangle.

The students are encouraged to work with natural (counting) numbers for trials of scale factors.

Prompts from the teacher could be:

1. Try drawing a triangle and working out its area.
2. Now enlarge that triangle by scale factor 2 and work out the new area.
3. What do you notice about the area of the triangles?
4. Try enlarging another triangle.
5. Can you see a pattern?
6. Try enlarging a triangle by scale factor 3.
7. What do you notice about the area of the triangles?
8. Can you see a pattern?
9. What would be the rule for the area of a triangle enlarged by scale factor n? (n stands for any natural number)





T: I notice you've tried two examples for scale factor 2 and only one for scale factor 3.

S: Yeah, I got the main idea on my 20cm². The others were just to check it worked.

T: What is the 'it' that is changing?

S: The area. The area gets bigger by the square of what you changed the sides by.

T: So can you say this all in a rule?

S: The sides get bigger because you times by the scale factor. The area gets bigger because you times by the scale factor squared.

The conceptual approach

The student is able to find the areas of an original triangle and an enlarged triangle, and to generalise the increase in area, in terms of the scale factor.
The students are encouraged to work with natural (counting) numbers for trials of scale factors, generalising by using n.

Prompts from the teacher could be:

1. Think about finding the area of a triangle. This could be done with an example or you could just write the rule.
2. Look at what happens when you enlarge that triangle by scale factor 2.
3. Is there a connection between the area of the two triangles? How does it involve the scale factor?
4. Test your idea for this connection by trying a scale factor of 3?
5. What would be the rule for the area of a triangle enlarged by scale factor n? (n stands for any natural number)