Level 7 – Measurement and Geometry

Overview

Activity name	Finding areas
Learning intention	To calculate and make comparisons between the area of regular shapes
Duration	40 minutes

Links to Victorian Curriculum

These work samples are linked to Level 7 of the Mathematics curriculum.

Extract from Mathematics Level 7 achievement standard

Students use formulas for the area and perimeter of rectangles.

Relevant content description

Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (VCMMG258)

Links to NAPLAN

Minimum standards – numeracy

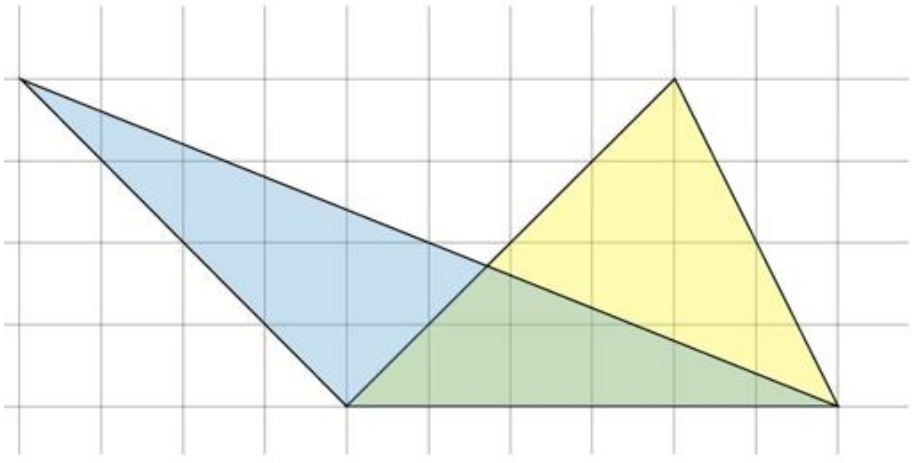
Year 7: Measurement, chance and data

In measurement, chance and data, students at the minimum standard at Year 7 use both formal and informal methods to measure and compare lengths, areas, volumes or angles.

Measures

Students measure and compare lengths, areas, volumes and angles.

Note: the image below has been used to form the Part 3 responses.



Student work samples –
Part 1: Finding the area of a triangle

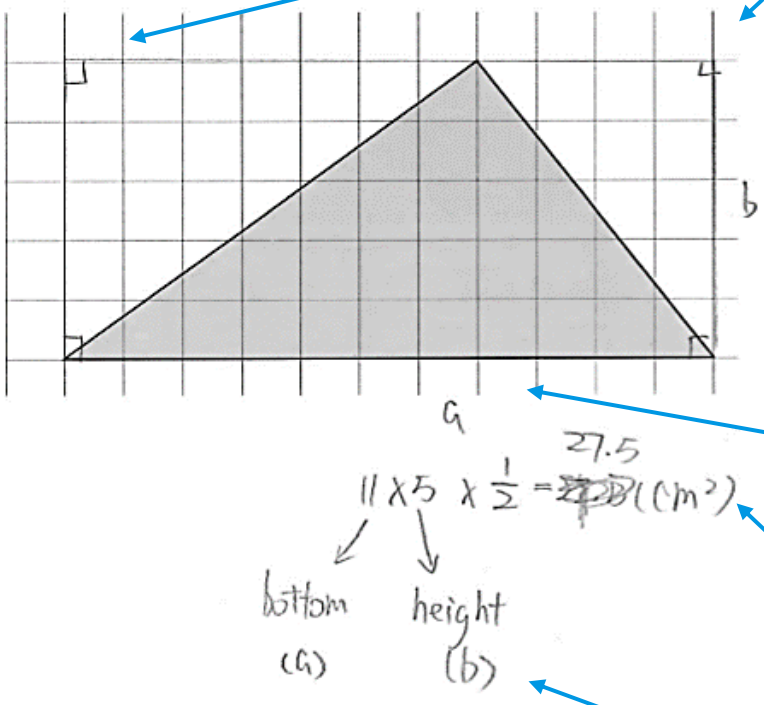
These work samples were created by students working at Level 7. Evidence of student achievement has been annotated.

Victorian Curriculum link

Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (VMMG258)

Part 1

Find the area of the triangle shown below and explain how this was obtained.



Draws a rectangle identifying right angle corners

Writes the formula for calculating the area of a rectangle

Writes the formula for calculating the area of a triangle

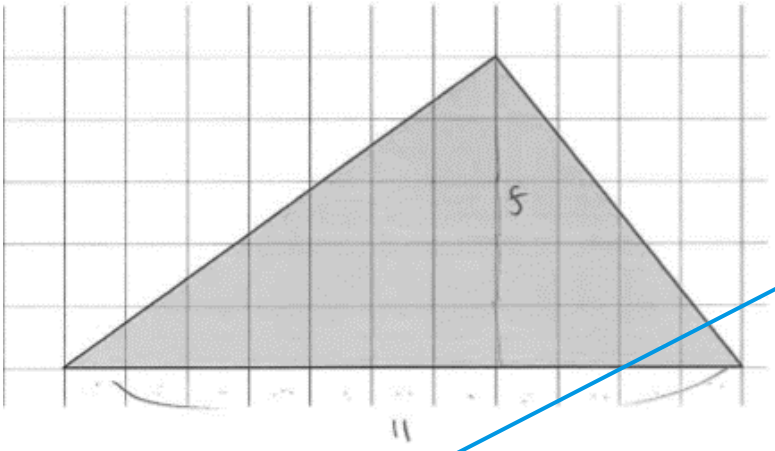
Labels the length and height on horizontal and vertical axes with variables shown in the formula

Uses cm^2 as unit of measurement

Substitutes values for variables in the formula and calculates area

Part 1

Find the area of the triangle shown below and explain how this was obtained.



length = 11 cm

I obtained the '11 cm' by counting the squares.

height = 5 cm

I also obtained this answer by counting the squares.

11 × 5 = 55

55 ÷ 2 = 27.5

= 27.5 cm²

27
2 | 55
4
15
14
1

I used this method to find the answer ($\frac{b \times h}{2}$). That is the formula of finding the area of triangle.

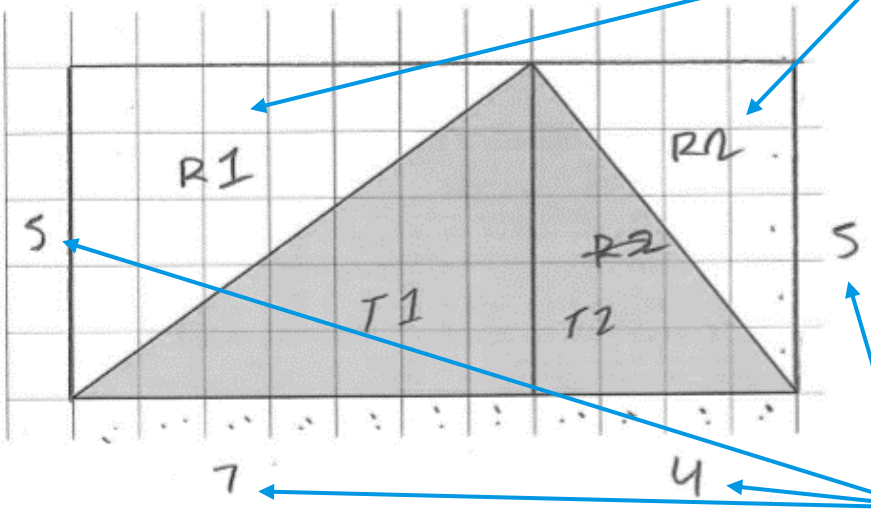
Specifies length of base and height

Includes working for division calculation

Applies algorithm for calculating the area of a triangle and justifies answer

Part 1

Find the area of the triangle shown below and explain how this was obtained.



Decomposes the triangle into two rectangles

Labels the length and width of each rectangle

L x W

R1 = 7x5 = 35 cm²

R2 = L x W
5 x 4 = 20 cm²

Calculates the area of each rectangle

R1:

17.5
2 ⟌35 cm
8-14 ↓
10

R2:

20 ÷ 2 = 10 cm²

Decomposes the area of each rectangle by two to calculate the area of each triangle

T1

area = 17.5 cm

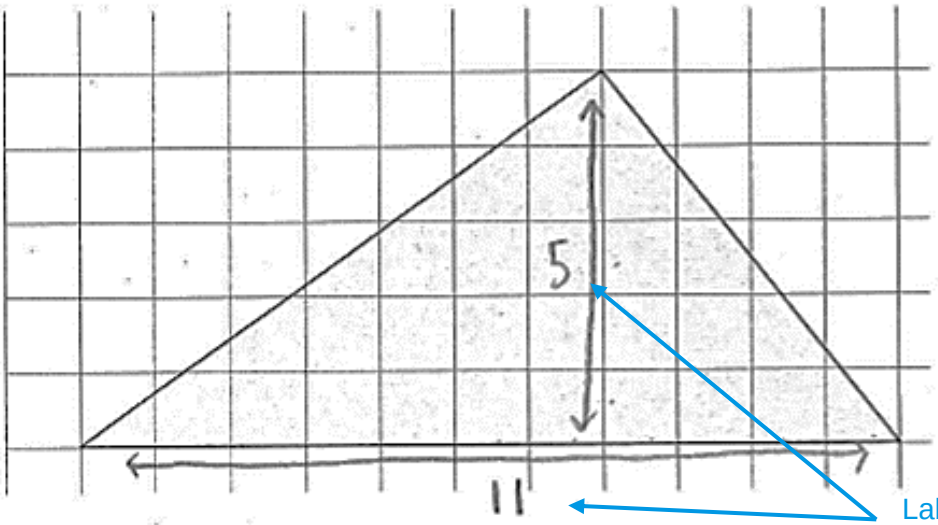
T2

area = 10 cm²

17.5 + 10 = 27.5 cm²

Part 1

Find the area of the triangle shown below and explain how this was obtained.



$A = \frac{1}{2}bh$

$= \frac{1}{2} \times 11 \times 5$

$= 5.5 \times 5$

$= 27.5 \text{ units}^2$

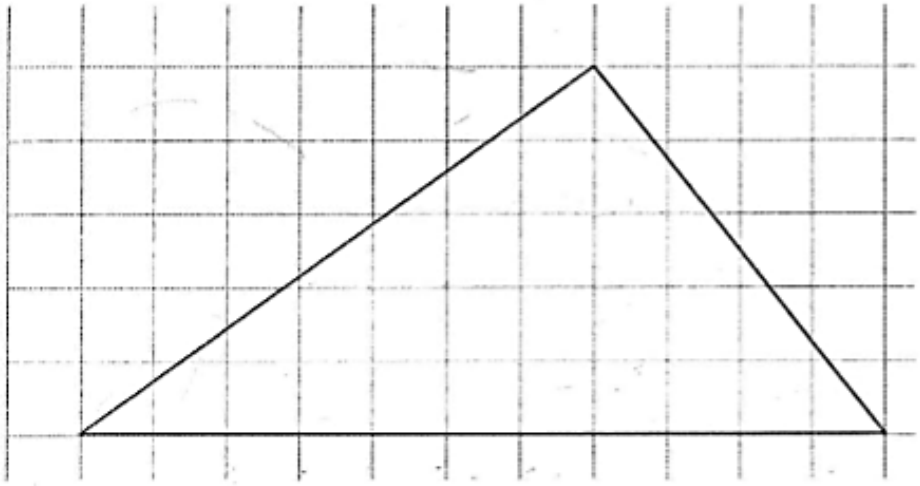
Labels the base and the height of the triangle

States the formula for calculating the area of a triangle

Completes calculation and includes unit of measurement in answer (units^2)

Part 1

Find the area of the triangle shown below and explain how this was obtained.



Let t equal to the area of the triangle
Let b equal to the length of the triangle
Let h equal to the height of the triangle

$t = \frac{b \times h}{2}$

The reason that we must divide the result of the length of the triangle multiplied by the height is because a triangle can be made from two parrellelogram. Therefor, we must find the area of the area of a half of a parrellelogram.

$b = 5$
$h = 11$

$t = \frac{5 \times 11}{2}$

$t = \frac{55}{2}$

$t = 27.5$

Justifies the formula and explains what the letters stand for within the formula

Completes the calculation using the algorithm; although the base and height have been incorrectly labelled, this doesn't affect the calculation

Student work samples – Part 2: Finding the area of a parallelogram

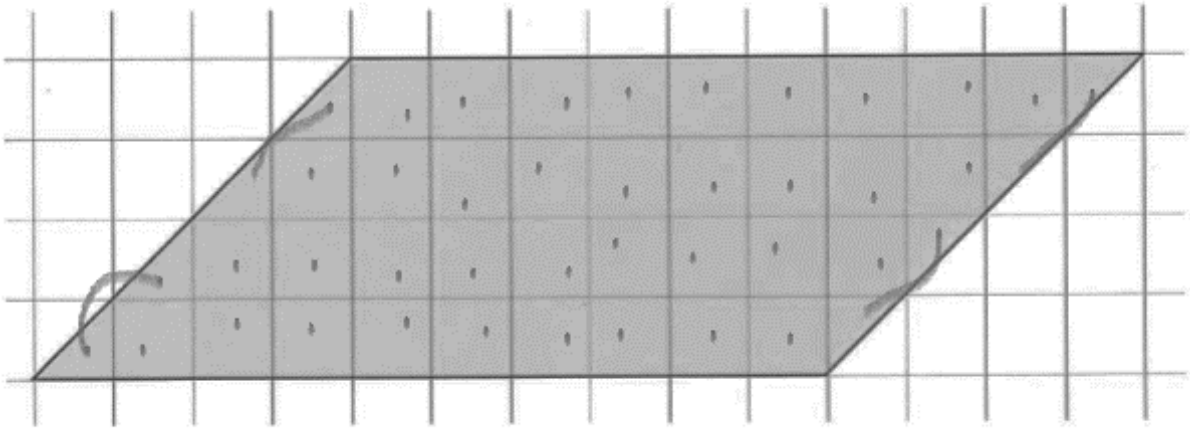
These work samples were created by students working at Level 7. Evidence of student achievement has been annotated.

Victorian Curriculum link

Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (VMMG258)

Part 2

Find the area of the parallelogram shown below and explain how this was obtained.



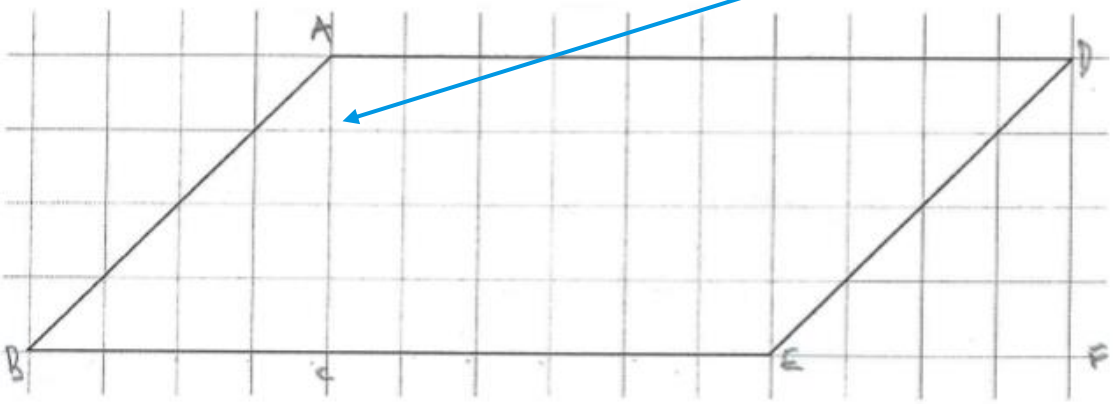
40 squares

i counted the squares...

Counts individual squares and triangles to calculate the area and indicates some combinations of two half squares to make a whole

Part 2

Find the area of the parallelogram shown below and explain how this was obtained.



Area of parallelogram = length × height

Area of rectangle = length × width

A parallelogram is just an angled rectangle. If we drag triangle ABC to the triangle blank space DEF, it will form a rectangle.

Area of parallelogram = 10 × 4

= 40 blocks²

Labels components of the parallelogram

Explains the formula to calculate the area of a parallelogram

Justifies using the same formula for a parallelogram and a rectangle

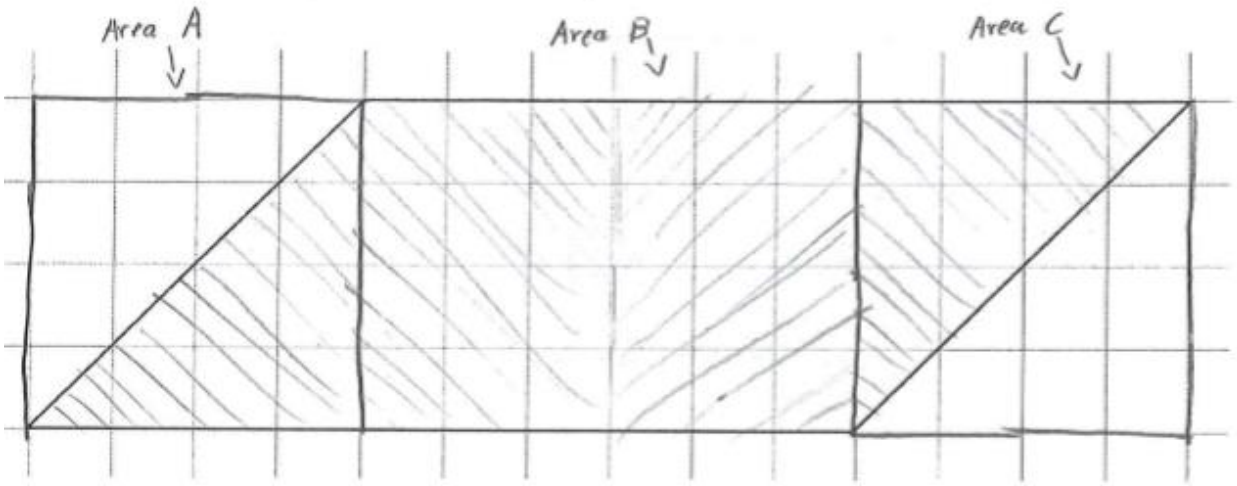
Substitutes numbers into the formula for calculating the area

Calculates the area of a parallelogram using units²

Decomposes and labels the parallelogram as three separate shapes

Part 2

Find the area of the parallelogram shown below and explain how this was obtained.



Area A is a 4x4 square. It is split in half. 4x4 is $16u^2$ so the shaded area is $8u^2$.

Area B is a 6x4 rectangle with area $24u^2$.

Area C is the same as Area A

Calculates the area of each shape

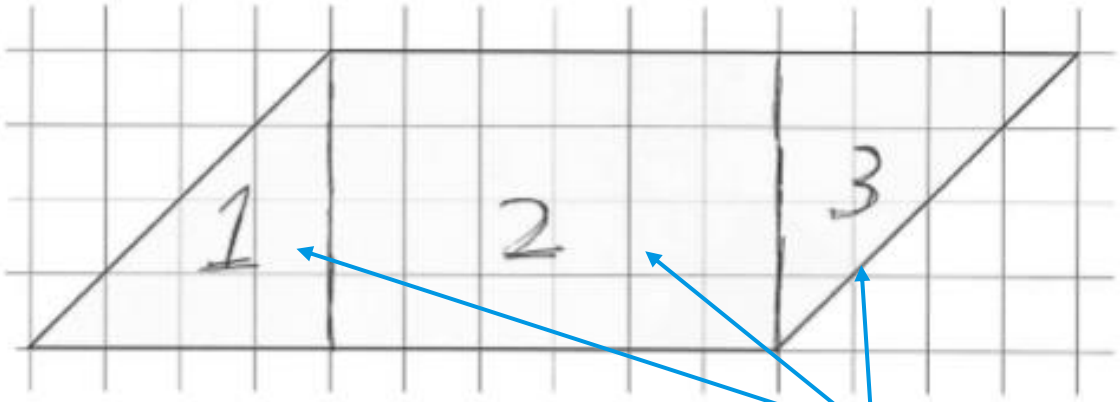
Adds the area of each shape to calculate the total area for the parallelogram

8+24+8 = $40u^2$

Calculates the area of a parallelogram using units^2

Part 2

Find the area of the parallelogram shown below and explain how this was obtained.



Decomposes and labels the parallelogram as three separate shapes

Records the base and height measurement of each shape

1: base = 4cm
Height = 4cm

4cm x 4cm ÷ 2 = 8cm²

Calculates the area for Shape 1 including cm²

2: L = 4cm
W = 6cm

6cm x 4cm = 24cm²

Calculates the area for Shape 2 including cm²

3: base = 4cm
Height = 4cm

4cm x 4cm ÷ 2 = 8cm²

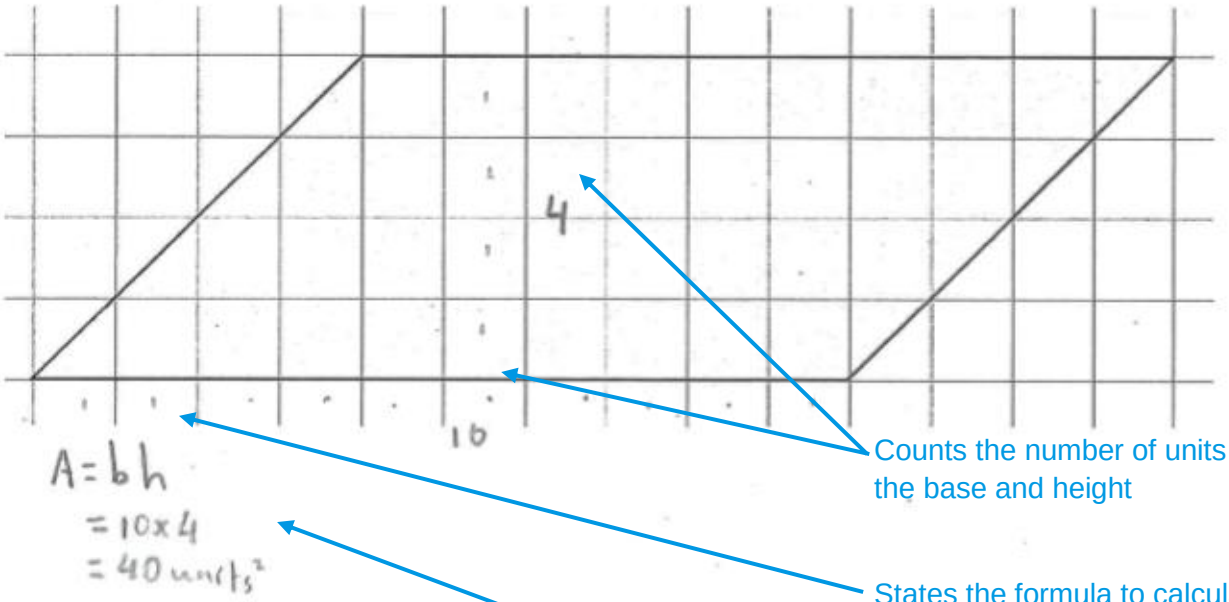
Calculates the area for Shape 3 including cm²

Calculates the total parallelogram area by adding the area of the three separate shapes using cm²

8cm² + 24cm² + 8cm² = 40cm²

Part 2

Find the area of the parallelogram shown below and explain how this was obtained.



Counts the number of units in the base and height

States the formula to calculate the area of a parallelogram

Applies the formula to calculate the area in units^2

Student work samples – Part 3: Comparing triangles

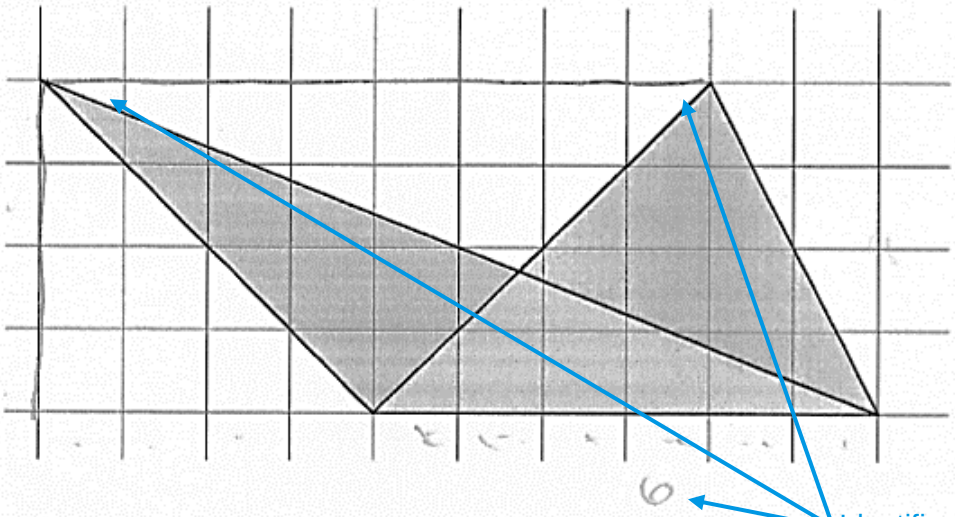
These work samples were created by students working at Level 7. Evidence of student achievement has been annotated.

Victorian Curriculum link

Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (VMMG258)

Part 3

Explain why the larger triangle formed by the blue and green triangles and the larger triangle formed by the green and yellow triangles have the same area.



Because they both have a base of 6 and height of 4 meaning 6x4 = 24cm².

6x4 = 24

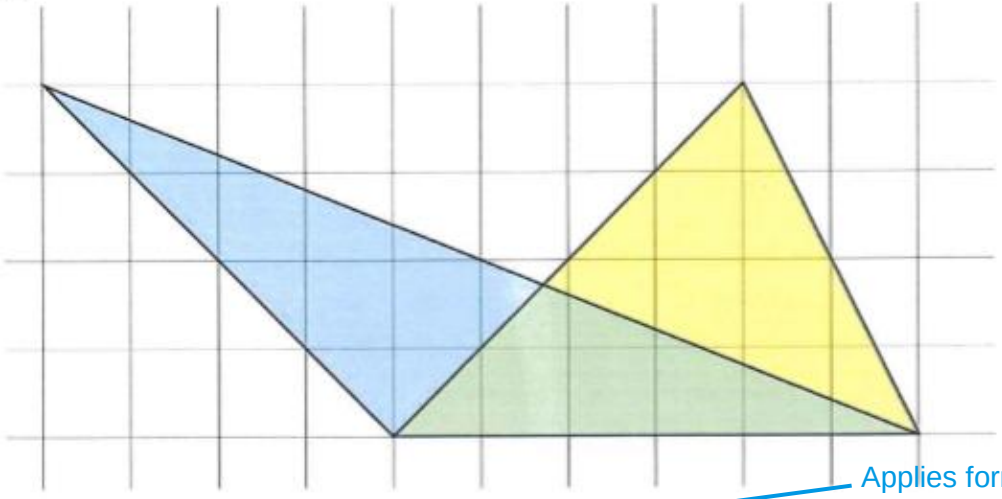
Identifies the base and the height of each shape

Identifies that the triangles have the same base and height, therefore they will have the same area

Calculates the base × height but does not halve the result

Part 3

Explain why the larger triangle formed by the blue and green triangles and the larger triangle formed by the green and yellow triangles have the same area.



Area of green & yellow : $6 \times 4 = 24$

$24 \div 2 = 12$

Area of green & blue : $12 \times 2 = 24$

$24 \div 2 = 12$

Because the green stays the same and the blue and yellow triangle has the same value.

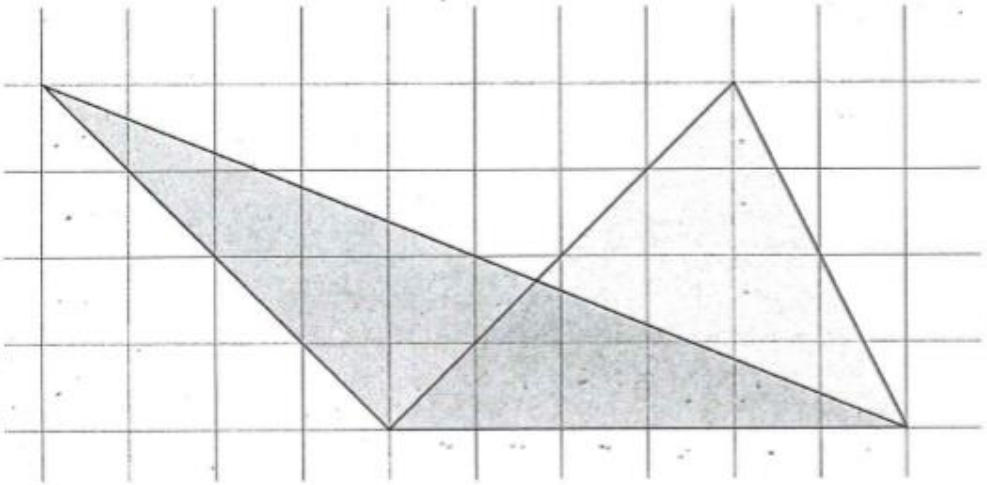
Applies formula to calculate the area of each triangle

Identifies that the base and the height of each triangle are the same

Explains that each of the triangles have the same value, as the green triangle is common

Part 3

Explain why the larger triangle formed by the blue and green triangles and the larger triangle formed by the green and yellow triangles have the same area.



$A = \frac{1}{2}bh$
$= \frac{1}{2} \times 6 \times 4$
$= 3 \times 4$
$= 12$ units

SAME Area

$A = \frac{1}{2}bh$
$= \frac{1}{2} \times 6 \times 4$
$= 3 \times 4$
$= 12$ units^2

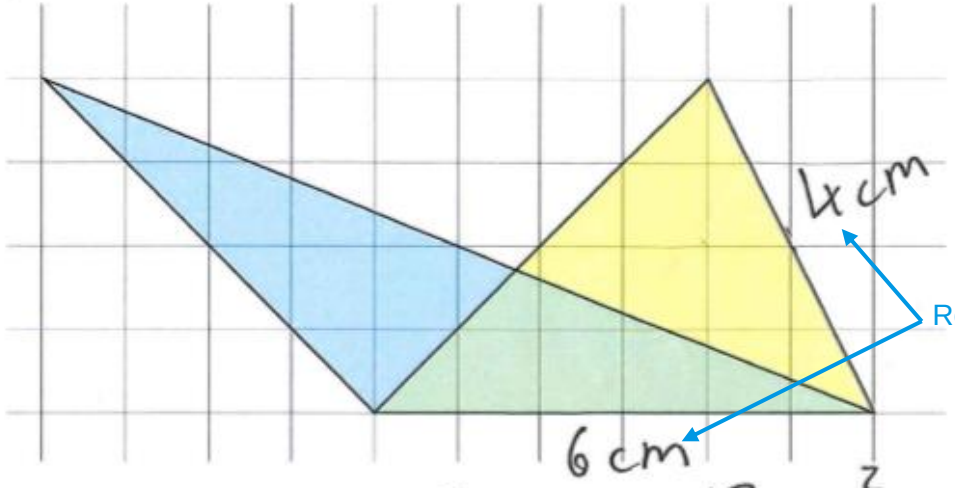
Records the formula for calculating the area of a triangle

Calculates the area of each triangle

Identifies each triangle as having the same area

Part 3

Explain why the larger triangle formed by the blue and green triangles and the larger triangle formed by the green and yellow triangles have the same area.



Records base and height of triangles

$6 \times 4 = 24 cm^2 \div 2 = 12 cm^2$

Calculates triangle area using the correct formula

~~Base and x hight~~

For the two triangles the base and hight are the same for both triangles. We know basexhight÷2 is the area of the triangle since they are the same base and hight

Describes the formula used to calculate the area of each triangle, and justifies their explanation

Where to next for the teacher?

When the task on which these annotated student work samples is based has been used as a classroom activity, there is opportunity to gather data on student achievement and to help inform further teaching.

An analysis of student responses, on an individual, group or whole class basis, can be used to develop and direct student learning with respect to the following content.

For students needing to review underpinning knowledge and skills at Level 6

- Convert between common metric units of length, mass and capacity (VCMMG223)
- Solve problems involving the comparison of lengths and areas using appropriate units (VCMMG224)

For students consolidating knowledge and skills at Level 7

- Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (VCMMG258)

For students moving on to new knowledge and skills at Level 8

- Choose appropriate units of measurement for area and volume and convert from one unit to another (VCMMG286)
- Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites (VCMMG287)
- Investigate the relationship between features of circles such as circumference, area, radius and diameter. Use formulas to solve problems involving determining radius, diameter, circumference and area from each other (VCMMG288)

Resources

- Mathematics Sample Programs, Victorian Curriculum and Assessment Authority (VCAA) – This set of sample programs covering the Victorian Curriculum Mathematics: F–10 were developed *as examples* to illustrate how the Mathematics curriculum could be organised into yearly teaching and learning programs.
- Numeracy Learning Progressions, Victorian Curriculum and Assessment Authority (VCAA) – The Numeracy Learning Progressions amplify, extend and build on the numeracy skills in the Victorian Curriculum Mathematics F–10 and support the application of numeracy learning within other learning areas.
- FUSE, Victorian Department of Education and Training (DET) – The FUSE website provides access to digital resources that support the implementation of the Victorian Curriculum F–10, including an extensive range of activities and other resources for Primary Mathematics and Secondary Mathematics.
- Mathematics Teaching Toolkit, Victorian Department of Education and Training (DET)
- Mathematics Curriculum Companion, Victorian Department of Education and Training (DET)
- Victorian Numeracy Portal, Victorian Department of Education and Training (DET)
- Aligned Australian Curriculum Resources (Mathematics), Australian Curriculum, Assessment and Reporting Authority (ACARA)