A Complete Guide to ...

Geometry

Utilising the objectives as written in

MATHEMATICS in the New Zealand CURRICULUM

for

Level 5

This resource contains:

- ☑ Table of contents
- ☑ Teaching notes
- ☑ In class activity sheets involving
  - worked examples
  - basic skills
  - word problems
  - problem solving
  - group work
- ☑ Homework / Assessment activity sheets
- ☑ Answers

These resources are supplied as PHOTOCOPY MASTERS

Author: A. W. Stark

AWS

AWS Publications Ltd

L5MG

A Complete Guide to ...

Geometry

Utilising the objectives as written in

MATHEMATICS in the New Zealand CURRICULUM

Level 5

This resource contains:

- ☑ Table of contents
- ☑ Teaching notes
- ☑ In class activity sheets involving
  - worked examples
  - basic skills
  - word problems
  - problem solving
  - group work
- ☑ Homework / Assessment activity sheets
- ☑ Answers

Author:
A. W. Stark

AWS Publications Ltd

L5MG

Author:
A. W. Stark

First Published March 1998

Formatting and publishing by
Andrew Stark

Formerly trading as: AWS Teacher Resources

NOW trading as: AWS Publications Ltd

PO Box 21304
Edgeware
CHRISTCHURCH 8143
NEW ZEALAND

☎ (03) 338 0516 or (03) 338 0514

Note from the author:

This resource ...

*A Complete Guide to Geometry

is one of a series of **FIVE** resources written utilising the objectives as stated in

Mathematics in the New Zealand Curriculum for Level 5.

With my experiences as a specialist mathematics teacher, I enjoyed mathematics as a subject, but I am aware that not all teachers feel the same way about mathematics. It can be a difficult subject to teach, especially if you are unsure of the content or curriculum and if resources are limited.

This series of resources has been written with you in mind. I am sure you will find this resource easy to use and of benefit to you and your class.

Resources in this series:

A Complete Guide to Number
written utilising the objectives as stated in
Mathematics in the New Zealand Curriculum for Level 5.
Resource Code: L5MN

A Complete Guide to Measurement
written utilising the objectives as stated in
Mathematics in the New Zealand Curriculum for Level 5.
Resource Code: L5MM

***A Complete Guide to Geometry**
written utilising the objectives as stated in
Mathematics in the New Zealand Curriculum for Level 5.
Resource Code: L5MG

A Complete Guide to Algebra
written utilising the objectives as stated in
Mathematics in the New Zealand Curriculum for Level 5.
Resource Code: L5MA

A Complete Guide to Statistics
written utilising the objectives as stated in
Mathematics in the New Zealand Curriculum for Level 5.
Resource Code: L5MS

For more information about these and other resources, please contact ...

AWS Publications Ltd

☎ (03) 338 0516

(03) 338 0514

Acknowledgement:

I would like to thank the staff and pupils of **Mairehau Primary School, Christchurch** for their assistance in making these resources possible.

This resource has been divided into EIGHT sections as listed below.

Although there are no page numbers, the sections follow in sequential order as listed.

Note: **'In-class' Worksheets Masters** are lesson by lesson reuseable worksheets that can be photocopied or copied on to an OHP.

Homework / **Assessment Worksheets Masters** can be used as homework to reinforce work covered in class or they can be used for pupil assessment.

Section	
1	**List of Geometry Objectives: Table of 'In-class' Worksheets / Objectives covered**
2	**Table of Contents: 'In-class' Worksheets**
3	**'In-class' Worksheets Masters**
4	**Teaching Notes / Answers for 'In-class' Worksheets**
5	**Table of Contents: Homework / Assessment Worksheets**
6	**Homework / Assessment Worksheets Masters**
7	**Answers for Homework / Assessment Worksheets**
8	**Worksheet tracking sheets for teachers to record pupil names / worksheets covered**

1 Geometry

The following are the objectives for **Geometry**, **Level 5**, as written in the **MATHEMATICS** *in the New Zealand Curriculum* document, first published 1992. ***[Refer Page 110]***

Exploring shape and space

Within a range of meaningful contexts, students should be able to:

- **G1** use the angle properties of parallel lines and explain the reasoning involved;
- **G2** apply the symmetry and angle properties of polygons;
- **G3** use the angle between a tangent and radius property, and the angle-in-a-semicircle property;
- **G4** construct right angles, parallel and perpendicular lines, circles, simple polygons, median, mediators, altitudes, and angle bisectors;
- **G5** find an unknown side in a right-angle triangle, using scale drawing, Pythagoras' theorem, or an appropriate trigonometric ratio..
- **G6** make isometric drawings of 3-dimensional objects built out of blocks;
- **G7** solve practical problems which can be modelled, using vectors.

Exploring symmetry and transformations

Within a range of meaningful contexts, students should be able to:

- **G8** recognise when 2 shapes are similar, find the scale factor, and use this to find an unknown dimension;
- **G9** use the symmetry and angle properties of polygons to solve practical problems;
- **G10** use and interpret vectors which describe translations;
- **G11** identify and use invariant properties under transformations.

At the top of each **'In-class' worksheet** and **Homework / Assessment worksheet**, the Geometry objective(s) being covered has been indicated. *Example:* **G1** means objective 1, **G2** means objective 2, etc.

The **Mathematical Processes Skills:** **Problem Solving**, **Developing Logic & Reasoning**, **Communicating Mathematical Ideas**, are learned and assessed within the context of the more specific knowledge and skills of number, measurement, geometry, algebra and statistics. The following are the **Mathematical Processes Objectives** for **Level 5**.

Problem Solving Achievement Objectives ***[Refer page 24]***

- **MP1** pose questions for mathematical exploration;
- **MP2** effectively plan mathematical exploration;
- **MP3** devise and use problem-solving strategies to explore situations mathematically;
- **MP4** find, and use with justification, a mathematical model as a problem-solving strategy;
- **MP6** use equipment appropriately when exploring mathematical ideas.

Developing Logic and Reasoning Achievement Objectives ***[Refer page 26]***

- **MP8** classify objects, numbers and ideas;
- **MP9** interpret information and results in context;
- **MP10** make conjectures in a mathematical context;
- **MP11** generalise mathematical ideas and conjectures;
- **MP15** use words and symbols to describe and generalise patterns.

Communicating Mathematical Ideas Achievement Objectives ***[Refer page 28]***

- **MP16** use their own language and mathematical language and diagrams to explain mathematical ideas;
- **MP17** devise and follow a set of instructions to carry out a mathematical activity;
- **MP20** record information in ways that are helpful for drawing conclusions and making generalisations;
- **MP21** report the results of mathematical explorations concisely and coherently.

Note:
The codes **MP1**, **MP2**, etc. have been created by numbering the **Mathematical Processes Achievement Objectives** in order as listed in the **MATHEMATICS** *in the New Zealand Curriculum* document. The numbering gaps occur as not all objectives are covered at **Level 5**. ***[Refer to pages 23 - 29 of the Curriculum document]***

‘In-class’ Geometry Worksheets
Table of Worksheet Number / Objectives Covered

See the opposite page for details of each objective.

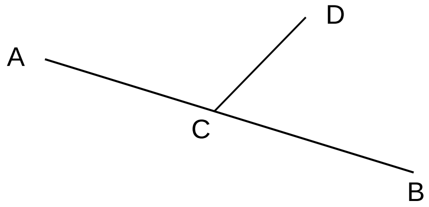
	Geometry Objectives												Mathematical Processes Objectives													
Worksheet Number	R	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8	G 9	G 10	G 11	MP 1	MP 2	MP 3	MP 4	MP 6	MP 8	MP 9	MP 10	MP1 1	MP 15	MP 16	MP 17	MP 20	MP 21
1	✖												✖		✖				✖							
2	✖												✖		✖				✖							
3	✖												✖		✖				✖							
4	✖												✖		✖				✖							
5		✖											✖		✖				✖							
6		✖											✖		✖				✖							
7			✖										✖		✖		✖		✖							
8			✖										✖		✖		✖		✖							
9			✖										✖		✖				✖					✖		
10				✖									✖		✖				✖							
11				✖									✖		✖				✖							
12					✖								✖		✖		✖		✖				✖			
13					✖										✖		✖		✖					✖		
14					✖										✖		✖		✖					✖		
15						✖									✖		✖		✖					✖		
16						✖											✖		✖							
17						✖									✖	✖			✖					✖		
18						✖									✖	✖			✖					✖		
19							✖								✖		✖		✖				✖			
20							✖										✖		✖				✖	✖		
21								✖				✖			✖		✖		✖					✖		✖
22								✖							✖		✖		✖					✖		
23									✖								✖		✖					✖		
24									✖			✖			✖		✖		✖					✖		✖
25										✖					✖		✖		✖					✖		
26										✖		✖					✖		✖					✖		✖
27										✖					✖				✖					✖		
28					✖							✖			✖		✖		✖					✖		✖
29									✖			✖											✖			✖

Table of Contents for the ‘In-class’ Worksheet Masters for Geometry, Level 5

Adjacent angles on a straight line:

There are many angle rules.

Example: David drew a straight line AB. At a point C on this line, he drew another line CD.



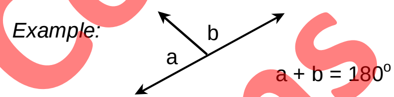
Line AB is a straight line and is also known as a **straight angle** therefore it equals 180°.

What would ∠ACD and ∠DCB add up to?

Answer: 180° as the angles are on a straight line.

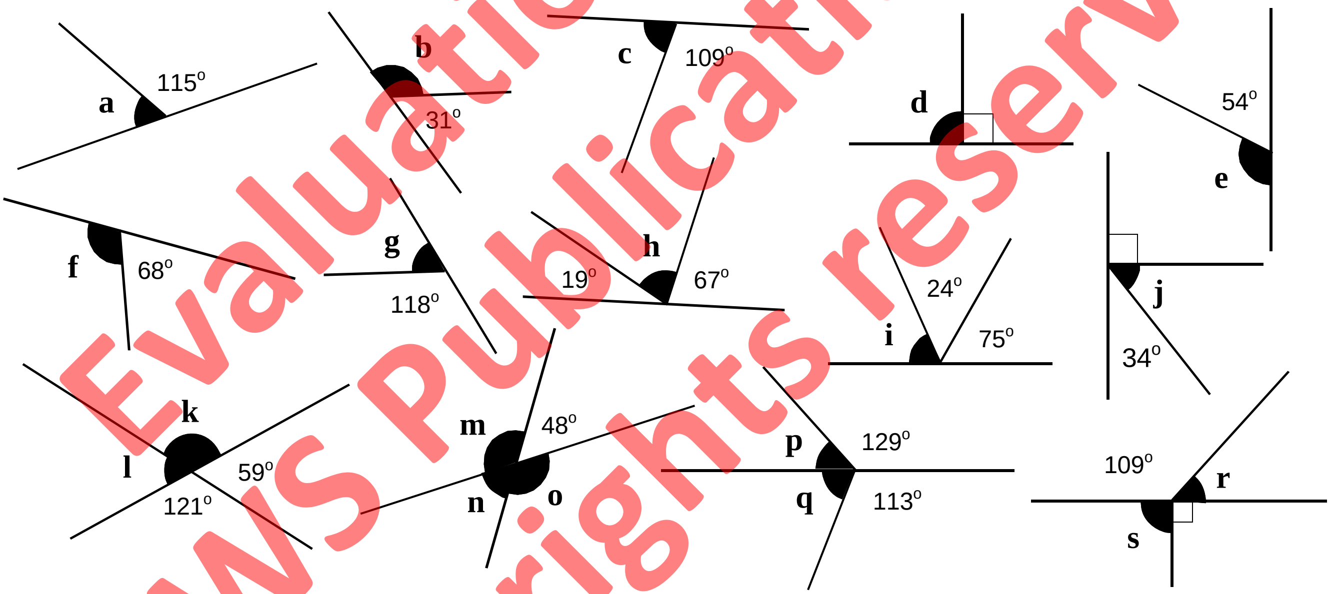
The two angles, ∠ACD and ∠DCB, on this line are called **adjacent** angles. Adjacent means 'next to' and these two angles are next to each other. From this, an angle rule has been created. Note: There can be more than two angles.

Adjacent angles on a straight line add up to 180°



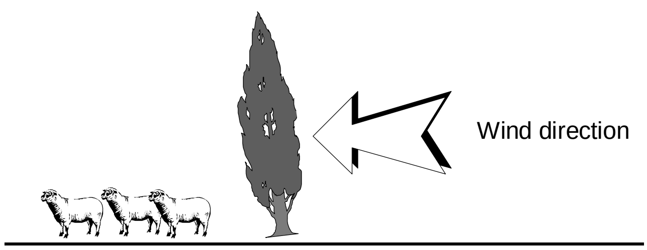
Task 1

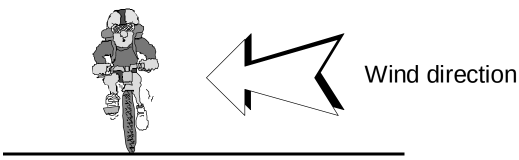
1. **Calculate** the missing angles (a to s) in these diagrams. Note: The diagrams are not drawn to scale.



A farmer planted some trees along a fence line to provide shelter for his sheep. Trees normally grow perpendicular to the ground but in this case, wind has forced the trees to lean 7° to the right.

2. Calculate the obtuse angle this row of trees makes with the ground.



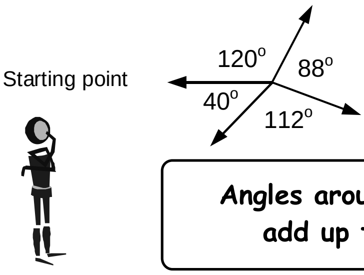


A cyclist is usually vertically, but due to a strong side wind, the cyclist makes an acute angle of 84° with the ground.

3. Calculate the lean the cyclist is on.
4. Calculate the obtuse angle the cyclist makes with the ground.

Angles around a point:

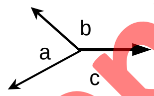
Example: Kylie turned or rotated through various angles, stopping several times until she was facing the same way as she started. Through how many degrees did Kylie rotate?



Answer: One complete revolution, therefore 360°.

Angles around a point add up to 360°

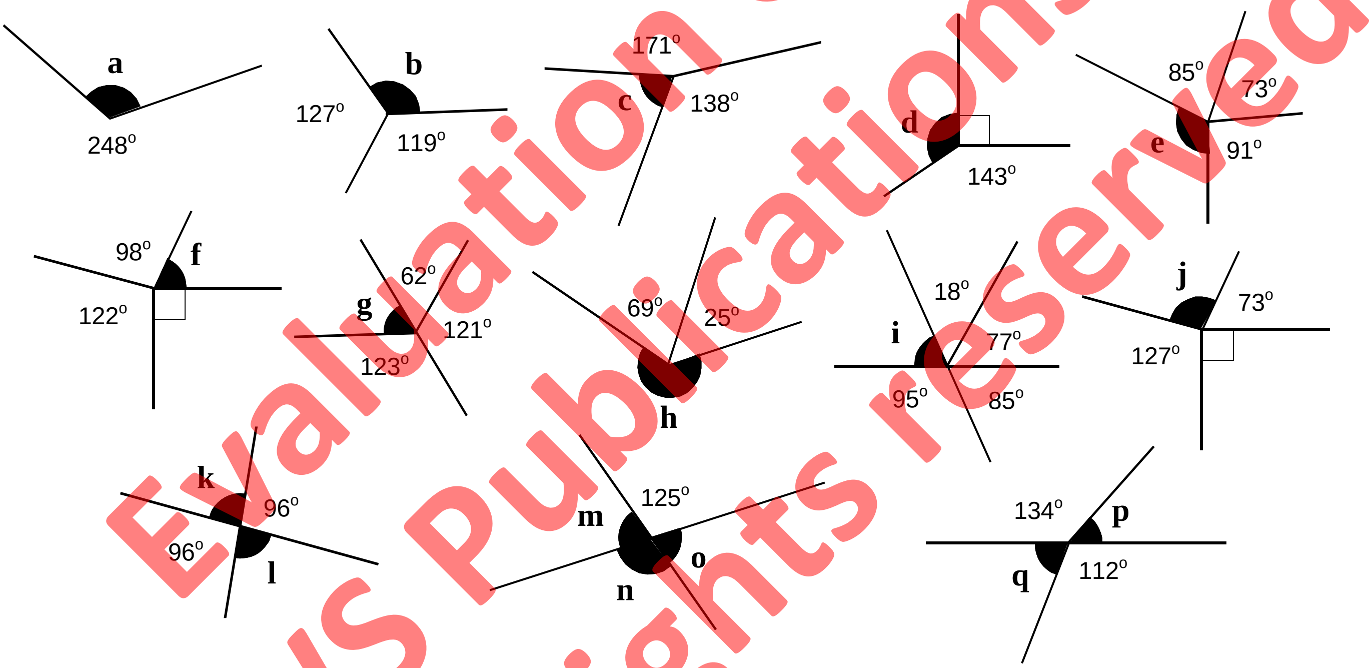
Example:



a + b + c = 360°

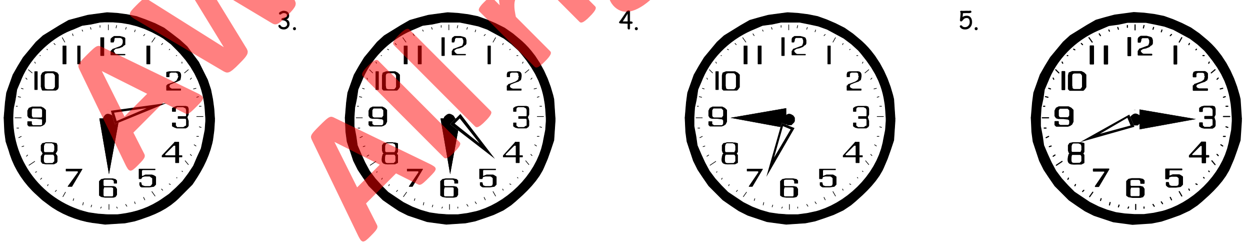
Task 2

1. **Calculate** the missing angles (a to q) in these diagrams. Note: The diagrams are not drawn to scale.



Calculate the size of the smaller of the two angles formed by the hands of these clocks.

2. 3. 4. 5.

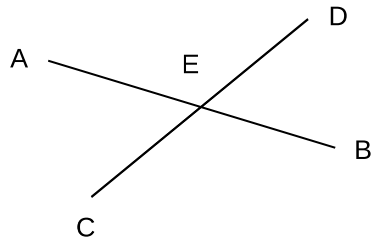


Several new bicycle wheels are being designed with a different number of equally spaced spokes.

6. If there are nine spokes, what is the angle size between each spoke?
7. If the spokes of a new wheel have an angle of 45° between them, how many spokes does this wheel have?
8. If the spokes of a new wheel have an angle of 24° between them, how many spokes does this wheel have?

Vertically opposite angles:

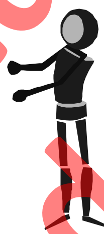
Example: Carl drew two straight lines, AB and CD, that crossed at point E.



Consider these two statements.
The two angles, ∠AED and ∠DEB are **adjacent** angles on the line AB.
The two angles, ∠DEB and ∠CEB are **adjacent** angles on the line CD.

As ∠DEB is common to both pairs of angles, what does that tell us about the angles ∠AED and ∠CEB? These angles are directly opposite each other and are called **vertically opposite angles**.

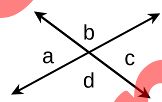
Answer: angles ∠AED and ∠CEB are both the same size.



In the diagram above, name two other angles that are vertically opposite.

Vertically opposite angles are equal

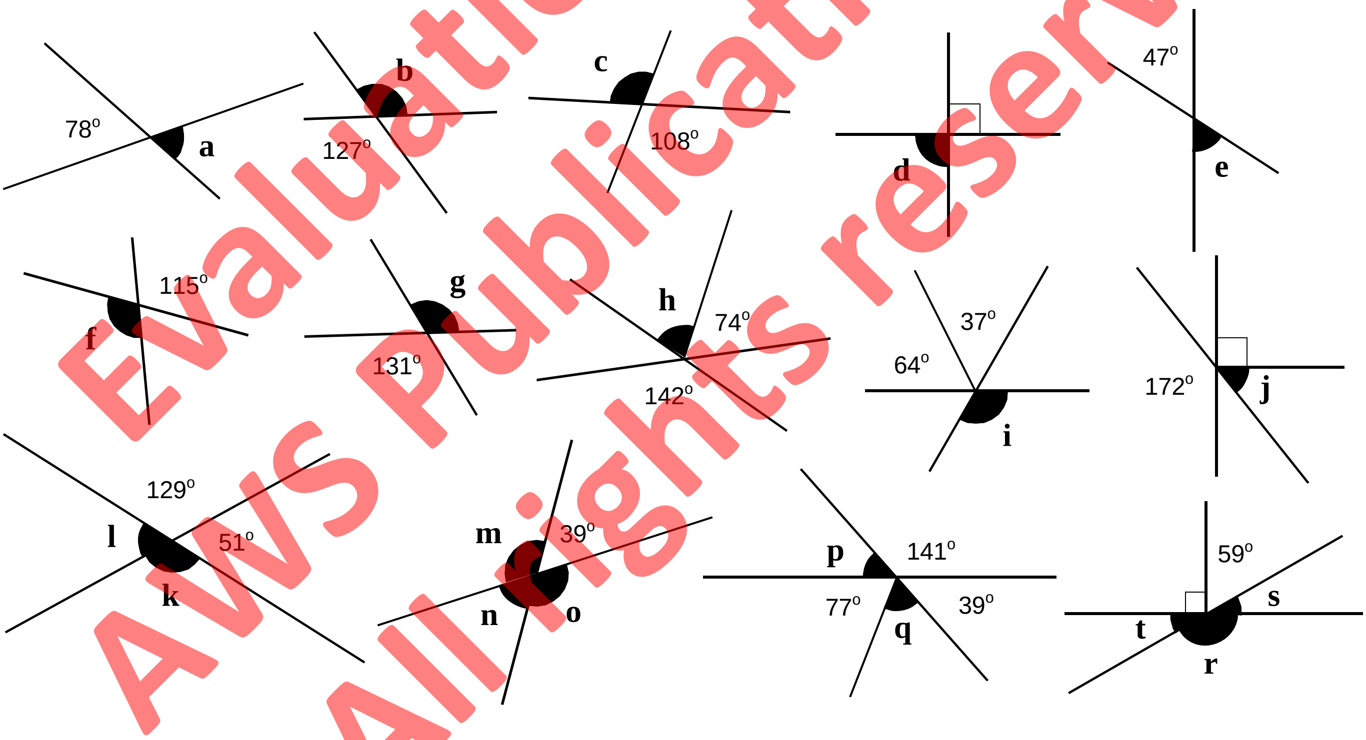
Example:



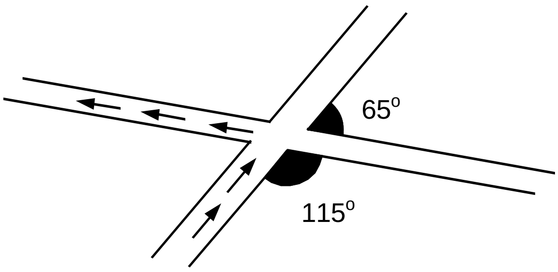
a = c
b = d

Task 3

1. **Calculate** the missing angles (a to t) in these diagrams. Note: The diagrams are not drawn to scale.



Two cross roads intersect as shown in the diagram.

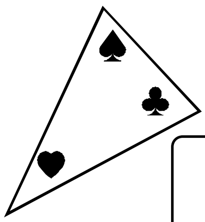


The arrows show which way Mr Davidson drove his car around the corner.

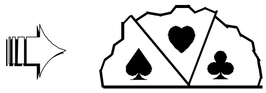
2. Through what angle did he turn, as he drove around this corner?

Angles in a triangle:

Example: Kylie cut a triangle out of paper. She ripped off each corner and joined them together. What do the three angles of a triangle add up to, if they formed a straight line?



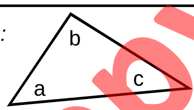
Corners joined together.



Answer: 180°.

Angles in a triangle add up to 180°

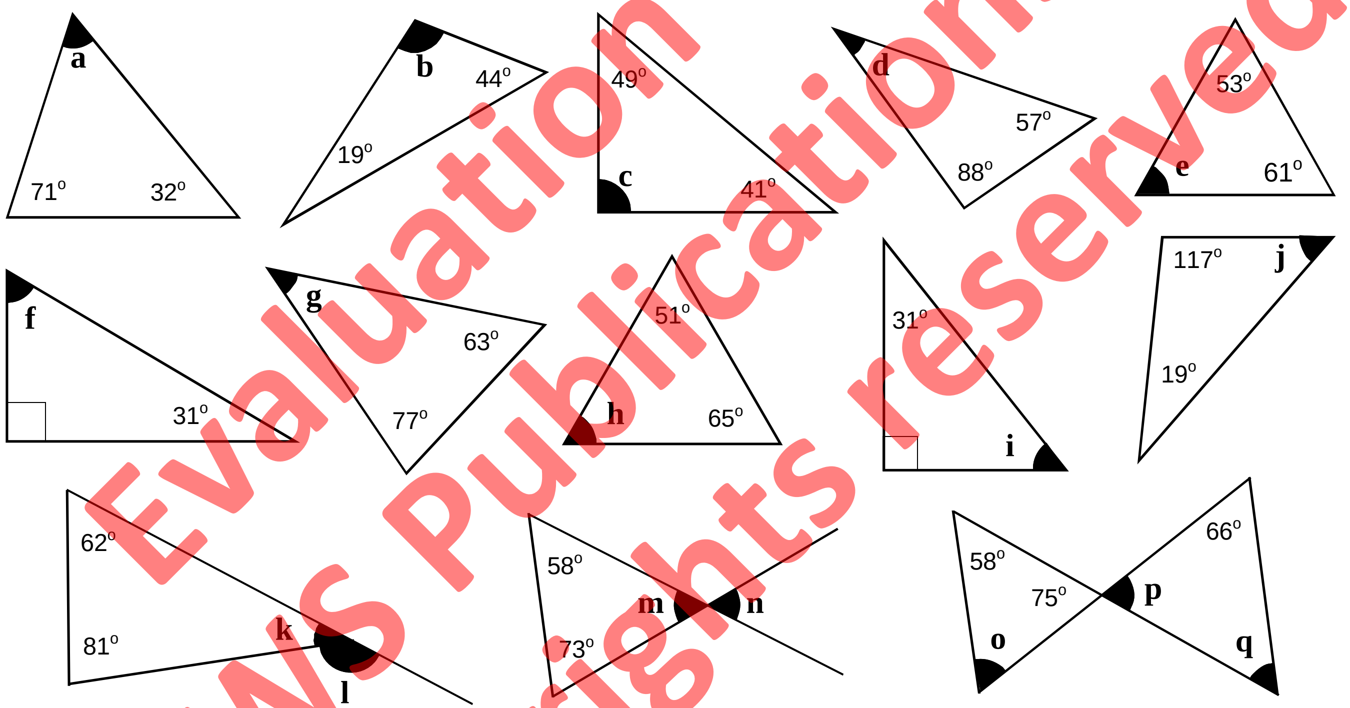
Example:



a + b + c = 180°

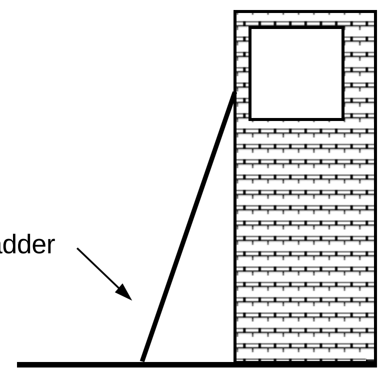
Task 4

1. **Calculate** the missing angles (a to q) in these diagrams. Note: The diagrams are not drawn to scale.



A fireman leans a ladder up against a building. The angle the bottom of the ladder makes with the ground must be 70°.

2. What angle does the top of the ladder make with the building?

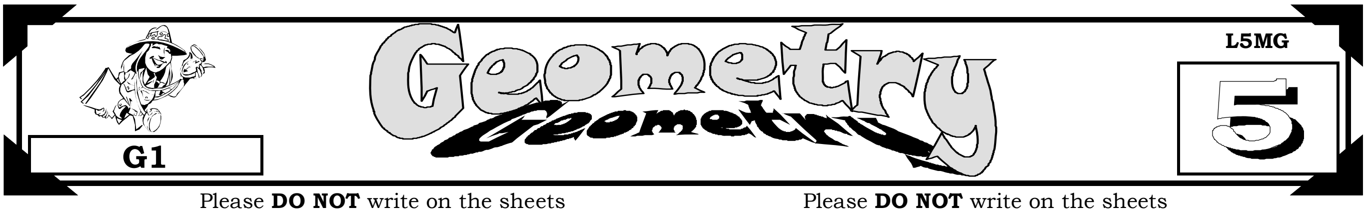


Task 5

Create angle diagrams similar to those of **Tasks 1, 2, 3** and **4**, involving the **four angle rules**.

Adjacent angles on a straight line add to 180°
Vertically opposite angles are equal
Angles around a point add to 360°
Angles in a triangle add to 180°

Exchange your diagrams with a classmate, for him / her to **work out** the **missing angles**. Justify each answer by stating the angle rule used. *Example:* Answer is 45°. Rule: ∠'s on a st. line add to 180°.

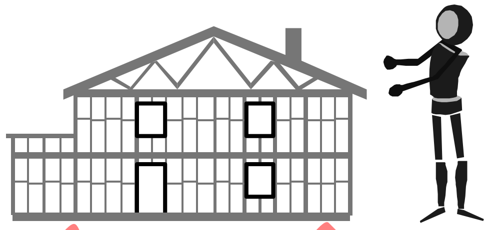


Angles and parallel lines:

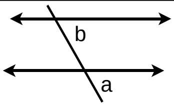
When two lines are the same distance apart, they are said to be parallel.
Example: Railway rails are parallel. The sides of a door are parallel.

What other things around your classroom are parallel?

There are three angle rules associated with parallel lines.

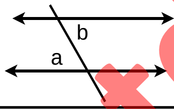


Corresponding angles are EQUAL



Example: **a = b**

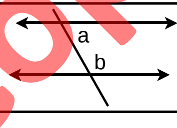
Alternate angles are EQUAL



Example: **a = b**

Co-interior angles add up to 180°

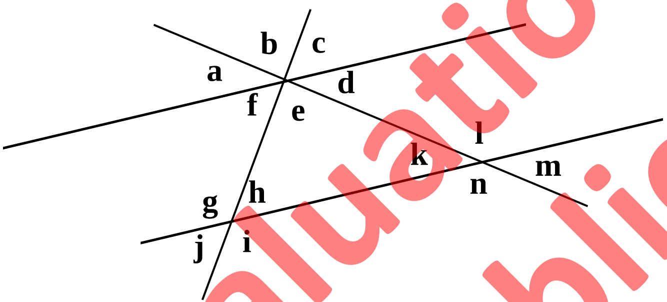
Example:



a + b = 180°

Task 6

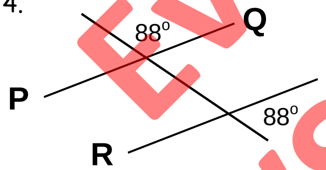
Use this diagram to answer questions 1 to 3. You can combine angles. *Example:* ∠a + ∠b = ∠g



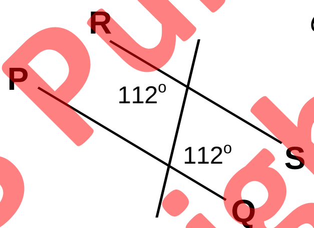
1. List 4 pairs of corresponding angles.
2. List 4 pairs of alternate angles.
3. List 4 pairs of co-interior angles.

Are the lines PQ and RS parallel? Give a reason for your answer.

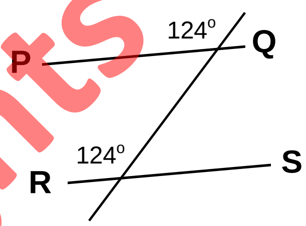
4.



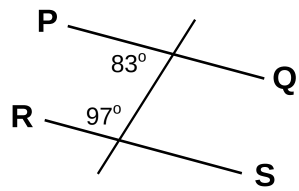
5.



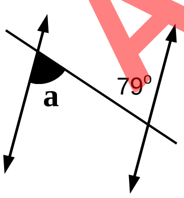
6.

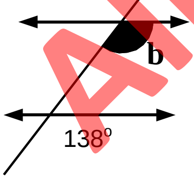


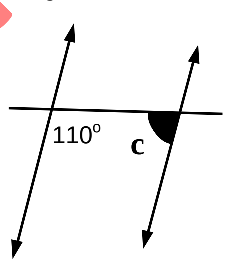
7.

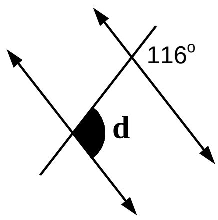


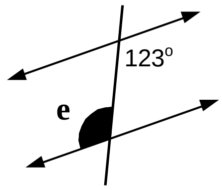
8. Calculate the missing angles (a to w) in these diagrams. Note: The diagrams are not drawn to scale.

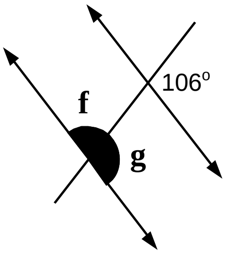


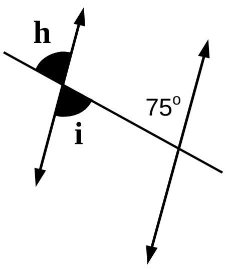


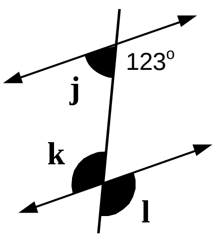


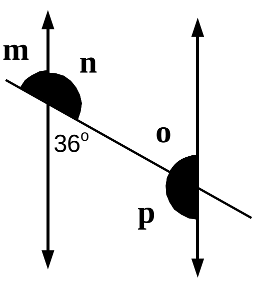


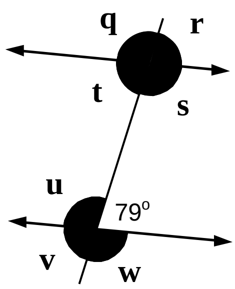






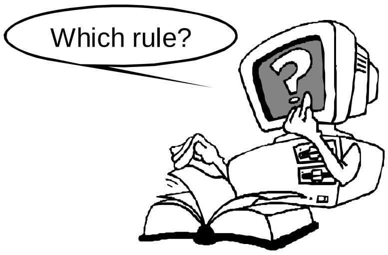






Understanding and stating angle properties:

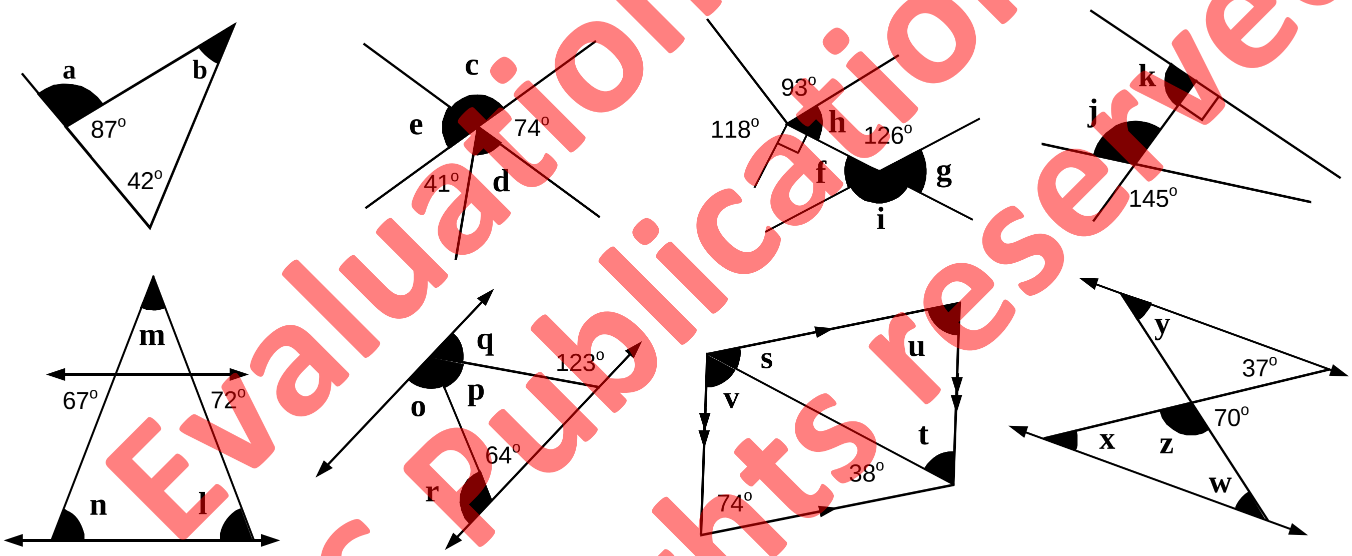
The angle rules used in **Tasks 1 to 6** can be written in an abbreviated form.

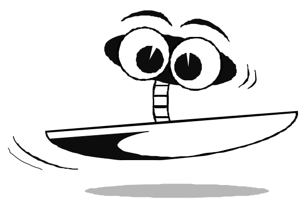


Rule	Abbreviation
Adjacent angles on a straight line add up to 180°	Adj. ∠'s st. line
Angles around a point add up to 360°	∠'s around pt.
Vertically opposite angles are equal	Vert. Opp. ∠'s
Angles in a triangle add up to 180°	∠'s in △
Corresponding angles are EQUAL	Corr. ∠'s // lines
Alternate angles are EQUAL	Alt. ∠'s // lines
Co-interior angles add up to 180°	Int. ∠'s // lines

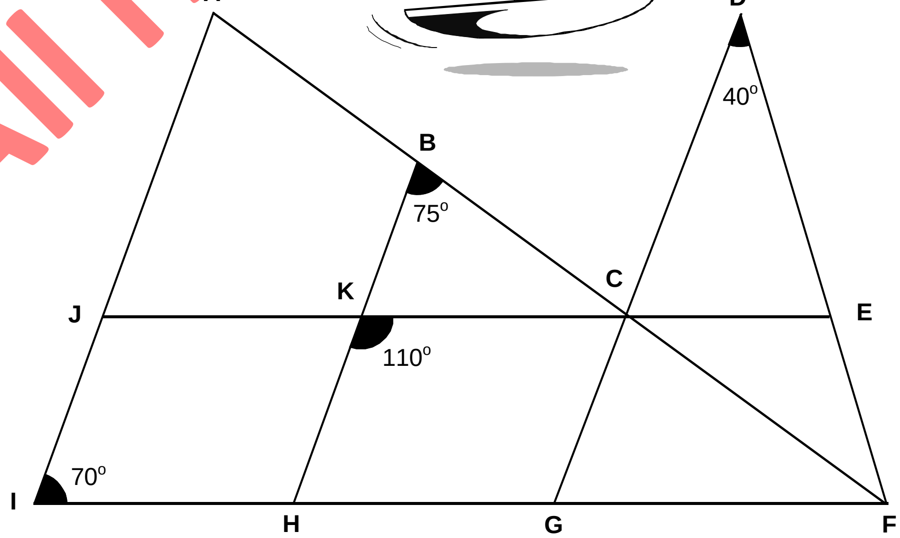
Task 7

1. Calculate the size of the missing angles (A to Z) and state the rule used using the abbreviations above. There may be more than on way to find some angles. Note: Diagrams are not drawn to scale.





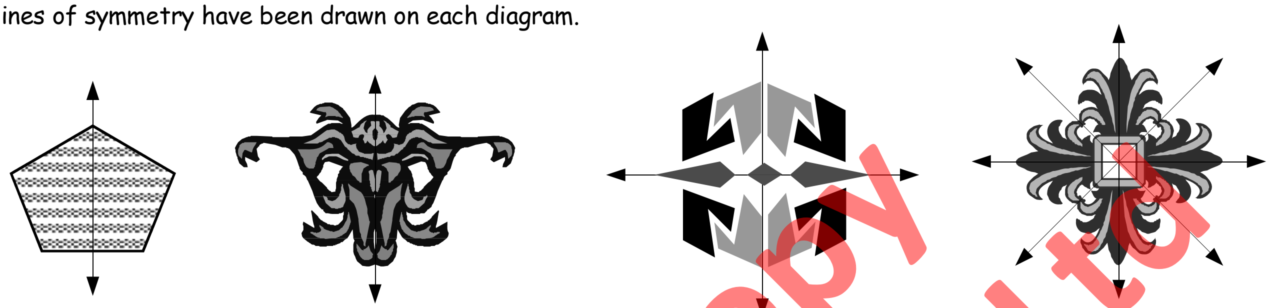
On this diagram ...
lines AI, BH and DG are parallel,
lines JE and IF are parallel,
∠JIH = 70°, ∠HKC = 110°,
∠KBC = 75°, ∠CDE = 35°.



2. Explain why ∠KHG = 70°
3. Explain why ∠JAB = 75°
4. Calculate the size of ∠JKB
5. List all angles that are the same size as ∠JIH
6. Calculate the size of ∠KCB
7. Calculate the size of ∠CED
8. Calculate the size of ∠GFC

Reflective symmetry:

Below are examples of shapes, patterns and pictures that all have lines of symmetry.
The lines of symmetry have been drawn on each diagram.

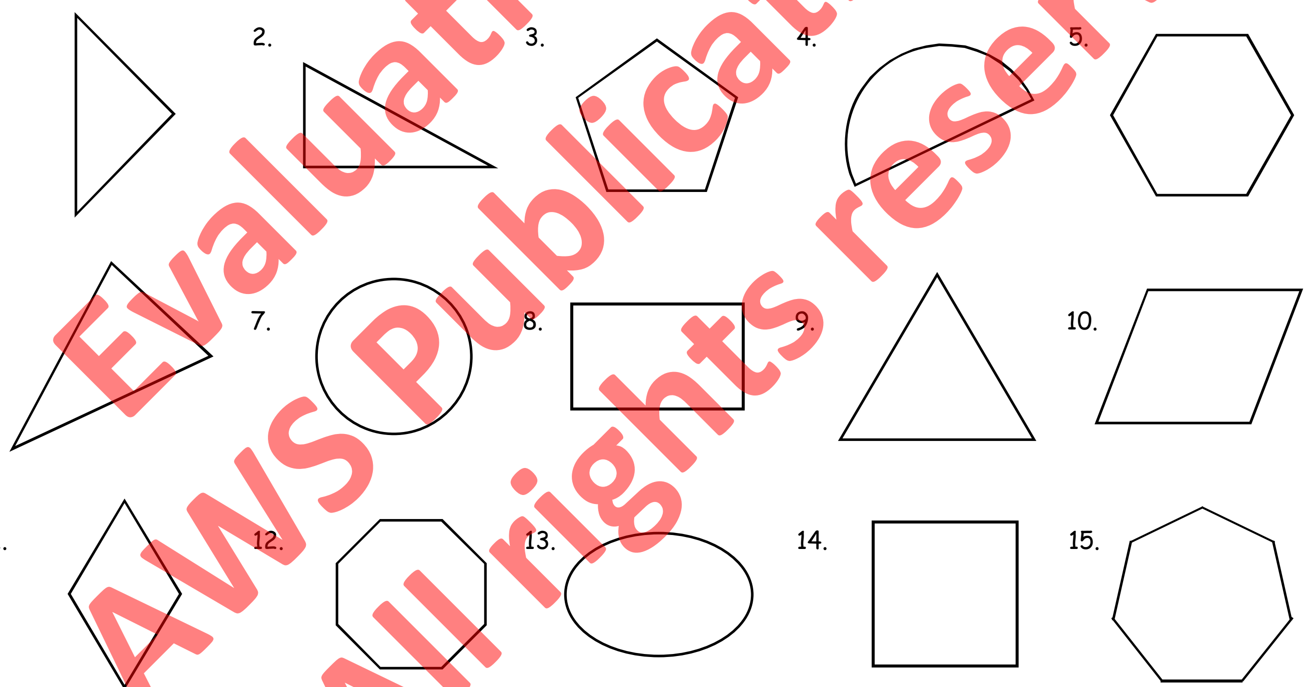


The **Order of Reflective Symmetry** of a shape is the number of lines of symmetry a shape has.
Lines of symmetry are also called axes of symmetry.

What is the order of reflective symmetry for each shape above? Answers: 1, 1, 2 & 4

Task 8

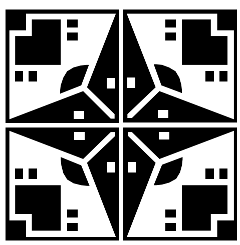
Copy and **name** each shape below, using the words listed below the shapes.



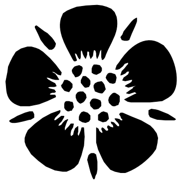
equilateral triangle, square, ellipse, semi-circle, hexagon, rectangle, pentagon, right-angled triangle, parallelogram, scalene triangle, octagon, isosceles triangle, circle, diamond (rhombus), heptagon

16. **Draw** in the lines of symmetry (if any) on the shape diagrams you copied from above and **state** the **order of reflective symmetry** for each shape.

17. Look around your classroom and make a **list** of objects that have lines of symmetry. **State** the **order of reflective symmetry** for each object on your list.

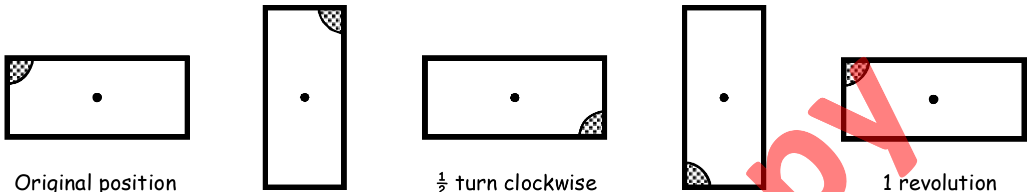


Rotational symmetry:



A shape has **rotational symmetry** if it fits onto itself as the shape is rotated through one complete revolution about a fixed point called the **centre of rotation**.

Example: This rectangle has been rotated in a clockwise direction.



Original position | $\frac{1}{4}$ turn clockwise or 90° | $\frac{1}{2}$ turn clockwise or 180° | $\frac{3}{4}$ turn clockwise or 270° | 1 revolution or 360°

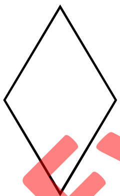
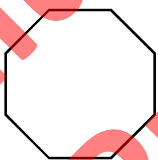
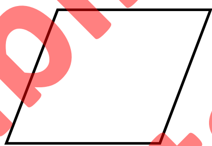
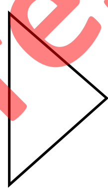
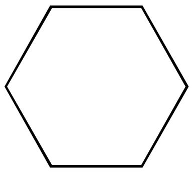
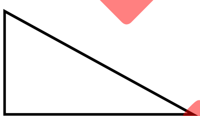
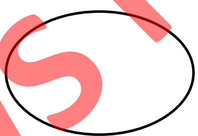
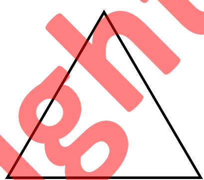
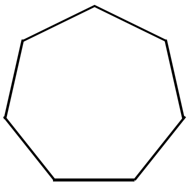
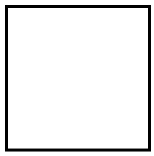
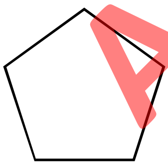
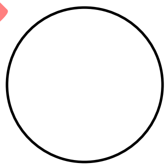
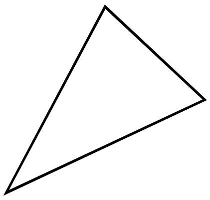
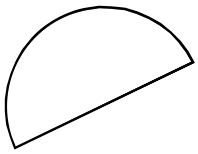
Where is the centre of rotation for this shape? *Answer:* The point in the middle.

The **Order of Rotational Symmetry** is the number of times a shape fits onto itself during one complete revolution. All shapes have an order of rotational symmetry of at least one, as they will fit onto themselves after 1 complete revolution through 360°.

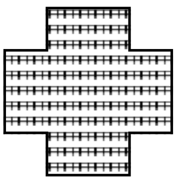
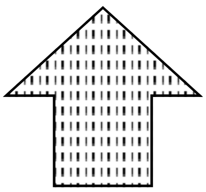
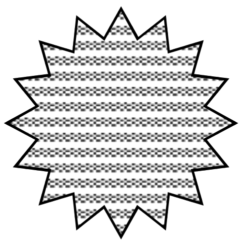
What is the order of rotational symmetry for this rectangle? *Answer:* 2 (180° & 360°)

Task 9

Name each shape below. **Copy** these shapes onto cardboard and cut them out.
By rotating your shapes, **work out** the **order of rotational symmetry** for each shape.

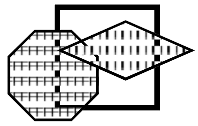
1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 

Work out the **order of rotational symmetry** for these shapes.

16. 
17. 
18. 

19. Look around your classroom and make a **list** of objects that have rotational symmetry. State the order of rotational symmetry for the objects of your list.

Interior angle sum of regular / non-regular polygons:



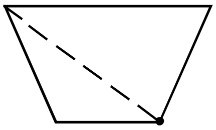
A polygon is a closed 2D shape that has three or more straight sides.
Example: A triangle has 3 sides, a quadrilateral has 4 sides ...

A Regular polygon has all sides the same length and all angles the same size.

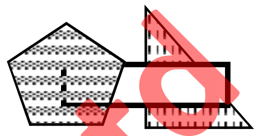
To calculate the sum of the interior angles of a polygon, use only ONE corner, from which to divide the the polygon into triangles.

Example:

4 sides



A 4 sided polygon can be divided into 2 triangles $\Rightarrow 2 \times 180^\circ = 360^\circ$



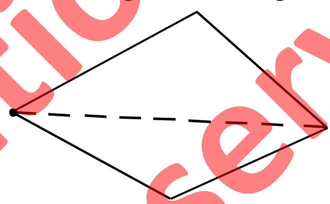
Task 10

What are the names given to polygons with the following number of sides?

1. 3 sides 2. 4 sides 3. 5 sides 4. 6 sides 5. 7 sides 6. 8 sides
7. 9 sides 8. 10 sides 9. 12 sides

10. Calculate the sum of the interior angles for polygons with 4 to 10 sides, using the following steps.

Step 1: Draw the shape
Step 2: Mark one corner
Step 3: Divide the shape into triangles from this corner
Step 4: Count the number of triangles created.
Step 5: Multiply the number of triangles by 180°

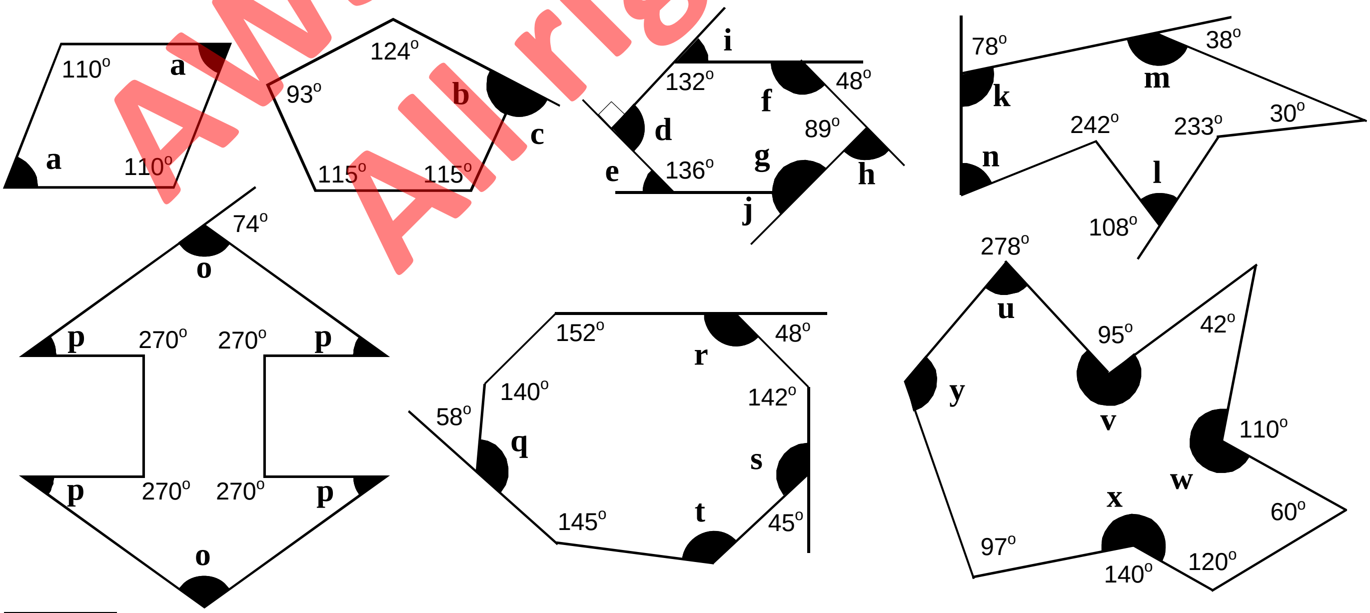


Present your result in a table with the following headings ...

Number of sides	Number of triangles	Interior angle sum
4	2	$2 \times 180^\circ = 360^\circ$
5	?	?

11. Create a word or algebraic rule for working out the *'sum of the interior angles"* of a polygon, where ***n = number of sides***.

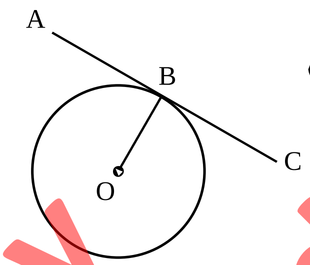
12. Use your *'sum of the interior angles'* calculations above to find the size of the missing angles (a to y) in these diagrams. Note: The diagrams are not drawn to scale.

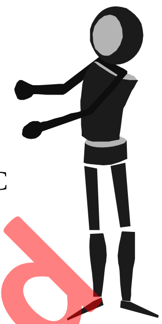


Angle between a tangent and a radius:

A tangent is a straight line that touches a circle at only one point on its circumference..

Example: Line AC is a tangent to the circle drawn.





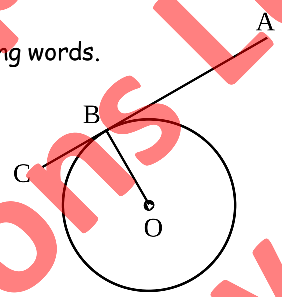
If point O is the centre of the circle, then line OB is a radius of the circle.
Line OB and line AC create a right-angle at point B.

The angle made by a tangent and a radius is 90°

Task 11

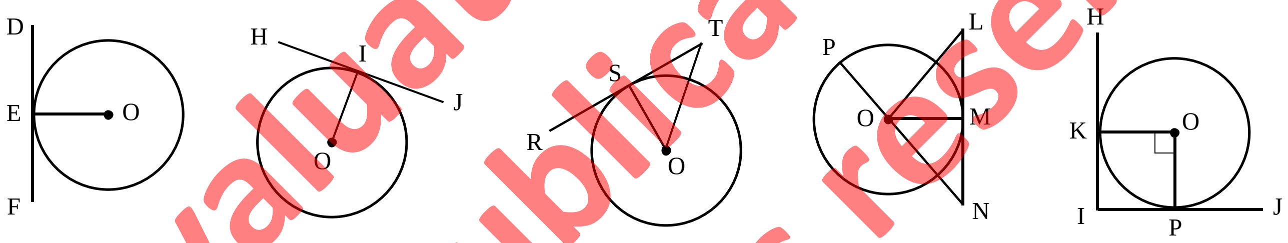
Copy each sentence using the diagram and the words in the box to fill in the missing words.

1. Point O is the .... of the circle.
2. Line OB is a .... of this circle.
3. Line AC is a .... to this circle.
4. The tangent to a circle and the radius of the circle form a ....

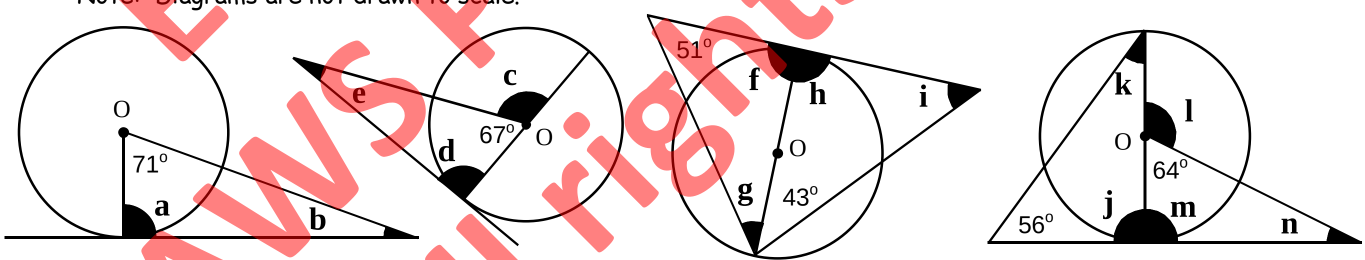


tangent	radius	centre	right-angle

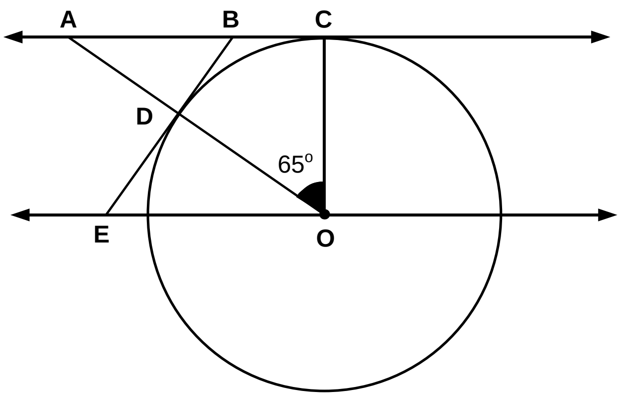
5. Name all the right-angles in these diagrams. *Example:* ∠DEO



6. Calculate the size of the missing angles (a to n), giving reasons for your answers.
Note: Diagrams are not drawn to scale.



On the diagram opposite...
lines AC and EO are parallel,
lines AC and EB are tangents to the circle, centre O
lines DO and CO are radii of the circle
∠DOC = 65°



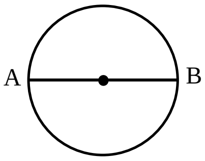
7. Explain why ∠ACO = 90°
8. Explain why ∠OAC = 25°
9. Explain why ∠ODB = 90°
10. Calculate the size of ∠DBA
11. Calculate the size of ∠DEO
12. Calculate the size of ∠EOD

Geometry

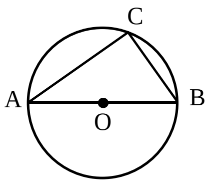
Angles in a semi-circle:

When a diameter is drawn across a circle, the circle is divided in half and each half is called a semi-circle.

Example: Line AB is a diameter.



Triangle ABC is drawn, with line AB (diameter) as one side.

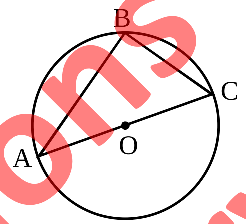


∠ACB touches the circumference. This angle is called the *'angle in a semi-circle'.*

An angle in a semi-circle is equal to 90°

Task 12

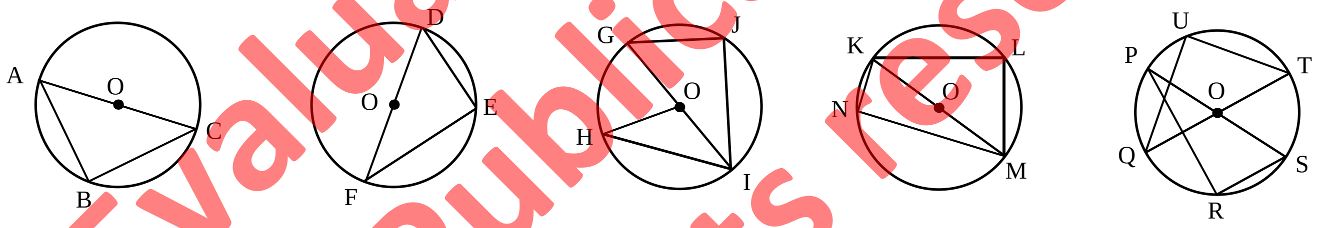
Copy and complete each sentence using the diagram and the information in the box.



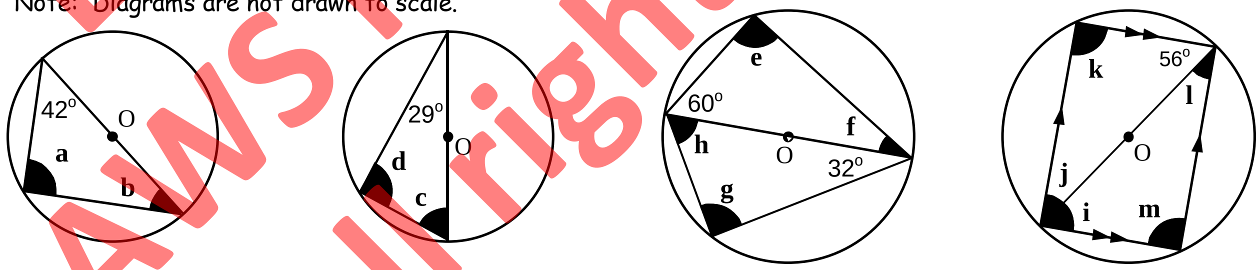
1. Point O is the .... of the circle.
2. Line AC is a .... of this circle.
3. Point B touches the .... of this circle.
4. ∠ABC is said to be the angle in a ....
5. An angle in a semi-circle is equal to ....

diameter	90°	semi-circle	centre	circumference

6. Name all the angles in a semi-circle in these diagrams. *Example:* ∠ABC

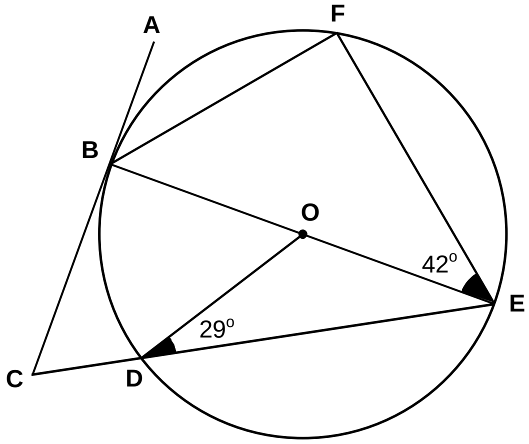


7. Calculate the size of the missing angles (a to n), giving a reason for each answer.
   Note: Diagrams are not drawn to scale.



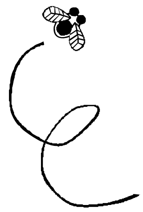
On the diagram opposite...

line BE is a diameter of the circle, centre O
lines OB, OD and OE are radii to the circle, centre O
line AC is a tangent to the circle
∠BEF = 42° and ∠ODE = 29°

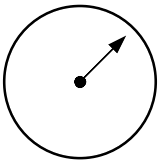


8. Explain why ∠BFE = 90°
9. Explain why ∠CBE = 90°
10. Calculate the size of ∠EBF
11. Explain why ∠OED = 29°
12. Calculate the size of ∠ECB
13. Calculate the size of ∠FBA

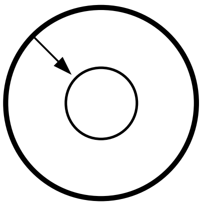
Creating pathways (loci):



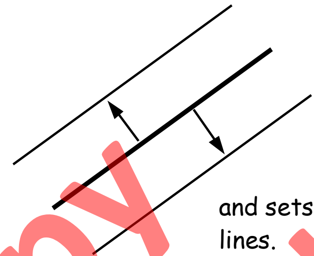
A **locus** is a path, or route followed by a moving object. **Loci** is the plural of locus.
Example: The flight of a bee creates a pathway or locus.
Other examples of some loci you could draw would include ...



a circle drawn around a point,



a circle drawn around another circle,



and sets of parallel lines.

In the three examples, a point moving the same distance around a single point, around a given circle and parallel to a given line, has created these loci or pathways. Discuss how you would draw each locus.

Task 13

Draw a dot on a page in your maths book. Draw the locus of a point that moves so that it is always ...

1. 1.5cm from the dot
2. 20mm from the dot
3. 3.2cm from the dot.
4. 27mm from the dot.

Draw a circle with a radius of 25mm on a page in your maths book.
Draw the locus of a point that moves so that it is always ...

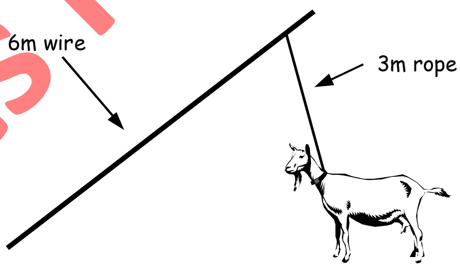
5. 1.0cm outside the circle
6. 8mm inside the circle
7. 1.5cm from the circle

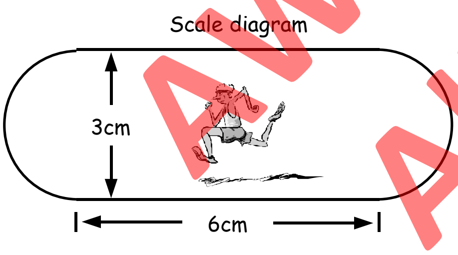
Draw a horizontal line on a page in your maths book.
Draw the locus of a point that moves so that it is always ...

8. 15mm above the line
9. 2.5cm below the line
10. 10mm from the line

Sally has a pet goat tied to a 3 metre rope. The rope is attached to a 6 metre wire. The goat can move either side of the wire and the rope can slide up and down the wire.

11. Draw the locus of the maximum distance the goat can walk.
Use a scale of 1cm to represent 1m in your diagram.





This diagram represents the inside lane of a 400m running track.
Richard is entered in the 400m race and is going to run in lane 2.

12. Copy this diagram of a 400m running track and draw 3 more lanes for this track. On your diagram, make each new lap 5mm apart.
13. Sketch the locus for the path that Richard will take as he runs in the 400m race in Lane 2.

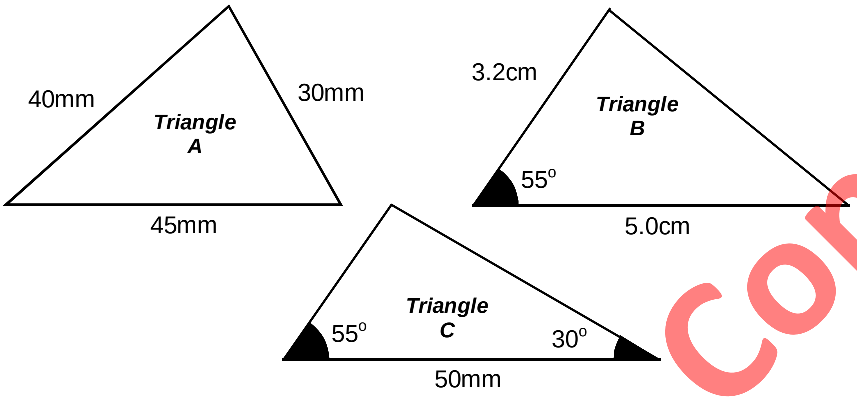
Not all loci are like those in the questions above.
Example: A feather floating through the air would not create a smooth locus.

14. Draw the locus of a rubber ball rolling off a table and bouncing onto a concrete floor.
15. Draw the locus of a teacher walking around the classroom.

16. Draw some everyday loci for situations around your school.
Example: The locus for a soccer player while playing a game of soccer.
The locus for the flight of a tennis ball during a rally.

Constructing triangles:

Using a ruler, a protractor and a compass, but not the compass you use for measuring compass bearings, the following triangles have been constructed.



Look at each triangle and discuss how each triangle was drawn.

See if you can reconstruct these triangles.

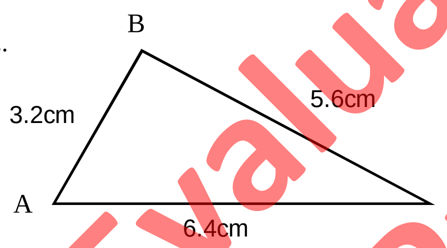
Write down the steps you would follow as you construct each triangle.

Answer: ***Triangle A*** was drawn using a compass and ruler.
Triangles B was drawn using a compass, a ruler and a protractor.
Triangles C was drawn using a ruler and a protractor.

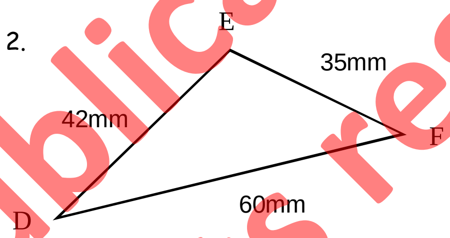
Task 14

Construct these triangles using a **compass** and a **ruler**. Show your construction marks.

1.



2.



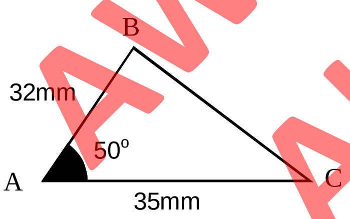
3. On your constructions, use a protractor to **measure** ∠ABC and ∠DEF.

4. **Construct** a triangle with all sides 7cm long. **Measure** the angles of your triangle. **Name** this type of triangle.

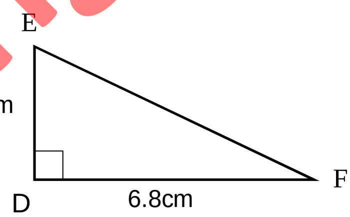
5. **Construct** a triangle with all sides 60mm, 60mm and 75mm long. **Measure** the angles of your triangle. **Name** this type of triangle.

Construct these triangles using a **compass**, a **ruler** and a **protractor**. Show your construction marks.

6.

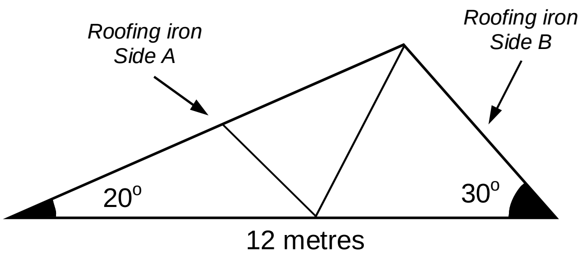


7.



8. On your constructions, **measure** the length of line BC and line EF, and **measure** ∠CBA and ∠DFE.

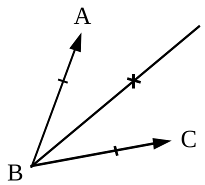
9 A builder is trying to work out the length of roofing iron required for *Side A* and *Side B* of a new building. (See diagram).
Construct a scale diagram, using a scale of 1cm = 1m, to work out the length of roofing iron required for *Side A* and *Side B*.



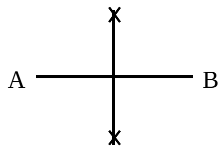
10. Draw your own construction diagrams and have a classmate try to reconstruct them.

More constructions:

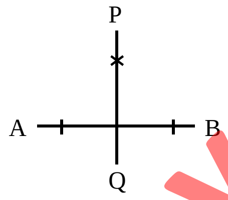
Various drawing instructions can be used to construct some simple and complicated diagrams.
Example:



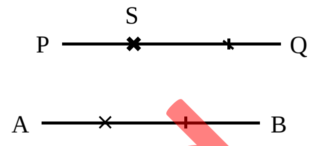
Bisecting ∠ABC



Bisect line AB



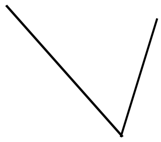
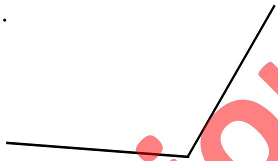
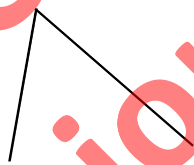
Constructing line PQ perpendicular to AB



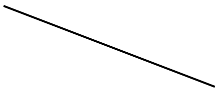
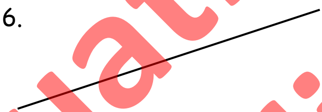
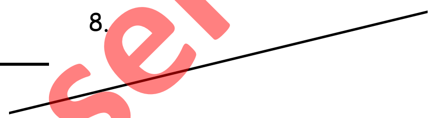
Constructing line PQ, through point S, parallel to AB

Task 15

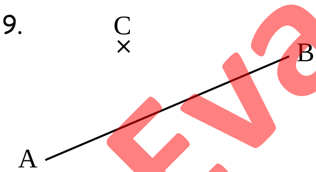
Copy these diagrams then using a compass, **bisect** each angle. Show all construction marks.

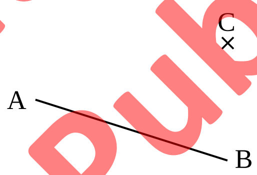
1. 
2. 
3. 
4. 

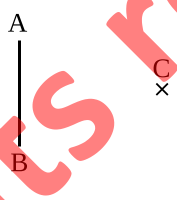
Measure each line, then using a compass **construct** the **mediator** (perpendicular bisector). Show all construction marks.

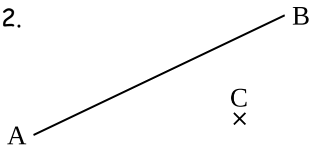
5. 
6. 
7. 
8. 

Copy each diagram, Then **construct** a line through C which is **parallel** to line AB. Show all construction marks.

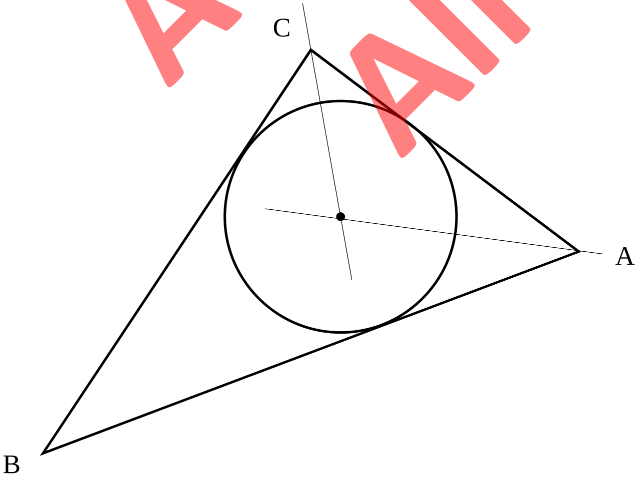
9. 

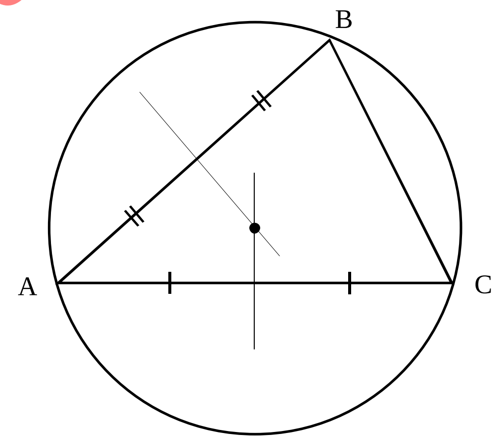
10. 

11. 

12. 

13. Follow these steps to construct an **Incircle**.
    - Draw a triangle.
    - Construct the bisector of two angles. Extend the angle bisector lines until they intersect inside the triangle.
    - Using the intersect point as a centre, draw a circle that just touches all three sides of the triangle.





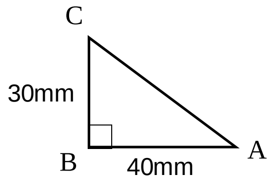
14. Follow these steps to construct a **Circumcentre**.
    - Draw a triangle.
    - Construct the perpendicular bisectors of two sides. Extend the angle bisector lines until they intersect inside the triangle.
    - Using the intersect point as a centre, draw a circle that passes through all three vertices of the triangle.

Please **DO NOT** write on the sheets

Scale diagrams:

A right-angled triangle with side AB = 40mm, side BC = 30mm and ∠ABC = 90° has been drawn using a scale 1mm = 2mm. From the diagram, find the length of the unknown side AC.

Example:



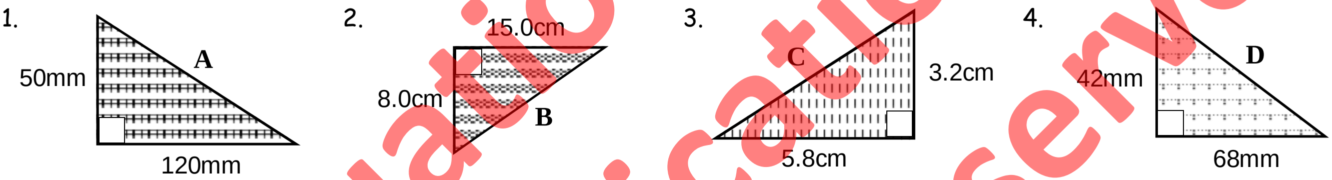
The length of side AC can be measured to the nearest mm.

Answer: Measured length of AC = 25mm,
therefore actual length of AC = 50mm

Discuss situations where the use of scale diagrams would be useful.

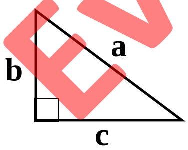
Task 16

Construct scale diagrams of these right-angled triangles using a **compass**, a **protractor** and a **ruler**.
Show your construction marks. Use your diagram to find the length of the missing side.
Remember to include the scale you have used. *Example:* 1 : 2

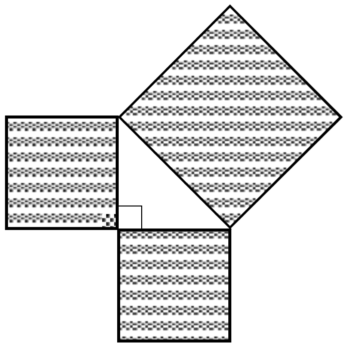


The Pythagoras relation:

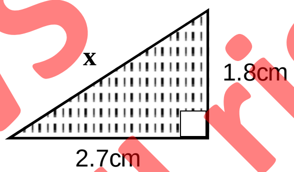
The longest side of a right-angled triangle is opposite the right-angle. It is called the **hypotenuse**..
The **Pythagoras** relation states *'the square of the hypotenuse equals the sum of the squares of the other two sides'.*
Example: For this triangle, side **a** is the hypotenuse.



$a^2 = b^2 + c^2$, where a = length of the hypotenuse



Example:
Find the length of side x, rounded to 2 d.p.

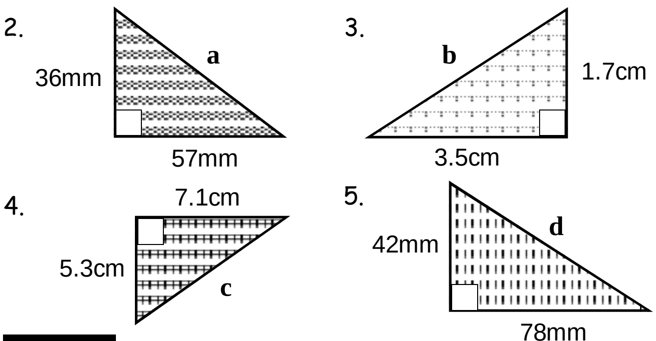


$x^2 = 2.7^2 + 1.8^2$
$x^2 = 7.29 + 3.24$
$x = \sqrt{10.53}$
$x = 3.24$ (2 d.p.)

Task 17

1. Use the Pythagoras relation to calculate the length of the missing sides of the triangles 1 to 4 in Task 16 above.

Use the Pythagoras relation to calculate the missing sides in the triangles below. Round answers to 2 d.p.

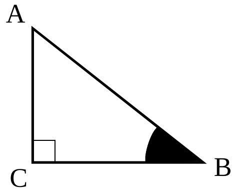


Calculate the length of the missing sides (z) for each of these right-angled triangles. Round answers to 2 d.p.

	Hypotenuse	Side B	Side C
6.	z	4.8cm	14.3cm
7.	z	9.7mm	5.8mm
8.	z	6.9cm	11.4cm
9.	15.9mm	z	8.5cm
10.	17.4cm	12.4cm	z

Hypotenuse, Opposite and Adjacent:

For a right-angled triangle, where ∠B is the angle **'marked'**, the sides can be named as follows ...

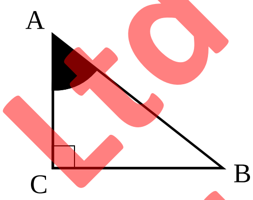


Side **AB** = **Hypotenuse** (The side opposite the right-angle)

Side **AC** = **Opposite side** (The side opposite the angle marked, that is ∠B)

Side **BC** = **Adjacent side** (The side next to the angle marked, that is ∠B)

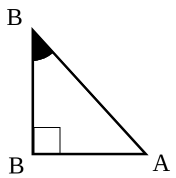
If A was the 'marked' angle, how would that change the naming of the sides? *Example:*

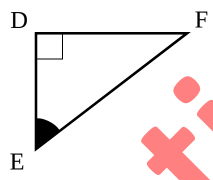


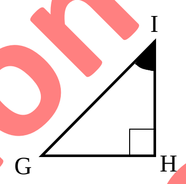
Side AC becomes the **adjacent** side and side BC becomes the **opposite** side.
The side named the Hypotenuse does not change as it is always opposite the right-angle..

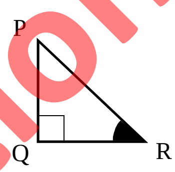
Task 18

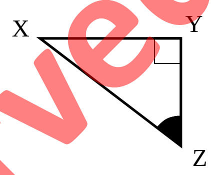
On each triangle an angle is marked. Name the hypotenuse, opposite and adjacent sides for the marked angle.

1. 

2. 

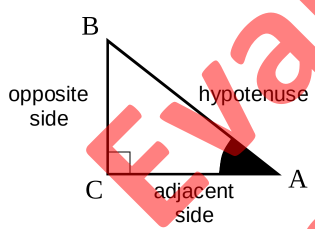
3. 

4. 

5. 

Sine, Cosine and Tangent as a ratio:

If the lengths of two sides of a right-angled triangle are known, then the size of any angle in the triangle can be found using one of following ratios ...



Sine of ∠A = $\frac{\text{length of opposite side}}{\text{length of hypotenuse}}$

Cosine of ∠A = $\frac{\text{length of adjacent side}}{\text{length of hypotenuse}}$

Tangent of ∠A = $\frac{\text{length of opposite side}}{\text{length of adjacent side}}$

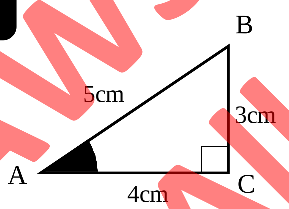
The letter **SOHCAHTOA** is a good way to remember the trig ratios.

If the lengths of at least two sides are known, a trigonometry ratio can be written as a fraction.

Task 19

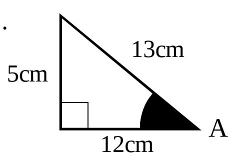
For this triangle

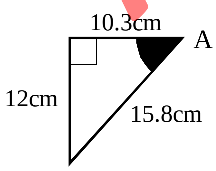
Sin A = $^3/_5$

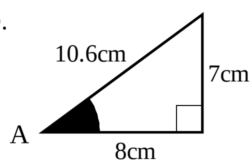


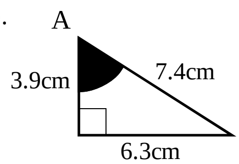
1. Write Cos A and Tan A as fractions.
2. Convert Sin A, Cos A and Tan A to decimals.

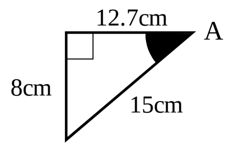
For each triangle write Sin A, Cos A and Tan A as fractions and then convert each fraction to a decimal (round to 4 d.p.).

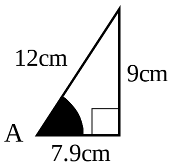
3. 

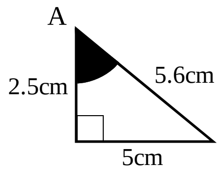
4. 

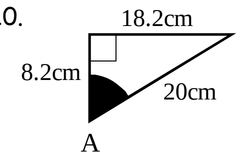
5. 

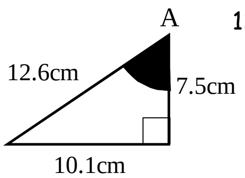
6. 

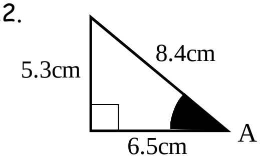
7. 

8. 

9. 

10. 

11. 

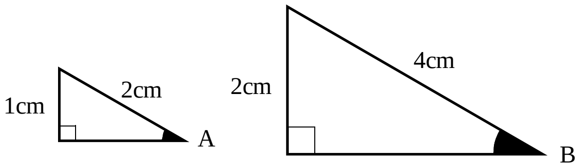
12. 

Please **DO NOT** write on the sheets

Converting a trig ratio to an angle:

Example: A trig ratio for ∠A and ∠B can be written as follows ...

Sin A = $^1/_2$ = 0.5   Sin B = $^2/_4$ = 0.5



Although these two triangles are different sizes, they are similar figures - Sin A = Sin B, therefore these angles are the same size.

Using either a scientific calculator or trig tables a trig ratio can be converted to an angle.

Example: Using a calculator ... If Sin A = 0.5, then ∠A = 30°   [On a calculator, enter $\boxed{0}$ $\boxed{.}$ $\boxed{5}$ $\boxed{=}$ $\boxed{\text{INV}}$ $\boxed{\text{Sin}}$]

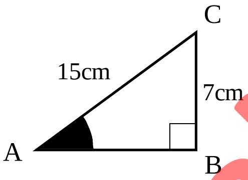
Task 20

Use a scientific calculator or trig tables to find the size of ∠A, rounded to 1 d.p. if ...

1.	Sin A = 0.5000	2.	Cos A = 0.9291	3.	Tan A = 1.000	4.	Sin A = 0.9699	5.	Sin A = 0.7406
6.	Cos A = 0.9742	7.	Sin A = 0.6152	8.	Cos A = 0.4196	9	Tan A = 9.5214	10.	Cos A = 0.1427
11.	Tan A = 0.8412	12.	Cos A = 0.3495	13.	Tan A = 6.4129	14.	Sin A = 0.4629	15.	Tan A = 0.7064
16.	Cos A = 0.0596	17.	Tan A = 2.9521	18.	Sin A = 0.2569	19.	Tan A = 7.0953	20.	Sin A = 0.6842

Finding the size of an angle using a trig ratio:

Example: To find the size of ∠A, given BC = 7cm (opposite ∠A) and AC = 15 cm (hypotenuse).



Which trig ratio involves using the opposite side and the hypotenuse? **[SOHCAHTOA]**

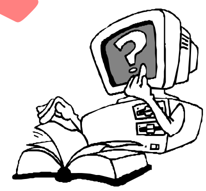
Answer: Sine = $^O/_H$

Show working as follows ...

Sin A = $^7/_{15}$

Sin A = 0.4666

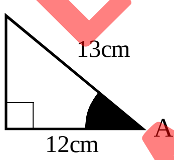
∠A = 27.8°

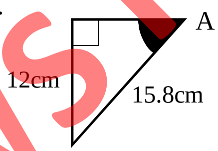


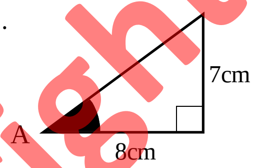
[On a calculator, enter $\boxed{7}$ $\boxed{\div}$ $\boxed{15}$ $\boxed{=}$ $\boxed{\text{INV}}$ $\boxed{\text{Sin}}$]

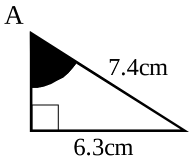
Task 21

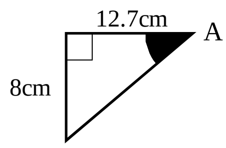
Use a trig ratio to find the size of ∠A, rounded to 1 d.p. Show your working.

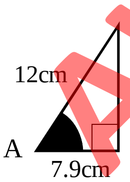
1.


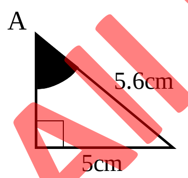
2.


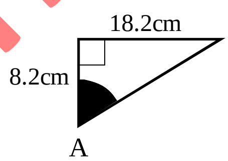
3.


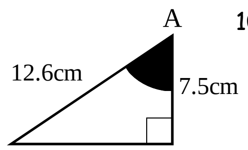
4.


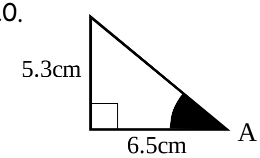
5.


6.


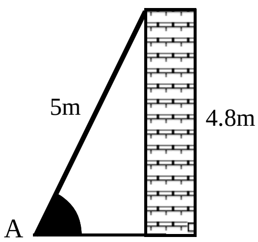
7.


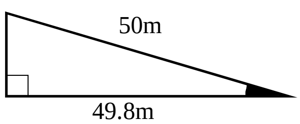
8.


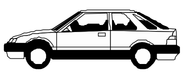
9.


10.


11. A 5m ladder is leaning against a building that is 4.8m high as shown in the diagram. Calculate the angle (A) the ladder makes with the ground.

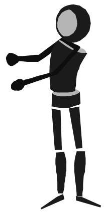






12. A driveway has a gentle slope as shown in the diagram. Calculate the slope of the drive.

Expressing an angle as a decimal:



All angles can be expressed as a trig ratio, written as a fraction and converted to a decimal.
Scientific calculators or trig tables can be used to find the value of any angle size, expressing it as a decimal.
Example: Sin 30° = 0.5, Cos 50° = 0.6428, Tan 80° = 5.6713

[On a calculator, enter $\boxed{3}\ \boxed{0}\ \boxed{\text{Sin}}$, $\boxed{5}\ \boxed{0}\ \boxed{\text{Cos}}$, $\boxed{8}\ \boxed{0}\ \boxed{\text{Tan}}$]

Note: On most sciencific calculators, enter the angle first, then enter Sine, Cosine or Tangent as required.

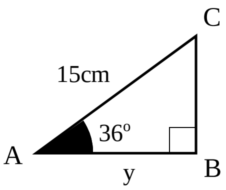
Task 22

Use a scientific calculator or trig tables to express each angle as a decimal, rounded to 2 d.p.

1.	Sin 40°	2.	Cos 70°	3.	Tan 45°	4.	Sin 80°	5.	Sin 37°
6.	Cos 9°	7.	Sin 16°	8.	Cos 25°	9	Tan 63°	10.	Cos 45°
11.	Tan 67.4°	12.	Cos 43.9°	13.	Tan 84.1°	14.	Sin 62.9°	15.	Tan 15.8°
16.	Cos 24.8°	17.	Tan 9.6°	18.	Sin 65.7°	19.	Tan 39.4°	20.	Sin 85.4°

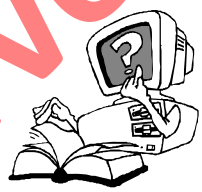
Finding the length of a side using a trig ratio:

Example: To find the length of side BC, given ∠A = 36° and AC = 15 cm (hypotenuse).



Which trig ratio involves using the adjacent side and the hypotenuse? **[SOHCAHTOA]**

Answer: Cos 36° = $^{y}/_{15}$



Show working as follows ...

Cos 36° = $^{y}/_{15}$

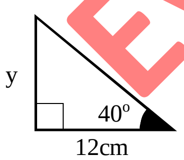
y = 15 × Cos 36°

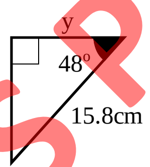
y = 12.14cm (2 d.p.)

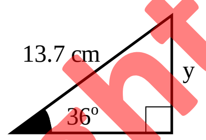
[On a calculator, enter $\boxed{1}\ \boxed{5}\ \boxed{\times}\ \boxed{3}\ \boxed{6}\ \boxed{\text{Cos}}\ \boxed{=}$]

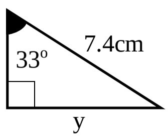
Task 23

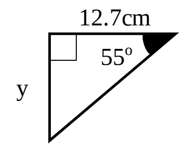
Use a trig ratio to find the length of side y, rounded to 1 d.p. Show your working.

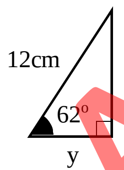
1.


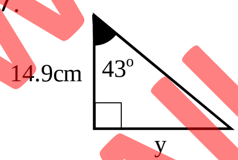
2.


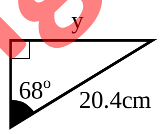
3.


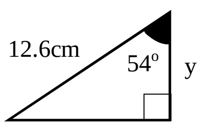
4.


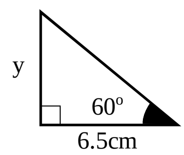
5.


6.


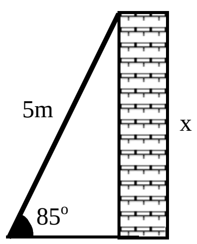
7.


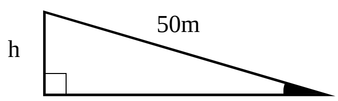
8.


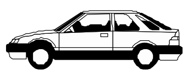
9.


10.


11. A 5m ladder, leaning against a building, makes an angle of 85° as shown in the diagram.
Calculate how high up the building the ladder reaches.



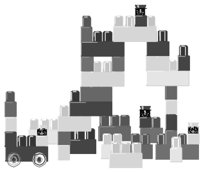




12. A 50m driveway has a slope of 2.5° as shown in the diagram. Calculate the height of the drive above the horizontal.

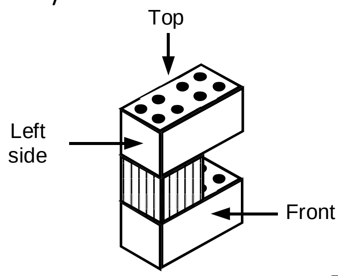
13. Create word problems involving Pythagoras, Sine, Cosine or Tangent to exchange with a classmate.
Exchange questions with a classmate and compare answers.

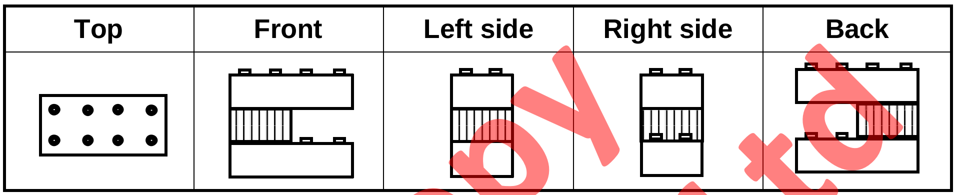
View diagrams and making models:

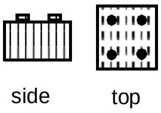


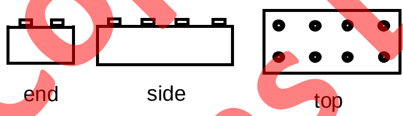
Kelly made a simple model out of Lego blocks and then drew a diagram of what the model looked like from the top, front, left, right and back.

Example:





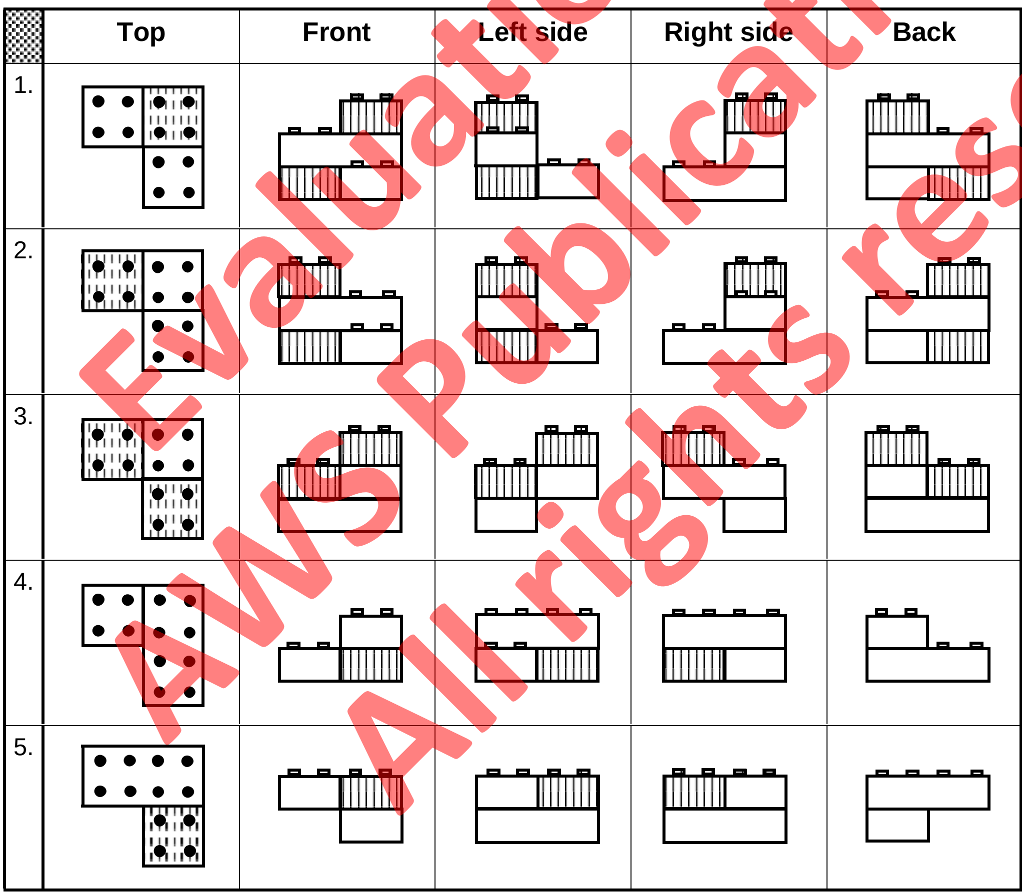
Note: 

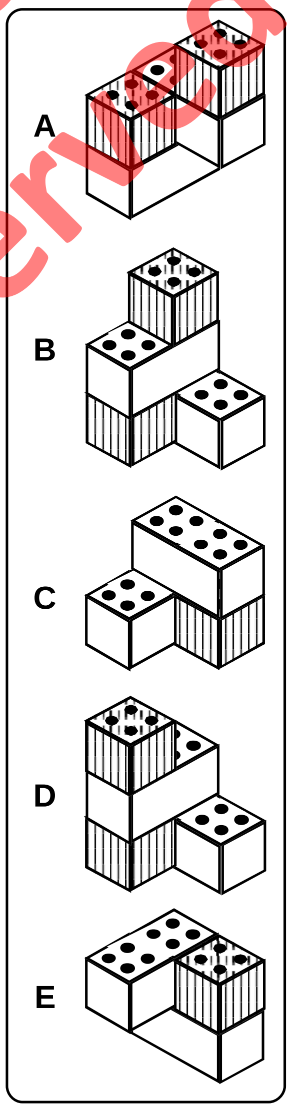
= 4 pin blocks 

= 8 pin blocks

Task 24

Look at the **top**, **front**, **left side**, **right side** and **back** view diagrams for the block structures drawn below. **Match** the view diagrams (1 to 5) with the block structure diagrams (A to E) in the box. ***Create*** each structure using blocks.





Task 25

Using the resource ...

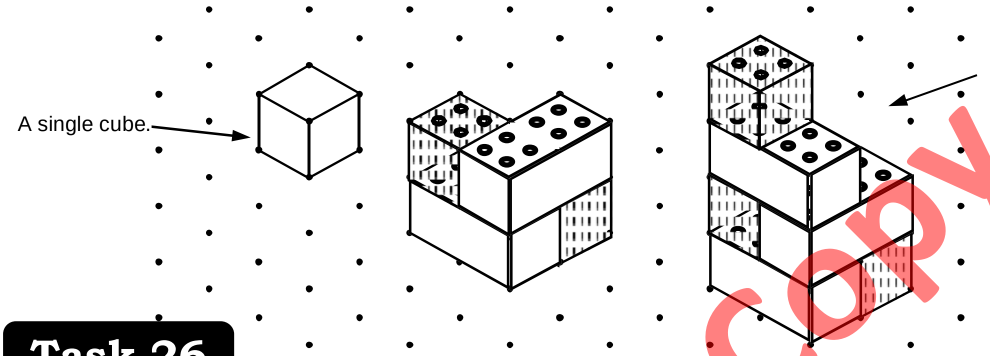
'Geometry Level 5: 3-Dimensional Block Structures & Isometric / View Diagrams'

created by AWS ***Teacher Resources,***

create more block structures given the **top**, **front**, **left side**, **right side** and **back** view diagrams.

Drawing on isometric paper:

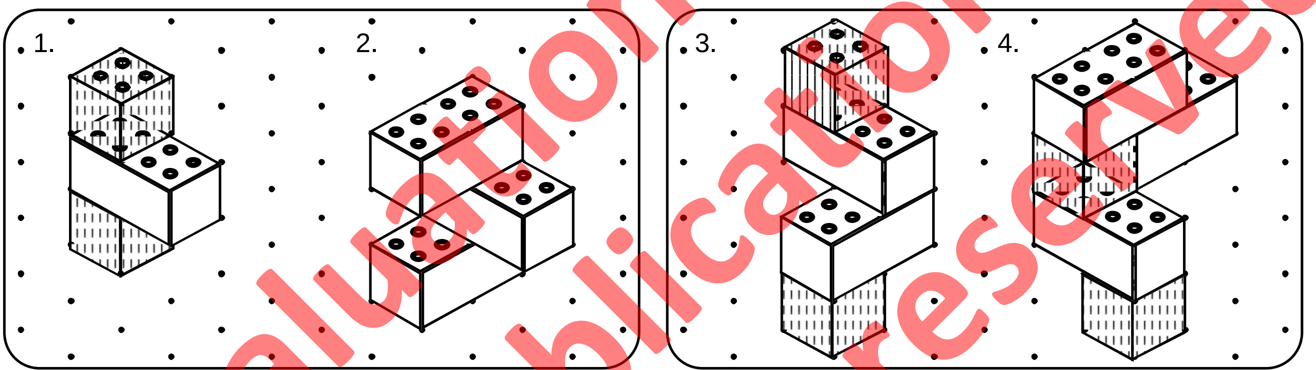
Isometric paper is special paper with dots on which 3D objects can be drawn and they look almost realistic.
Example:



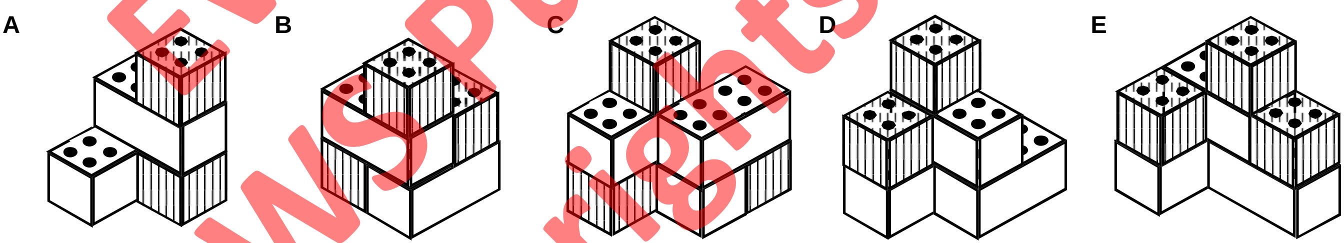
Everyday objects can also be drawn on isometric paper.

Task 26

Copy these block structures below on some '**Isometric paper**'.



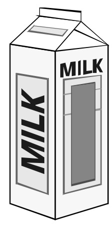
Redraw these block structures below on some '**Isometric paper**'.



5. Using some Lego type blocks, **build** each of the block structures A to E.

6. **Draw** the **top**, **front**, **left side**, **right side** and **back** view diagrams for each block structure A to E.

7. Everyday objects can also be drawn on isometric paper. Look around your classroom for objects that you could draw on some isometric paper.



Task 27

Using the resource ...

'Geometry Level 5: 3-Dimensional Block Structures & Isometric / View Diagrams'
created by ***AWS Teacher Resources,***
draw more block structures on **isometric paper** and view diagrams on specially prepared **squared paper**.

Geometry

G6

Isometric Paper Master Sheet

Worksheet **20**

Name: **Class:**

G6

Geometry

View Diagram Master Sheet

L5MG

Worksheet 20

Name:

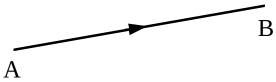
Class:

	Top	Front	Left Side	Right Side	Back

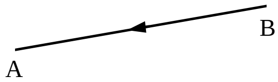
Translation using vectors:

A vector has direction and distance. A vector is a way of describing how a point or shape has been moved, without being reflected, rotated or enlarged. This type of movement is called a translation.

Example: This is vector $\underset{\sim}{AB}$



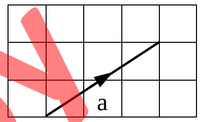
This is vector $\underset{\sim}{BA}$



A vector drawn on a grid can be described using two numbers written in the form of ...

$\begin{pmatrix} x \\ y \end{pmatrix}$ ← left or right direction
← up or down direction

Example: On this grid ...



$\underset{\sim}{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

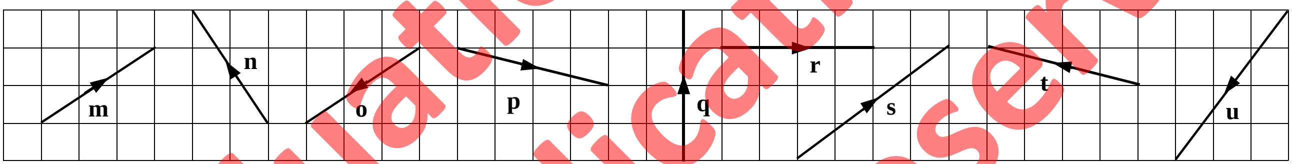
Vector 'a' moves 3 squares right, then 2 squares up.

Task 28

1. Describe in words the direction of each vector, then draw each vector on a grid.

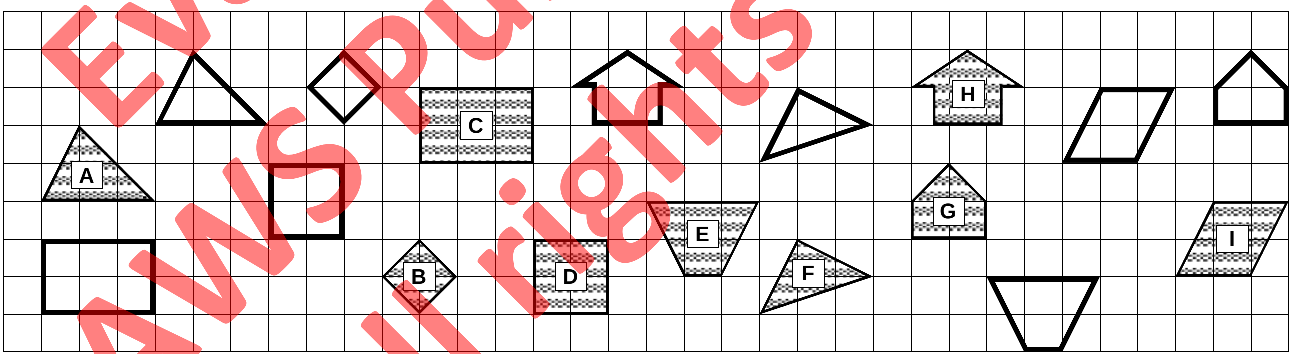
$\underset{\sim}{a} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ $\underset{\sim}{b} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ $\underset{\sim}{c} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$ $\underset{\sim}{d} = \begin{pmatrix} -2 \\ -4 \end{pmatrix}$ $\underset{\sim}{e} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$ $\underset{\sim}{f} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$

2. Describe each vector below using two numbers as above.



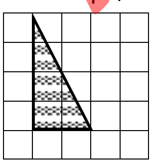
The movement of the shapes on this grid below can be described using vectors.
The original position is the shaded shape (object). The new position is the clear shape (image).

3. Describe the translation vector for each shape A to I using as a vector.



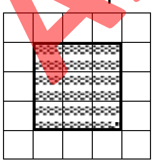
Copy each shape, then translate the shape to a new position by the vector given below the diagram.

4.



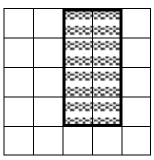
$\underset{\sim}{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$

5.



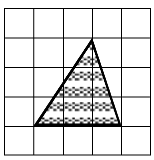
$\underset{\sim}{b} = \begin{pmatrix} 2 \\ -6 \end{pmatrix}$

6.



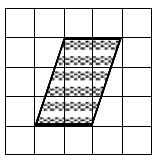
$\underset{\sim}{c} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$

7.



$\underset{\sim}{d} = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$

8.



$\underset{\sim}{e} = \begin{pmatrix} 0 \\ -5 \end{pmatrix}$

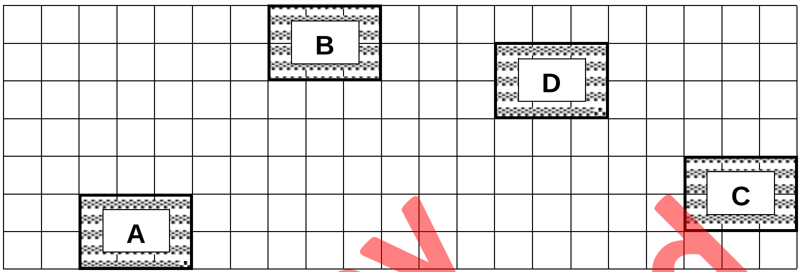
9. Look back at your **TRANSLATION** diagrams.
Write two headings, ***'Things that HAVE NOT changed'*** and ***'Things that HAVE changed'***.

List the properties of translation that would go under each heading.
Example: length of sides, area, shape, angle size, orientation etc.

More Translations:

A shape can be translated more than once.

Example: A moves to B, from B to C, then from C to D.



Vectors can be written for each translation.

$\underset{\sim}{AB} = \begin{pmatrix}5\\5\end{pmatrix}$ $\underset{\sim}{BC} = \begin{pmatrix}11\\-4\end{pmatrix}$ $\underset{\sim}{CD} = \begin{pmatrix}-5\\3\end{pmatrix}$

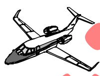
The direct route from A to D can be described as the vector ... $\underset{\sim}{AD} = \begin{pmatrix}11\\4\end{pmatrix}$

Add the top numbers of vectors AB, BC and CD. Add the bottom numbers of vectors AB, BC and CD. Answer: 11 & 4

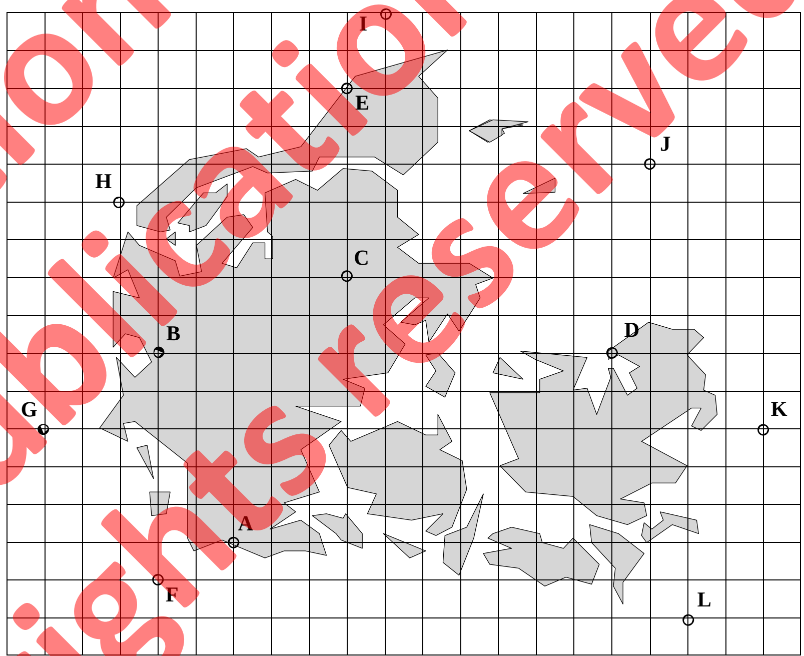
Compare these answers to the vector AD. What do you notice about the numbers?

Task 29

This diagram represents a map of some islands surrounded by sea.

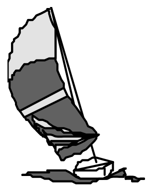


Points A to E represent towns.



1. John travels from Town A to Town C by air. Write the vector for this journey.
2. Jan flies from Town D to Town B. Write the vector for this journey.
3. Andrew is in Town B and travels to a town described by the vector ... $\begin{pmatrix}2\\-5\end{pmatrix}$

   In which town is Andrew now in?
4. Write each vector for a journey from
   - Town A to Town B,
   - Town B to Town C,
   - Town C to Town D,
   - Town D to Town E.
5. Add your vector answers from question 4 above, then compare your answer with the vector for a journey directly from Town A to Town E. What do you notice about your answers?



6. A sailing ship goes around the islands, starting from Town A and passing through the points F, G, H, I and J. Write the vectors for each part of the journey.
7. If the final part of the journey is given by the vector $\begin{pmatrix}-1\\-5\end{pmatrix}$ where does the journey end?
8. Create your own map on a grid that represents ....

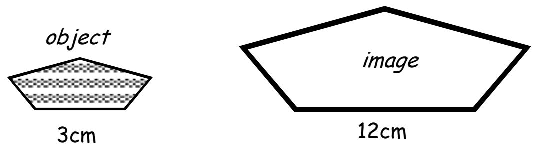
   your classroom,
   the school grounds,
   a treasure map,
   or an idea of your own.

Use your map to create questions using vectors to locate or move between points on your maps. Exchange your map and questions with a classmate.

Similar figures and scale factors:

When similar figures are made bigger (or smaller) they are said to be **enlarged**.

Example: This shaded shape (object) has been enlarged, to create the clear shape (image).



By how much has the object been enlarged?

Answer: A 3cm long side on the object has become a 12cm long side on the image, therefore the shape is 4x bigger.

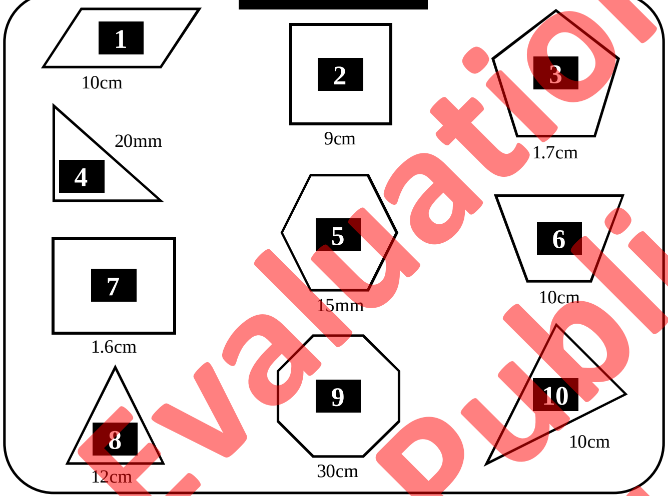
The size of the enlargement is called the **scale factor**. In this example, the scale factor is 4.

If a **shape** is made **bigger** when enlarged, the **scale factor** is a **whole number**.
If a **shape** is made **smaller** when enlarged, the **scale factor** is a **fraction**.

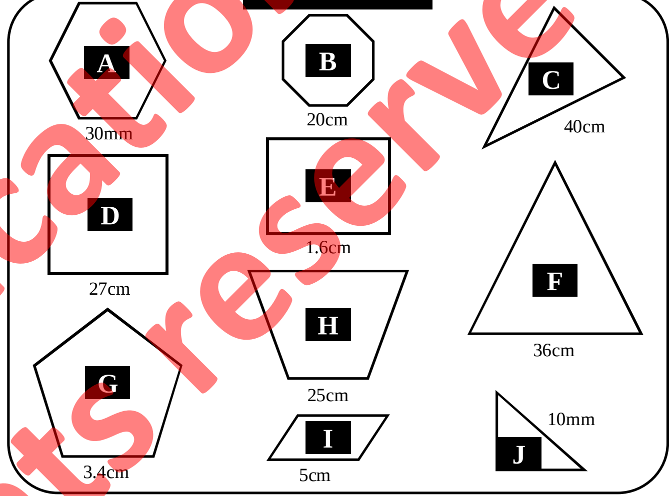
Task 30

Match the figures in **Box A** (Objects) with the similar figures in **Box B** (Images).
Work out the **scale factor** for each enlargement. (These diagrams are not drawn to scale).

Box A



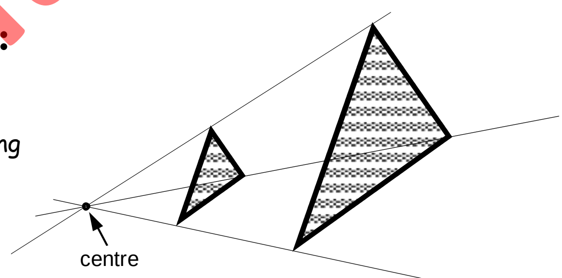
Box B



Finding the centre of an enlargement:

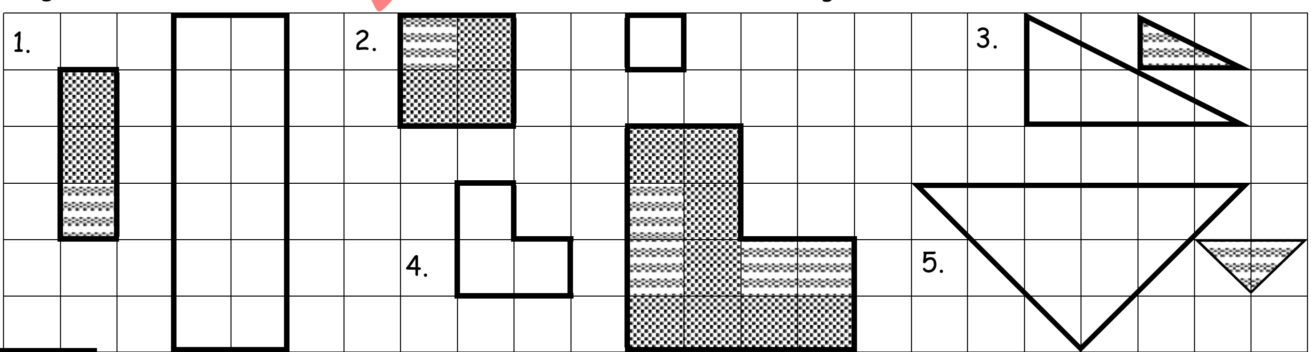
As well as a scale factor, an enlargement must have a **centre of enlargement**.

Example: To find the centre of an enlargement, join corresponding corners of the object and its image.
Where the lines cross is the centre of the enlargement.



Task 31

Copy each pair of diagrams. Object = shaded shape, Image = clear shape. **Draw** lines to find the **centre of enlargement** and label the centre C. State the **scale factor** for each enlargement.

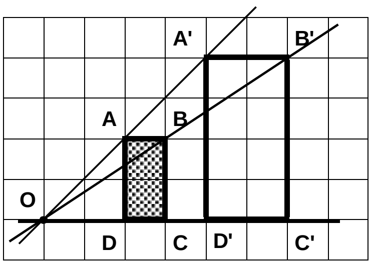


Please **DO NOT** write on the sheets

Drawing enlargements:

To enlarge a shape you need to know both the **scale factor** and the **centre of enlargement**.

Example: Using point O, enlarge ABCD by a scale factor of 2.



The **centre of enlargement** can be outside or inside the shape, or on one of its sides. The **scale factor** can be a whole number or a fraction.

If the object is labelled ABCD, then the image is labelled A'B'C'D'.
To enlarge a shape, follow these steps.

Step 1: **Locate** the **centre** of enlargement and one corner of the object.

Step 2: **Count** the squares across and / or up & down to get from the centre to this corner.
Example: From centre O to corner A is 2 squares right and 2 squares up.

Step 3: **Multiply** your answers in Step 2 by the scale factor.
Example: 2 × 2 = 4, therefore 4 to the right, 2 × 2 = 4, therefore up.

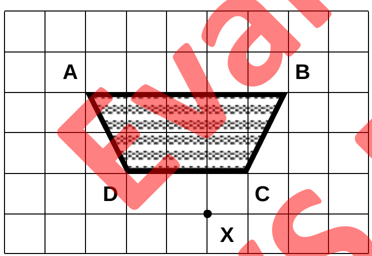
Step 4: Using your answers in Step 3, count from the centre to **mark** the new position of the corner, then label. *Example:* Point A moves to point A'.

Step 5: Repeat these steps for all corners of the shape, then draw lines to join corners, **drawing** the enlarged shape.

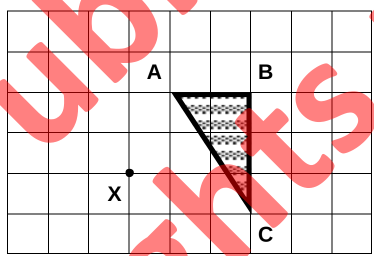
To check if your enlarged shape is in the right position, draw a line from the centre of enlargement through any point on the object and its corresponding point on the image. It should be a straight line.

Task 32

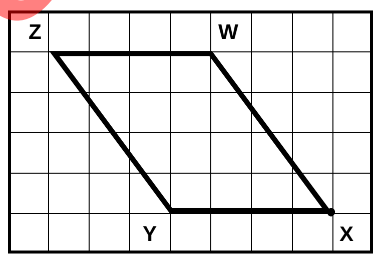
Copy each diagram. Using **X** as the centre of enlargement, **enlarge** each shape by the scale factor given.
Remember to **label** the image and **draw** some lines on your completed enlargement diagram to show that the position of your diagram is correct.

1.


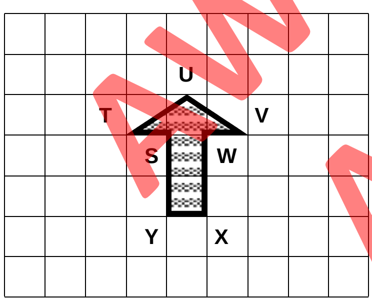
scale factor = 2

2.


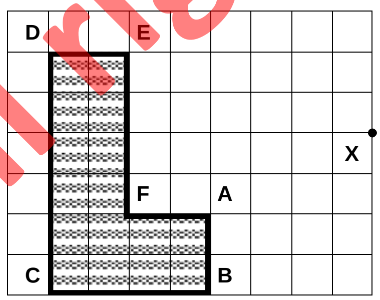
scale factor = 3

3.


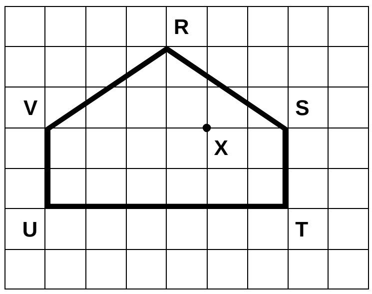
scale factor = ½

4.


scale factor = 3

5.


scale factor = ½

6.


scale factor = 2

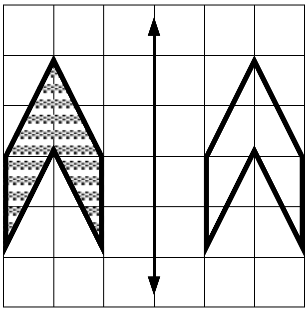
7. **Draw** a shape of your own and **mark a centre** of enlargement. Decide on a **scale factor**.
Have a classmate draw the enlargement of your shape.

8. Look back at your **ENLARGEMENT** diagrams.
Write two headings, ***'Things that HAVE NOT changed'*** and ***'Things that HAVE changed'***.

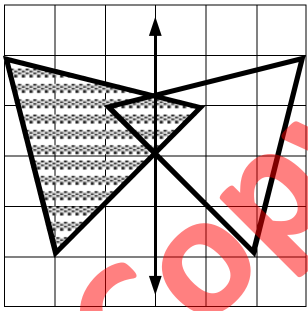
List the properties of enlargement that would go under each heading.
Example: length of sides, area, shape, angle size, orientation etc.

Locating and drawing lines of symmetry:

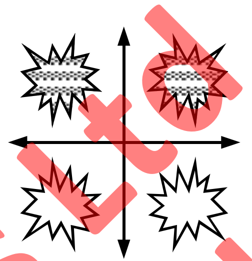
For a shape to be reflected there must be a mirror line. The mirror line is often represented by an arrow.
Example: The shaded shape has been reflected to its new position (clear shape).


m

Some shapes may cross the mirror line and have to be reflected both sides of the mirror line.


m

There may be more than one mirror line.

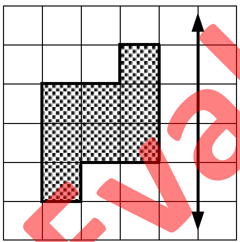
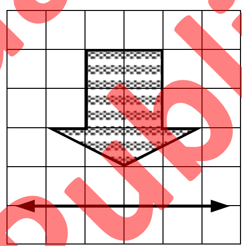
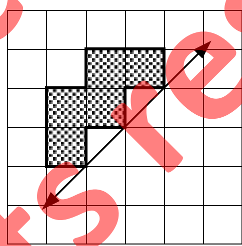
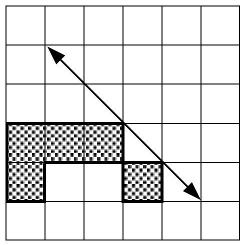
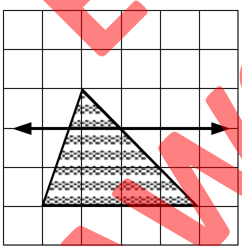
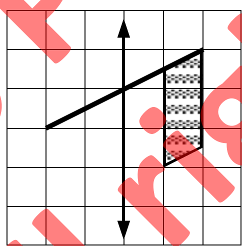
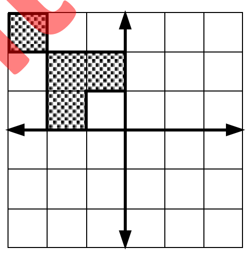
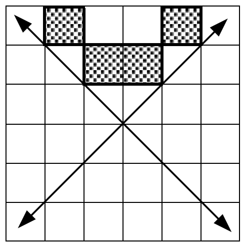


A **mirror line** is half way between corresponding points on a shape and its new reflected position.
A mirror line is also known as the **line of symmetry**.

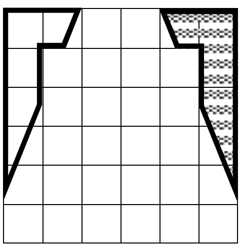
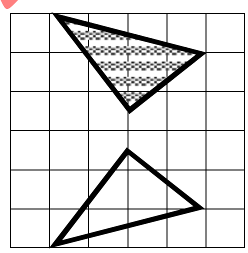
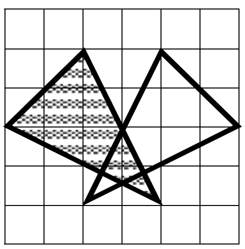
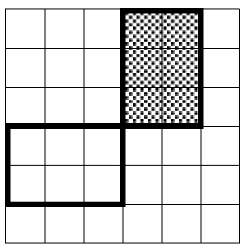
The original shape is called the **object**. Redrawn in its new position, the shape is called the **image**.

Task 33

Copy each diagram below onto the squares of your maths book.
Reflect each shape (object) to its new position (image) using the arrowed line(s) as the mirror line(s).

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. **Draw** your own shapes (objects) and mirror lines. Ask a classmate to **reflect** each shape and draw the new position of the shape (image).

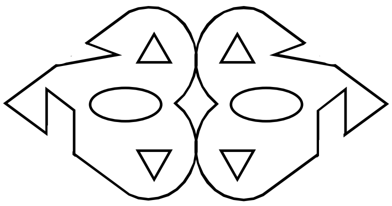
Copy these diagrams below and **draw** in the **mirror lines** (lines of symmetry).

10. 
11. 
12. 
13. 
14. **Create** your own diagram with a shape and its new position drawn, but no mirror line(s) marked. Have a classmate locate and draw in the mirror line(s).

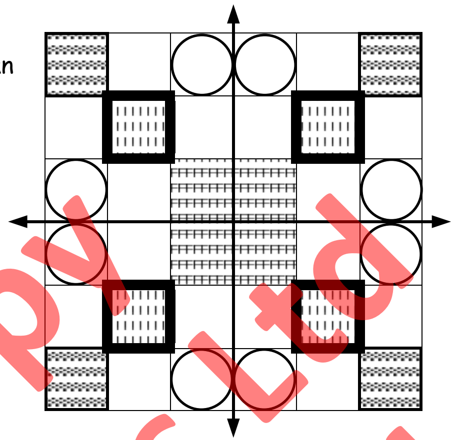
Creating designs involving reflection:

The use of reflection in designs is common, such as in wallpaper, floor or tile patterns. Some buildings have lines of symmetry. Making reflective designs can be fun.

Example: Folding paper, then cutting out pieces will produce designs.



Other designs can be created by using lines of symmetry and copying patterns.



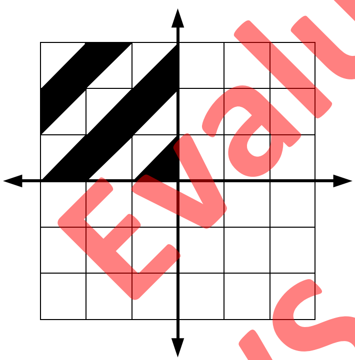
Task 34

By folding paper and using scissors, create paper designs that have the following number of lines of symmetry. The pieces of paper you use to create your designs can be any shape.

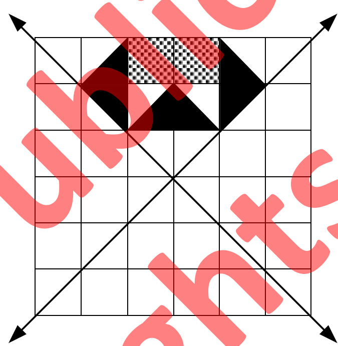
1. 0 lines of symmetry
2. 1 line of symmetry
3. 2 lines of symmetry
4. 4 lines of symmetry
5. On your paper designs, mark all lines of symmentry.

Copy each diagram below using the squares in your maths book.
Complete each design by reflecting the shaded squares using the lines of symmetry marked as arrows.

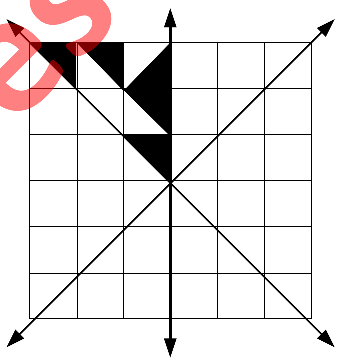
6.



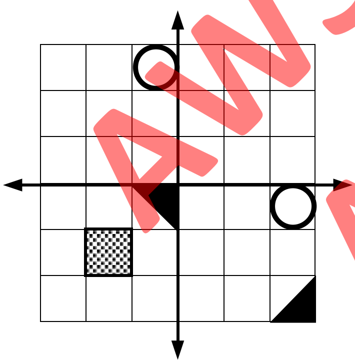
7.



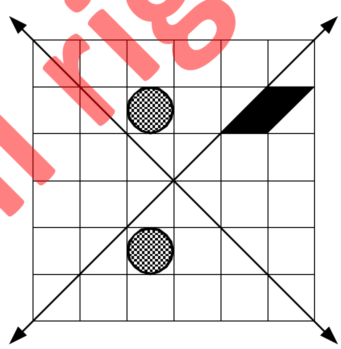
8.



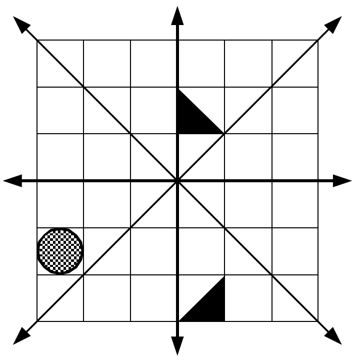
9.



10.



11.



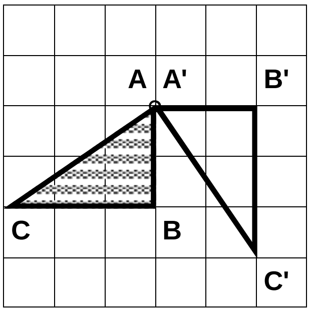
12. Look back at your **REFLECTION** diagrams.
Write two headings, ***'Things that HAVE NOT changed'*** and ***'Things that HAVE changed'***.
List the properties of reflection that would go under each heading.
Example: length of sides, area, shape, angle size, orientation etc.

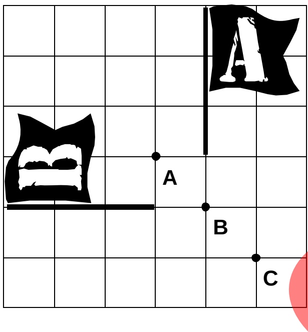
13. **Create** your own **designs** in one corner as above and have a classmate complete the reflective patterns.

Rotating shapes and finding the centre of rotation:

To rotate a shape or an object, you need an **angle of rotation** and a **centre of rotation**.

Example: Rotate the shaded triangle ABC (object) $\frac{3}{4}$ turn (270°) clockwise about point A.
The new position of the triangle is the clear shape labelled A'B'C', called the image.





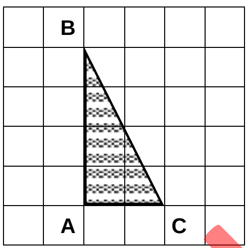
Example:
Flag A (object) has been rotated to its new position shown by Flag B (image).

Describe this rotation. Is the centre of rotation point A, B or C?

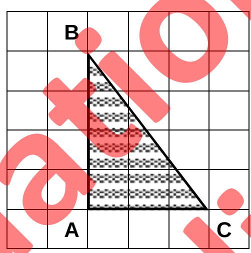
Answer: $\frac{1}{4}$ turn or 90° anti-clockwise rotation.
($\frac{3}{4}$ turn or 270° clockwise rotation)
Centre of rotation was point B.

Task 35

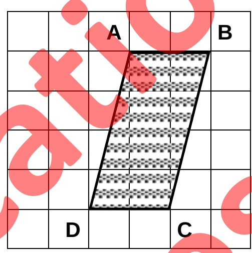
Copy each diagram below. Rotate the shaded shape (object) to its new position (image) as directed below each diagram.

1. 

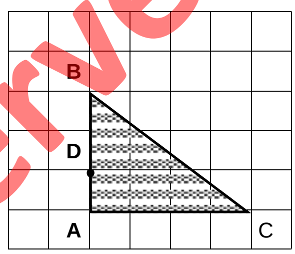
Rotate triangle ABC 90° clockwise, about point B.

2. 

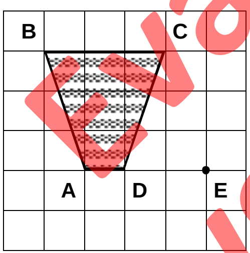
Rotate triangle ABC 180° anti-clockwise, about point A.

3. 

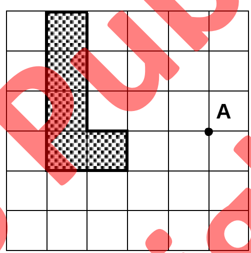
Rotate triangle ABC 90° anti-clockwise, about point B.

4. 

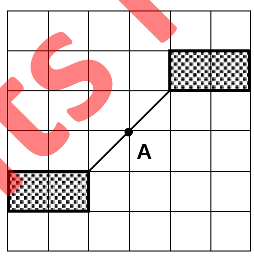
Rotate triangle ABC 90° clockwise, about point D.

5. 

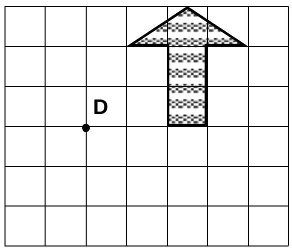
Rotate this shape 90° clockwise, about point E.

6. 

Rotate this shape 90° anti-clockwise, about point A.

7. 

Rotate this shape 90° clockwise, about point A.

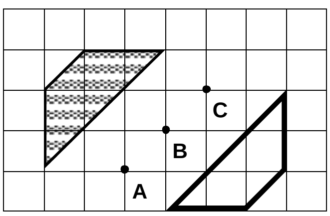
8. 

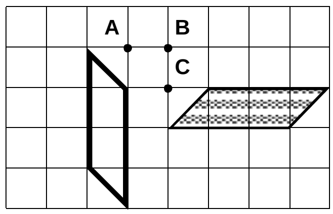
Rotate this shape 180° clockwise, about point D

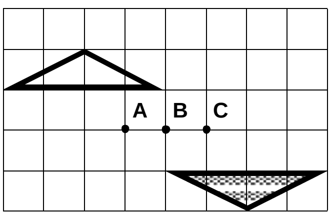
9. **Draw** your own shapes and mark centres of rotation. Have a **classmate redraw** your shapes after they have been rotated either 90° or 180° in a clockwise or anti-clockwise direction.

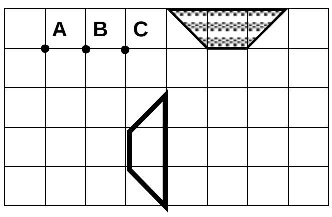
In each diagram the shaded shape (object) has been rotated to a new position (image).

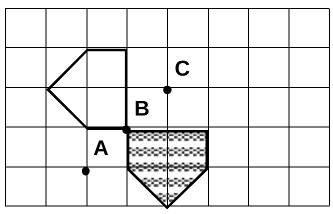
Describe each rotation and name the centre of rotation.

10. 

11. 

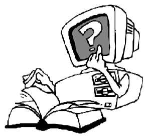
12. 

13. 

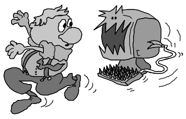
14. 

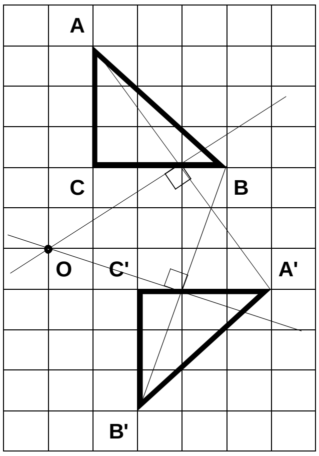
 Please **DO NOT** write on the sheets

Locating a centre of rotation and an angle of rotation:



In more difficult rotations, construction skills can be used to locate a centre of rotation.
Example: Triangle ABC has been rotated to its new position, triangle A'B'C'.





To locate the **centre of rotation**, follow these steps ...

Step 1: Join two pairs of corresponding corners of the object and its image.
Example: Join A to A', B to B'.

Step 2: Local the mid-point of line AA' and line BB'.

Step 3: Construct a perpendicular line through the mid-point of line AA' and line BB'.

Step 4: Extend the lines until they cross. Where the lines cross is the centre of rotation. *Example:* point O.

To find the **angle of rotation**, follow these steps ...

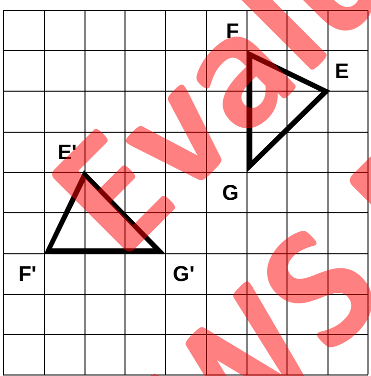
Step 1: Join a line between a corner of the object, the centre of rotation and the corresponding corner on the image. *Example:* Join A to O and O to A'.

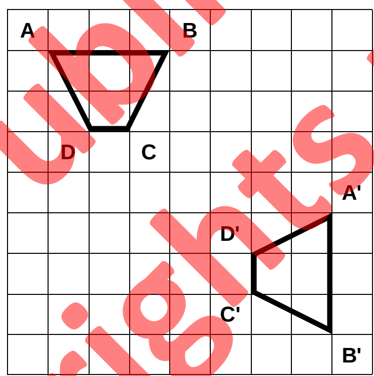
Step 2: Measure the angle created using a protractor, that is ∠AOA'.
Example: 90° clockwise This is the angle of rotation.

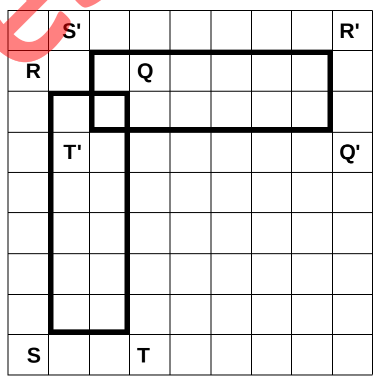
Note: For anti-clockwise rotations, the angle of rotation is positive.
For clockwise rotations, the angle of rotation is negative.

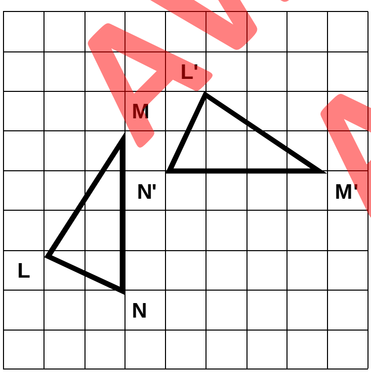
Task 36

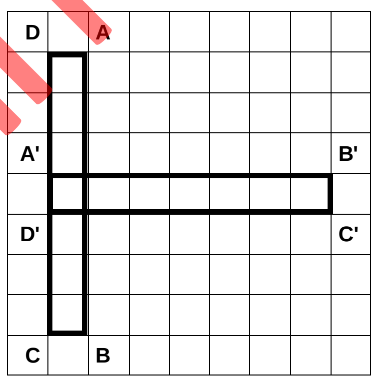
Copy each pair of diagrams. Locate the centre of rotation and mark the centre with an X, then find the angle of rotation using the method outlined above. Show all your construction marks.

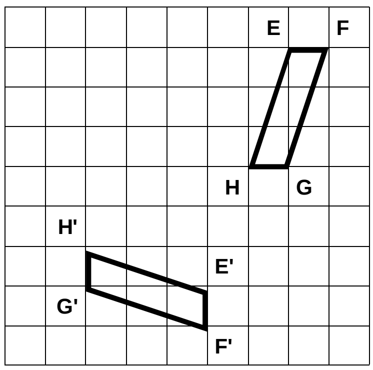
1.


2.


3.


4.


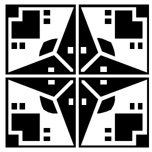
5.


6.


7. Look back at your **ROTATION** diagrams.
Write two headings, *'Things that HAVE NOT changed'* and *'Things that HAVE changed'*.

List the properties of rotation that would go under each heading.
Example: length of sides, area, shape, angle size, orientation etc.

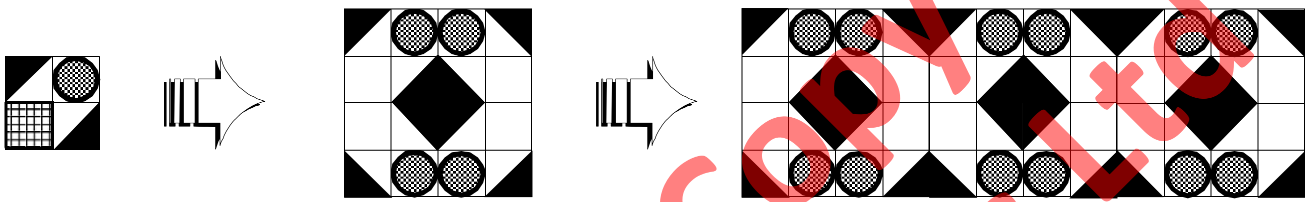
Describing symmetrical designs:



Many wallpapers, wrapping paper and indigenous art work from various countries have been created using patterns that have been reflected or rotated and then repeated many times.
Example: Katie drew this simple pattern below ...

... she then **reflected** her pattern four times to create this pattern.

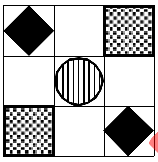
... she then **translated** this pattern three times to create a bigger pattern.

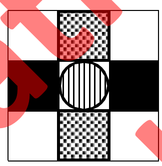


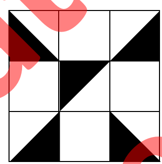
Remember, a shape or design is **translated** if it slides to a new position without being reflected (turned over) or rotated (turned around).

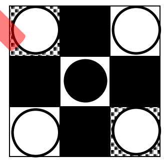
Task 37

Use each one of these simple designs to **create a larger pattern** by reflecting, rotating and / or translating each simple design. The different shadings represent different colours.

1. 

2. 

3. 

4. 

5. **Describe** how you created each of your designs.

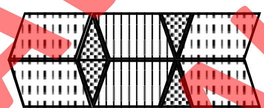
6. **Create and describe** your own patterns.

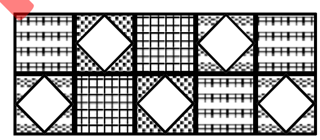
Look around your classroom for examples of patterns, objects or designs that have been created by reflecting, rotating and / or translating a simple design.
Example: Patterns such as wall paper, wrapping paper, frieze patterns, kowhaiwhai patterns etc.

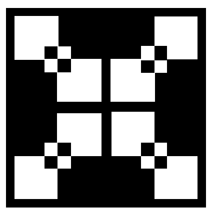
7. **Describe** how each pattern, object or design has been created.

Designs created by tessellating shapes:

A design made up of repeating shapes, without gaps between the shapes, is called a **tessellation**.
The shapes in the design have been reflected and / or rotated and / or translated.
Example:

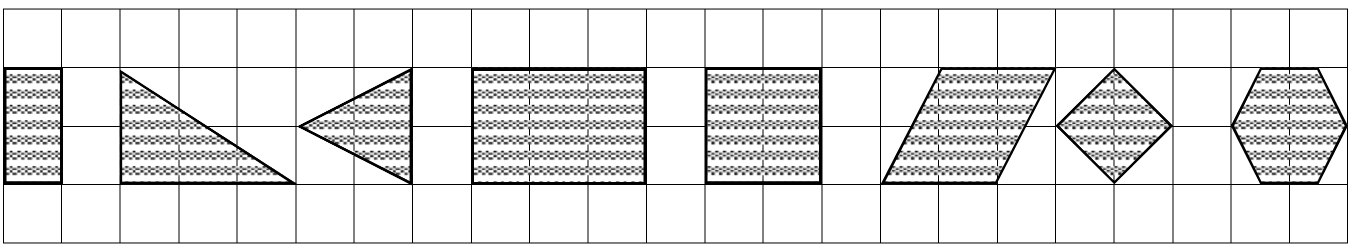






Task 38

Create a design by tessellating any combination of these shapes.



'In-class' Worksheet

Teaching Notes & Answers

How to use this section:
Teaching notes are enclosed in a box with a 'push-pin' at the top left corner. The teaching notes precede the answers for each worksheet / task. The teaching notes have been included to provide assistance and background information about each topic or unit of work.

Introduction:
The topic of Geometry is concerned with exploring shape and space. Angle properties introduced at Level 4 are revised and angle properties involving polygons with more than 4 sides, and circles are introduced, Reflective and rotational symmetry of 2D shapes is covered, plus various mathematical constructions are explored using a compass, ruler and protractor. Pythagoras' Theorem and trigonometric ratios are introduced using scale diagrams and calculators. The making of 3D block structures and drawing on isometric paper is further extended from work covered at Level 4. All four transformations - reflection, rotation, translation and enlargement are investigated.

Worksheets 1 to 4

Adjacent angles on a straight line:
Angles around a point:
Vertically opposite angles:
Angles in a triangle:

In **Tasks 1** to **4** pupils are to revisit many of the angle properties introduced at a previous level.

In **Task 5** pupils create angles to exchange with classmates.

Task 1

1. a = 65°, b = 149°, c = 71°, d = 90°, e = 126°, f = 112°, g = 62°, h = 94°, i = 81°, j = 56°, k = 121°, l = 59°, m = 132° n = 48°, o = 132°, p = 51°, q = 67°, r = 71°, s = 90° 2. 97° 3. 6° 4. 96°

Task 2

1. a = 112°, b = 114°, c = 51°, d = 127°, e = 111°, f = 50°, g = 54°, h = 266°, i = 85°, j = 70°, k = 84°, l = 84°, m = 55° n = 125°, o = 55°, p = 46°, q = 68° 2. 105° 3. 45° 4. 67.5° 5. 157.5° 6. 40° 7. 8 spokes 8. 15 spokes

Task 3

1. a = 78°, b = 127°, c = 108°, d = 90°, e = 47°, f = 115°, g = 131°, h = 68°, i = 101°, j = 82°, k = 129°, l = 51°, m = 141° n = 39°, o = 141°, p = 39°, q = 64° r = 149°, s = 31°, t = 31°, 2. 65°

Task 4

1. a = 77°, b = 117°, c = 90°, d = 35°, e = 66°, f = 59°, g = 40°, h = 64°, i = 62°, j = 44°, k = 37°, l = 143°, m = 49° n = 49°, o = 47°, p = 75°, q = 39° 2. 20°

Worksheets 5 & 6

Angles and parallel lines:
Understanding and stating angle properties:

In **Task 6** pupils are to investigate three angle properties associated with parallel lines. Using these rules, pupils are to state whether or not two lines are parallel.

In **Task 7** pupils are to find missing angles, giving reasons for the answers by stating the rules used.

Task 6

1. $\angle a = \angle k$, $\angle d = \angle m$, $\angle c = \angle h$, $\angle f = \angle j$, $\angle a + \angle b = \angle g$, $\angle b + \angle c = \angle l$, $\angle e + \angle f = \angle n$, $\angle d + \angle e = \angle i$ 2. $\angle f = \angle h$, $\angle d = \angle k$, $\angle f + \angle e = \angle l$, $\angle e + \angle d = \angle g$ 3. $\angle f + \angle g = 180°$, $\angle d + \angle l = 180°$, $\angle d + \angle e + \angle h = 180°$, $\angle e + \angle f + \angle k = 180°$
4. No, does not satisfy either angle rule for parallel lines   5. Yes, alternate angles   6. Yes, corresponding angles
7. Yes, co-interior angles adding to 180°   8. a = 79°, b = 138°, c = 70°, d = 116°, e = 123°, f = 74°, g = 106°, h = 75°, i = 75°, j = 57°, k = 123°, l = 123°, m = 36°, n = 144°, o = 36°, p = 144°, q = 101°, r = 79°, s = 101°, t = 79°, u = 101°, v = 79°, w = 101°,

Task 7

Note: There may be more than one reason for each answer, depending on the order or the way the missing angles are found.
1. a = 93° - Adj. $\angle$'s st. line, b = 51° -$\angle$'s in △, c = 106° - Adj. $\angle$'s st. line, d = 65° - Adj. $\angle$'s st. line, e = 74° - Vert. Opp. $\angle$'s, f = 54° - Adj. $\angle$'s st. line, g = 54° - Vert. Opp. $\angle$'s, h = 59° - $\angle$'s around pt, i = 126° - Vert. Opp. $\angle$'s, j = 145°- Vert. Opp. $\angle$'s, k = 90° - Adj. $\angle$'s st. line, l = 72° - Alt. $\angle$'s // lines, m = 41° - $\angle$'s in △, n = 67° - Alt. $\angle$'s // lines, o = 64° - Alt. $\angle$'s // lines, p = 59° - Adj. $\angle$'s st. line, q = 57°, - Int. $\angle$'s // lines, r = 116° - Adj. $\angle$'s st. line, s = 38° - Alt. $\angle$'s // lines, t = 68° - Int. $\angle$'s // lines, u = 74° - $\angle$'s in △, v = 68° - $\angle$'s in △, w = 33° - $\angle$'s in △, x = 38° - Alt. $\angle$'s // lines, y = 33° - Alt. $\angle$'s // lines, z = 110° - Adj. $\angle$'s st. line
2. Corr. $\angle$'s // lines or Int. $\angle$'s // lines   3. Corr. $\angle$'s // lines   4. 110°
5. $\angle AJK$, $\angle JKH$, $\angle BKC$, $\angle DCE$, $\angle CGF$, $\angle KHG$, $\angle KCG$ 6. 35°   7. 70°   8. 35°

Worksheets 7 to 9

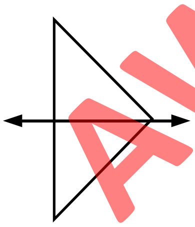
Reflective symmetry:
Rotational symmetry:
Vertically opposite angles:
Interior angle sum of regular / non-regular polygons:

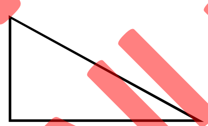
In **Task 8** pupils are to revisit the naming of and the reflective symmetry properties of 2D shapes introduced at a previous level.

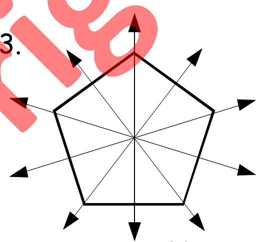
In **Task 9** pupils are to revisit the rotational symmetry properties of 2D shapes introduced at a previous level. A shape has rotational symmetry if, as it is being rotated you can stop in a position whereby the shape looks the same as it did before it was rotated. The number of times this occurs will determine the number or order of rotational symmetry for that particular shape. All shapes have at least one order of rotational symmetry as any shape will look like itself once it has been rotated through 360°. The 2D shapes in this task can be drawn on cardboard, cut out and physically rotated to determine the order of rotation. Remember the centre of the shape will be the centre of the rotation.

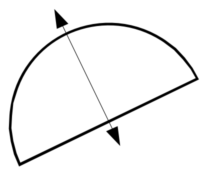
In **Task 10** pupils are to determine the sum of the interior angles of polygons with 4 or more sides, using the instructions at the top of Worksheet 9. Missing angles can then be found.

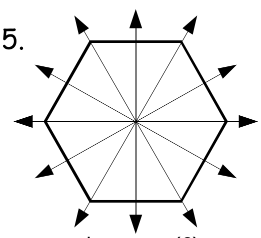
Task 8

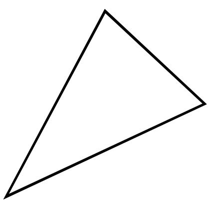
1.

isosceles triangle (1)

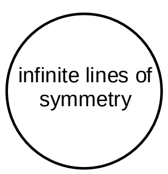
2.

right-angled triangle (0)

3.

pentagon (5)

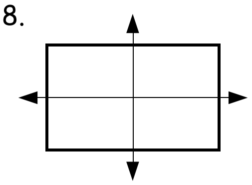
4.

semi-circle (1)

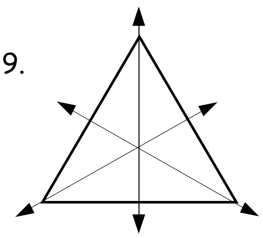
5.

hexagon (6)

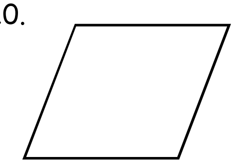
6.

scalene triangle (0)

7.


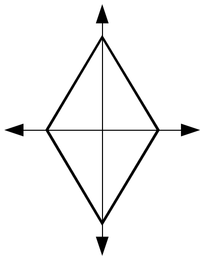
circle (infinite)

8.

rectangle (2)

9.

equilateral triangle (3)

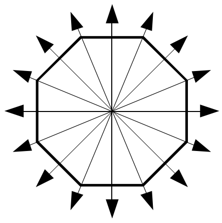
10.

parallelogram (0)

11.



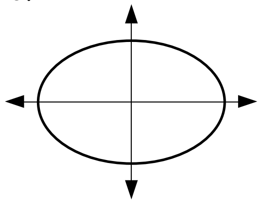
diamond (rhombus) (2)

12.



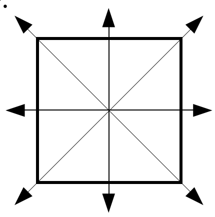
octagon (8)

13.



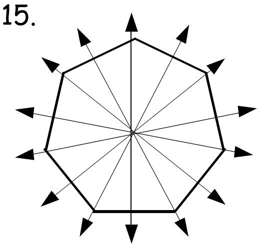
ellipse (2)

14.



square (4)

15.



heptagon (7)

16. Symmetry lines are drawn on each shape. Order of reflective symmetry is the number in the brackets after the name of each shape.

Task 9

1. rhombus or diamond (2) 2. octagon (8) 3. parallelogram (1) 4. isosceles triangle (1) 5. hexagon (6) 6. right-angled triangle (1) 7. ellipse (2) 8. equilateral triangle (3) 9. heptagon (7) 10. square (4) 11. pentagon (5) 12. rectangle (2) 13. circle (infinite) 14. scalene triangle (1) 15. semi-circle (1) 16. 4 17. 1 18. 16

Task 10

1. triangle 2. quadrilateral 3. pentagon 4. hexagon 5. heptagon 6. octagon 7. nonagon 8. decagon 9. dodecagon

10.

Number of sides	No. of triangles	Interior angle sum
4	2	360°
5	3	540°
6	4	720°
7	5	900°
8	6	1080°
9	7	1260°
10	8	1440°
12	10	1800°

11. Sum of the Interior Angles = n × 180°
12. a = 70°, b = 93°, c = 87°, d = 90°, e = 144°, f = 132°, g = 141°, h = 91°, i = 48°, j = 39°, k = 102°, l = 72°, m = 142° n = 79°, o = 106°, p = 37°, q = 122°, r = 132°, s = 135°, t = 112°, u = 82°, v = 265°, w = 250°, x = 220°, y = 124°

Worksheets 10 & 11

Angle between a tangent and a radius:
Angles in a semi-circle:

In **Task 11** pupils are introduced to a new angle property involving a circle, tangent and radius. The tangent is a line that touches a circle at one point only on the circumference. A tangent to a circle makes an angle of 90° with the radius at the point of contact. Using this property and other angle properties previously used, missing angles are to be found. Pupils are to give a reason for angle sizes.

In **Task 12** pupils are introduced to the angle in a semi-circle property. Using this and other angle rules, missing angles are to be found. Pupils are to give a reason for angle sizes, when required.

Task 11

1. centre 2. radius 3. tangent 4. right-angle 5. ∠DEO, ∠FEO, ∠HIO, ∠JIO, ∠RSO, ∠TSO, ∠LMO, ∠NMO, ∠HKO, ∠IKO, ∠IPO, ∠JPO, ∠KOP, ∠KIP 6. a = 90° - ∠ between tang & rad, b = 19° - ∠'s in △, c = 113° - Adj. ∠'s st. line, d = 90° - ∠ between tang & rad, e = 23° - ∠'s in △, f = 90° - ∠ between tang & rad, g = 39° - ∠'s in △, h = 90° - ∠ between tang & rad, i = 47° - ∠'s in △, j = 90° - ∠ between tang & rad, k = 34° - ∠'s in △, l = 116° - Adj. ∠'s st. line, m = 90° - ∠ between tang & rad, n = 26° - ∠'s in △ 7. ∠ between tang & rad 8. ∠'s in △ 9. ∠ between tang & rad 10. 65° 11. 65° 12. 25°

Task 12

1. centre 2. diameter 3. circumference 4. semi-circle 5. 90° 6. ∠ABC, ∠DEF, ∠GJI, ∠KLM, ∠KNM, ∠QUT, ∠PRS 7. a = 90° - ∠ in a semi-circle, b = 48° - ∠'s in △, c = 61° - ∠'s in △, d = 90° - ∠ in a semi-circle, e = 90° - ∠ in a semi-circle, f = 30° - ∠'s in △, g = 90° - ∠ in a semi-circle, h = 58° - ∠'s in △, i = 56° -Alt. ∠'s // lines, j = 34° - ∠'s in △, k = 90° - ∠ in a semi-circle, l = 34° -Alt. ∠'s // lines, m = 90° - ∠ in a semi-circle 8. ∠ in a semi-circle 9. ∠ between tang & rad 10. 48° 11. △ODE is an isosceles triangle as OD and OE are radii, ∠ODE = 29° therefore ∠OED = 29° 12. 61° 13. 42°

Worksheets 12 to 14

Creating pathways (loci):
Constructing triangles:
More constructions:

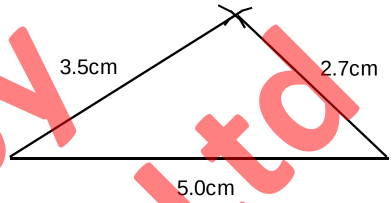
In **Task 13** pupils are to draw pathways called a **loci**. Mathematical instructions are to be used. Examples of locii that are not smooth or constant pathways are also explored.

The accurate construction of any shape using mathematical instructions, is a valuable skill. Triangles can be constructed using a ruler, compass and / or protractor.

To construct a triangle with sides of 5.0cm, 3.5cm and 2.7cm follow these steps.

Step 1: Draw one of the sides, *Example:* 5.0cm

Step 2: Open the compass to 3.5cm, place the point of the compass on the left end of the line and draw an arc.



Step 3: Open the compass to 2.7cm, place the point of the compass on the right end of the line and draw an arc.

Step 4: Complete the triangle by joining the ends of the lines to where the two arcs cross.

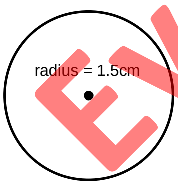
To construct a triangle when one or two angle sizes are given, the procedure is very similar except a protractor is used to draw accurate angles.

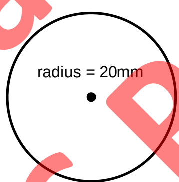
In **Task 14** pupils are to construct triangles given the length of all sides or given the lengths of some sides, plus 1 or 2 angle sizes. Pupils create their own diagrams and have a classmate reconstruct a copy of each diagram using mathematical instruments.

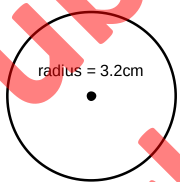
In **Task 15** pupils are to attempt more mathematical constructions involving bisecting an angle, drawing a perpendicular or parallel lines, plus constructions involving circles and triangles.

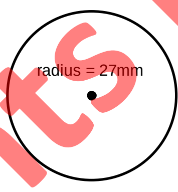
Task 13

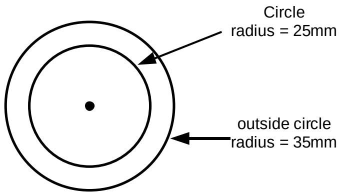
Diagrams below are not drawn to scale.

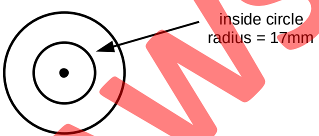
1.


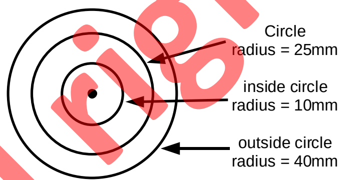
2.


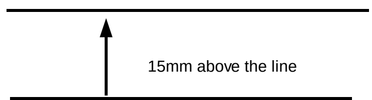
3.


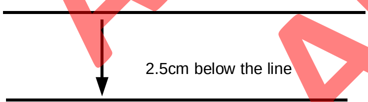
4.


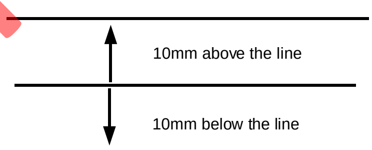
5.


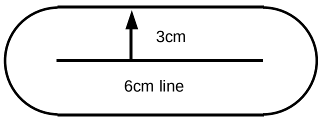
6.


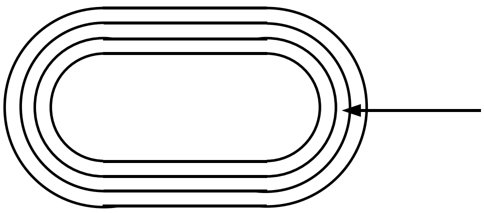
7.


8.


9.


10.


11.


12.


13.

Draw a line in this lane to show where Richard will run in this 400m race.

Task 14 & Task 15

No answers drawn for construction exercises.

Worksheets 15 to 18

Scale Diagrams:
The Pythagoras relation:
Hypotenuse, Opposite and Adjacent:
Sine, cosine and Tangent as a ratio:
Converting a trig ratio to an angle:
Finding the size of an angle using a trig ratio:
Express an angle as a decimal:
Finding the length of a side using a trig ratio:

In **Task 16** pupils are to construct a right-angled triangle given the lengths of two sides. Using the diagram, the length of the longest side (hypotenuse) is to be found by measuring.

In **Task 17** pupils are introduced to the Pythagoras relation which states *'the square of the hypotenuse equals the sum of the squares of the other two sides'*. From the diagrams created in **Task 16**, pupils are to compare the length of the missing side as obtained by measuring, with the values obtained by using the Pythagoras relation. Further calculations involve rearranging the relation to find one of the shorter two sides.

In **Task 18** pupils are introduced to naming of sides for right-angled triangles, as preparation for using trig ratios. Remind pupils that the longest side, called the hypotenuse is always opposite the right-angle. The remaining two sides are named in relation to the angle that is known or is to be found.

In **Task 19** pupils are to write sine, cosine and tangent ratios as fractions, given side lengths. These fraction are to be converted to decimals rounded to 4 d.p.

In **Task 20** pupils are to convert sine, cosine or tangent values to angle sizes, using trig tables or a scientific calculator.

In **Task 21** pupils are to find the size of missing angles using a trig ratio. Word problems are included.

In **Task 22** pupils are to convert angle sizes to a decimal using trig tables or a scientific calculator.

In **Task 23** pupils are to find the length of a side, given an angle size and one side length, using a trig ratio. Word problems are included.

Task 16

Approximate measurement lengths.

1. 130mm ± 1mm   2. 17mm ± 1mm   3. 6.6cm ± 0.1cm   4. 80mm ± 1mm

Task 17

1. A = 130mm, B = 17mm, C = 6.6cm, D = 79.9mm   2. a =67.42mm   3. b = 6.6cm   4. c = 8.86cm   5. d = 88.59mm
6. 15.08cm   7. 11.30mm   8. 13.33cm   9. 13.44mm   10. 12.21

Task 18

1. Hyp = AB, Opp = AC, Adj = BC   2. Hyp = EF, Opp = DF, Adj = DE   3. Hyp = GI, Opp = GH, Adj = HI
4. Hyp = PR, Opp = PQ, Adj = QR   5. Hyp = XZ, Opp = XY, Adj = YZ

Task 19

1. Cos A = $^{4}/_{5}$, Tan A = $^{3}/_{4}$ 2. Sin A = 0.6, Cos A = 0.8, Tan A = 0.75
3. Sin A = $^{5}/_{13}$ = 0.3846, Cos A = $^{12}/_{13}$, = 0.9231, Tan A = $^{5}/_{12}$ = 0.4166
4. Sin A = $^{12}/_{15.8}$ = 0.7595, Cos A = $^{10.3}/_{15.8}$, = 0.6000, Tan A = $^{12}/_{10.3}$ = 1.1650
5. Sin A = $^{7}/_{10.6}$ = 0.6604, Cos A = $^{8}/_{10.6}$, = 0.7547, Tan A = $^{7}/_{8}$ = 0.8750
6. Sin A = $^{6.3}/_{7.4}$ = 0.8514, Cos A = $^{3.9}/_{7.4}$, = 0.5270, Tan A = $^{6.3}/_{3.9}$ = 1.6154
7. Sin A = $^{8}/_{15}$ = 0.5333, Cos A = $^{12.7}/_{15}$, = 0.8466, Tan A = $^{8}/_{12.7}$ = 0 6299
8. Sin A = $^{9}/_{12}$ = 0.7500, Cos A = $^{7.9}/_{12}$, = 0.6583, Tan A = $^{9}/_{7.9}$ = 1.1392
9. Sin A = $^{5}/_{5.6}$ = 0.8929, Cos A = $^{2.5}/_{5.6}$, = 0.4464, Tan A = $^{5}/_{2.5}$ = 2.0000
10. Sin A = $^{18.2}/_{20}$ = 0.9100, Cos A = $^{8.2}/_{20}$, = 0.4100, Tan A = $^{18.2}/_{8.2}$ = 2.2195
11. Sin A = $^{10.1}/_{12.6}$ = 0.8016, Cos A = $^{7.5}/_{12.6}$, = 0.5952, Tan A = $^{10.1}/_{7.5}$ = 1.3466
12. Sin A = $^{5.3}/_{8.4}$ = 0.6310, Cos A = $^{6.5}/_{8.4}$, = 0.7738, Tan A = $^{5.3}/_{6.5}$ = 0.8154

Task 20

1. 30.0° 2. 21.7° 3. 45.0° 4. 75.9° 5. 47.8° 6. 13.0° 7. 38.0° 8. 65.2° 9. 84.0° 10. 81.8°
11. 40.1° 12. 69.5° 13. 81.1° 14. 27.6° 15. 35.2° 16. 86.6° 17. 71.3° 18. 14.9° 19. 82.0° 20. 43.2°

Task 21

1. Cos A = $^{12}/_{13}$ = 0.9231, A = 22.6° 2. Sin A = $^{12}/_{15.8}$ = 0.7595, A = 49.4° 3. Tan A = $^{7}/_{8}$ = 0.875, A = 41.2°
4. Sin A = $^{6.3}/_{7.4}$ = 0.8514, A = 58.4° 5. Tan A = $^{8}/_{12.7}$ = 0.6299, A = 32.2° 6. Cos A = $^{7.9}/_{12}$ = 0..6583, A = 48.8°
7. Sin A = $^{5}/_{5.6}$ = 0.8929, A = 63.2° 8. Tan A = $^{18.2}/_{8.2}$ = 2.2195, A = 65.7° 9. Cos A = $^{7.5}/_{12.6}$ = 0.5952, A = 53.5°
10. Tan A = $^{5.3}/_{6.5}$ = 0.8154, A = 39.2° 11. Sin A = $^{4.8}/_{5}$ = 0.96, A = 73.7° 12. Cos A = $^{49.8}/_{50}$ = 0.996, A = 5.1°

Task 22

1. 0.6428 2. 0.3420 3. 1.0000 4. 0.9848 5. 0.6018 6. 0.9877 7. 0.2756 8. 0.9063 9. 1.9626
10. 0.7071 11. 2.4023 12. 0.7206 13. 9.6768 14. 0.8902 15. 0.2830 16. 0.9078 17. 0.1691
18. 0.9114 19. 0.8214 20. 0.9968

Task 23

1. Cos 40° = $^{y}/_{12}$, y = 12 × Cos 40°, y = 9.2cm 2. Cos 48° = $^{y}/_{15.8}$, y = 15.8 × Cos 48°, y = 10.6cm
3. Sin 36° = $^{y}/_{13.7}$, y = 13.7 × Sin 36°, y = 8.1cm 4. Sin 33° = $^{y}/_{7.4}$, y = 7.4 × Cos 33°, y = 4.0cm
5. Tan 55° = $^{y}/_{12.7}$, y = 12.7 × Tan 55°, y = 18.1cm 6. Cos 62° = $^{y}/_{12}$, y = 12 × Cos 62°, y = 5.6cm
7. Tan 43° = $^{y}/_{14.9}$, y = 14.9 × Tan 43°, y = 13.9cm 8. Sin 68° = $^{y}/_{20.4}$, y = 20.4 × Cos 68°, y = 7.6cm
9. Cos 54° = $^{y}/_{12.6}$, y = 12.6 × Cos 54°, y = 7.4cm 10. Tan 60° = $^{y}/_{6.5}$, y = 6.5 × Tan 60°, y = 11.3cm
11. Sin 85° = $^{x}/_{5}$, y = 5 × Sin 85°, x = 4.98m 12. Sin 2.5° = $^{h}/_{50}$, h = 50 × Sin 2.5°, h = 2.18m

Worksheets 19 & 20

View diagrams and making models:
Drawing on isometric paper:

To draw a 3D object on plain paper can be difficult. Using isometric paper can make it easier.

In **Task 24** pupils are to study the top, front, left side, right side and back view diagrams of structures made of Lego blocks and match them with '3D' looking diagrams of the same structure. Pupils are to use blocks to create these structures.

In **Task 25** pupils are to use a Level 5 Geometry resource specially created by **AWS *Teacher Resources*** to cover objective 6 of the Geometry strand.

In **Task 26** pupils are to practise drawing block structures on isometric paper and make structures out of Lego blocks. Having made the structures, pupils are to draw top, front, left side, right side and back views of these structures. Using isometric paper, everyday objects are to be drawn.

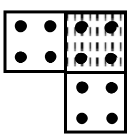
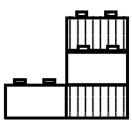
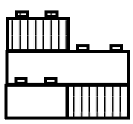
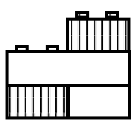
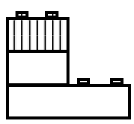
In **Task 27** pupils are to create more block structures and draw them on isometric and squared paper.

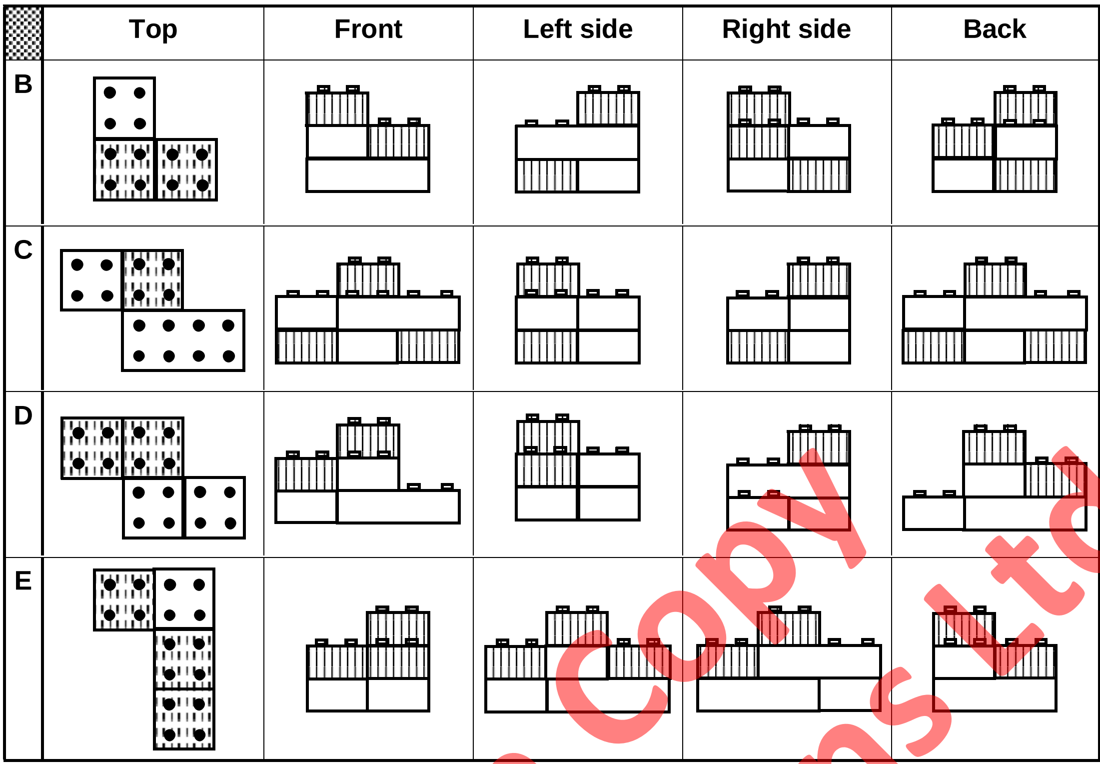
Task 24

1. B 2. D 3. A 4. C 5. E

Task 26

6. The following view diagrams have been drawn as if what can be seen on the page is the left side and the front of the block structure. There will be different correct orders.

	Top	Front	Left side	Right side	Back
A					



Worksheets 21 & 22

Translation using vectors:
MoreTranslations:

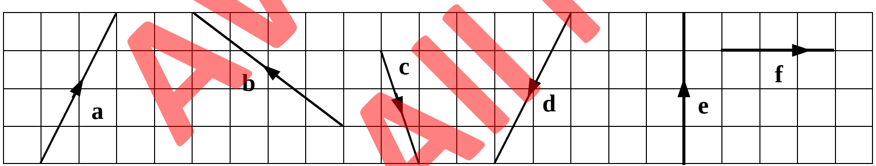
In **Task 28** pupils are introduced to vectors. A vector has both direction and distance and can be described using two numbers written in the form ... $\underset{\sim}{AD} = \begin{pmatrix} x \\ y \end{pmatrix}$ where the curved line under the letters means it is a vector.

Just like the directions on a graph, the 'x' number represents a movement left (negative number) or right (positive number). The 'y' number represents a movement up (positive number) or down (negative number). Vectors can also be described by giving a compass bearing and a length, (*Example:* 60°, 5.2m), however at this level only the x-y method is explored. Pupils are to describe and draw translations using vectors, describe how a shape has been translated and translate a shape by a given vector.

In **Task 29** pupils are to use vectors to find positions on a map and describe movements about the map using vectors.

Task 28

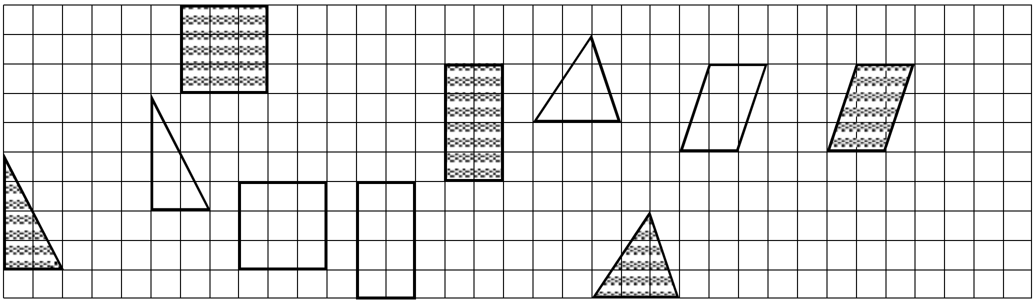
1. a = 2 squares right, 4 squares up b = 4 squares left, 3 squares up c = 1 square right, 3 squares down
d = 2 squares left, 4 squares down e = 0 squares left or right, 4 squares up f = 3 squares right, 0 squares up or down



2. $\underset{\sim}{m} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\underset{\sim}{n} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\underset{\sim}{o} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$ $\underset{\sim}{p} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$ $\underset{\sim}{q} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$ $\underset{\sim}{r} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$ $\underset{\sim}{s} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $\underset{\sim}{t} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$
$\underset{\sim}{u} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$

3. $\underset{\sim}{A} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\underset{\sim}{B} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\underset{\sim}{C} = \begin{pmatrix} -10 \\ -4 \end{pmatrix}$ $\underset{\sim}{D} = \begin{pmatrix} -7 \\ 2 \end{pmatrix}$ $\underset{\sim}{E} = \begin{pmatrix} 9 \\ -2 \end{pmatrix}$ $\underset{\sim}{F} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$ $\underset{\sim}{G} = \begin{pmatrix} 8 \\ 3 \end{pmatrix}$ $\underset{\sim}{H} = \begin{pmatrix} -9 \\ 0 \end{pmatrix}$
$\underset{\sim}{I} = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$

Questions 4 to 8. For each translation below, the shaded shape is the object, the clear shape is the image.



9. 'Things that HAVE NOT changed' Length, angle size and area

'Things that HAVE changed' All points move

Task 29

1. $\begin{pmatrix} 3 \\ 7 \end{pmatrix}$ 2. $\begin{pmatrix} -12 \\ 0 \end{pmatrix}$ 3. Town A 4. $\underset{\sim}{AB} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\underset{\sim}{BC} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ $\underset{\sim}{CD} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$ $\underset{\sim}{DE} = \begin{pmatrix} -7 \\ 7 \end{pmatrix}$

5. $\begin{pmatrix} 3 \\ 12 \end{pmatrix}$ $\underset{\sim}{AE} = \begin{pmatrix} 3 \\ 12 \end{pmatrix}$ The answers are the same

6. $\underset{\sim}{AF} = \begin{pmatrix} -2 \\ -1 \end{pmatrix}$ $\underset{\sim}{FG} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$ $\underset{\sim}{GH} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$ $\underset{\sim}{HI} = \begin{pmatrix} 7 \\ 5 \end{pmatrix}$ $\underset{\sim}{IJ} = \begin{pmatrix} 7 \\ -4 \end{pmatrix}$ 7. Town D

Worksheets 23 & 24

Similar figures and scale factors:
Finding the centre of an enlargement:
Drawing enlargements:

For an enlargement to occur, there must be a a scale factor and a centre of enlargement. An enlargement can result in a shape becoming bigger or smaller, depending on the scale factor.

In **Task 30** pupils are to calculate the scale factors given an object and its image. By comparing the length of corresponding sides on the object and its image, the scale factor can be calculated.

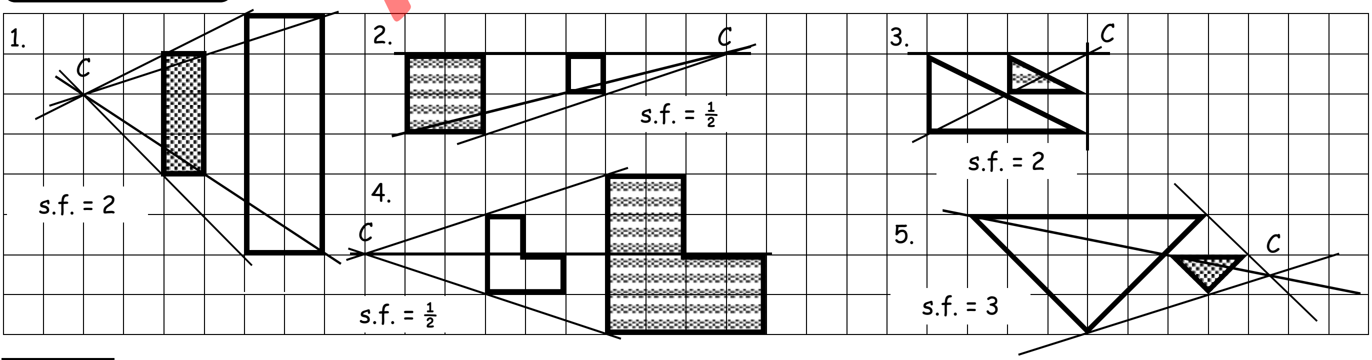
In **Task 31** pupils are to find the centres of enlargement for various shapes. This can be done by drawing lines through pairs of corresponding corners on the object and its image. Where the lines cross is the centre of enlargement. The scale factors can also be calculated from the diagrams.

In **Task 32** pupils are to enlarge a shape, given the scale factor and the centre of enlargement. The steps are outlined in Worksheet 24. Note the convention for labelling corresponding corners whereby if a corner on an object is labelled A, then the corresponding corner on its image would be labelled A'. Having drawn several enlargements, pupils are to comment on the properties of enlargement that are invariant. Invariant properties do not change.

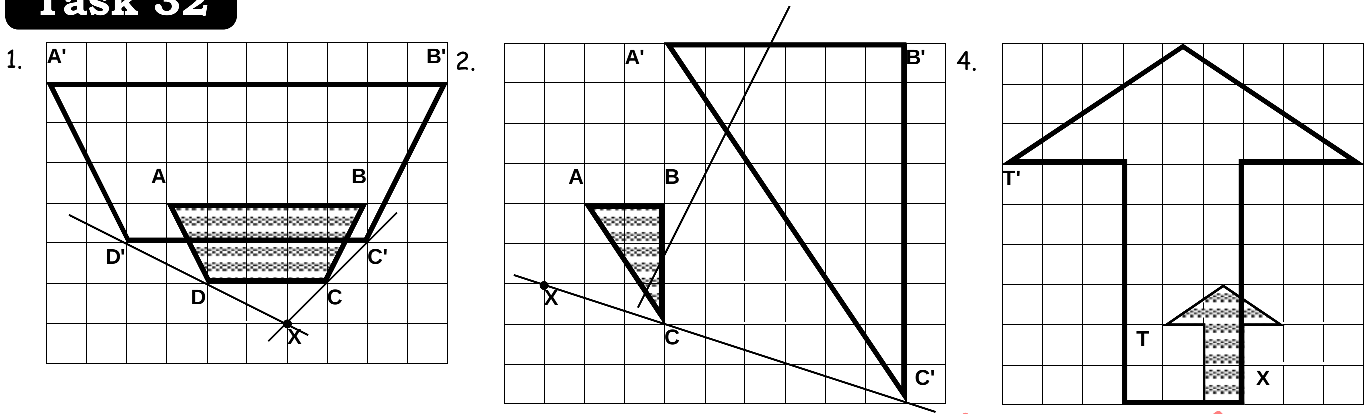
Task 30

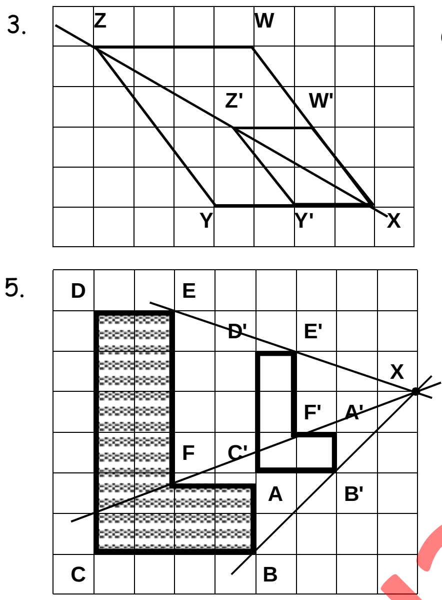
1. I, s.f = $\frac{1}{2}$ 2. D, s.f = 3 3. G, s.f = 2 4. J, s.f. = $\frac{1}{2}$ 5. A, s.f. = 2 6. H, s.f = $2\frac{1}{2}$ 7. E, s.f. = 1
8. F, s.f. = 3 9. B, s.f. = $\frac{2}{3}$ 10. C, s.f. = 4

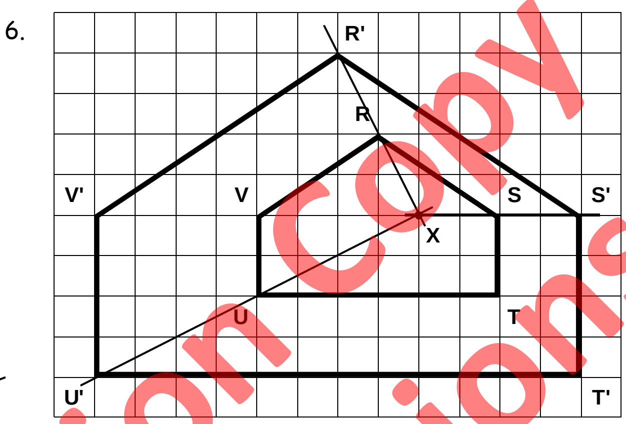
Task 31



Task 32







8. 'Things that HAVE NOT changed' would include ...
angle sizes, corresponding sides are always parallel, the centre of enlargement does not move, the labelling of letters is still in the same direction.

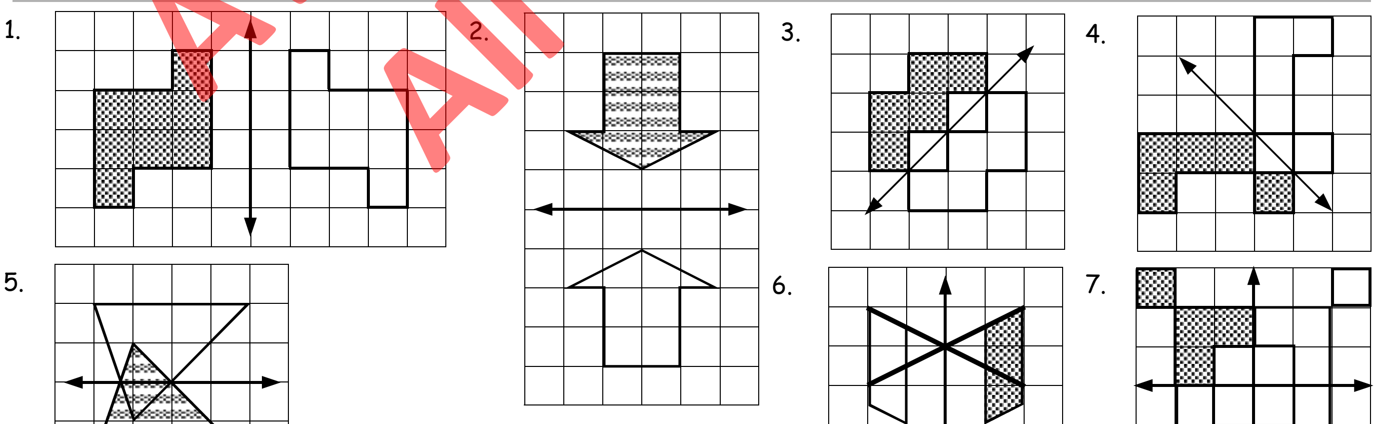
'Things that HAVE changed' would include ...
length of sides, area of the shape

Worksheets 25 & 26

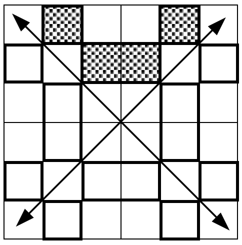
Locating and drawing lines of symmetry:
Creating designs involving reflections:

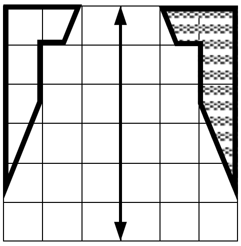
In **Task 33** pupils are to copy shapes onto the squares of their maths books, then reflect the shapes, given the position of the mirror lines. Some shapes cross the mirror line, therefore the reflection will involve reflecting parts of the shape in different directions. More than one mirror line is involved in some questions. Pupils are to locate mirror lines or lines of symmetry between two shapes and create their own diagrams that classmates can reflect.

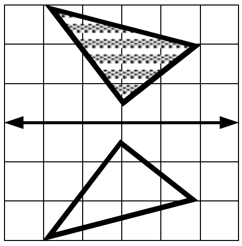
In **Task 34** pupils are to create paper designs and complete patterns for designs involving reflection.

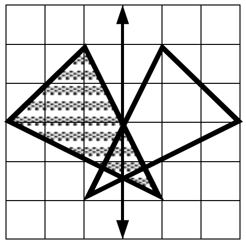


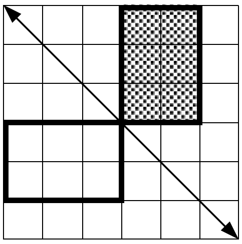
Task 33

8.


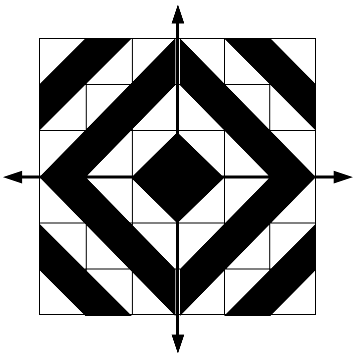
10.


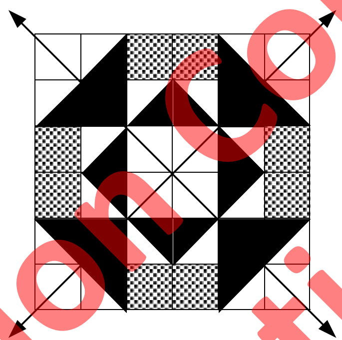
11.


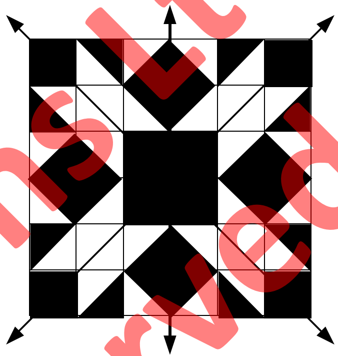
12.


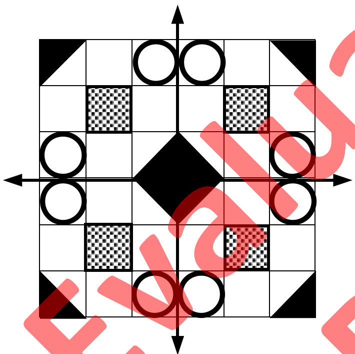
13.


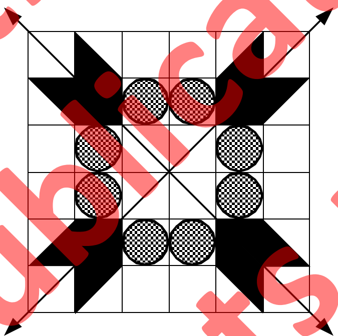
Task 34

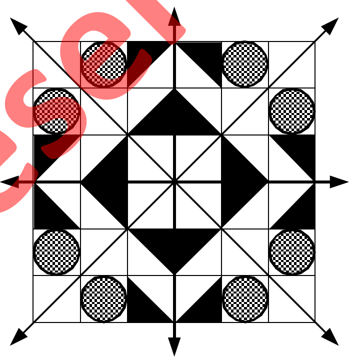
6.


7.


8.


9.


10.


11.


12. 'Things that HAVE NOT changed' would include ...
angle sizes, length of sides, area, any points on the mirror line

'Things that HAVE changed' would include ...
all points on the mirror line have moved, shape is turned over

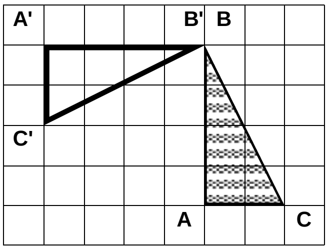
Worksheet 27

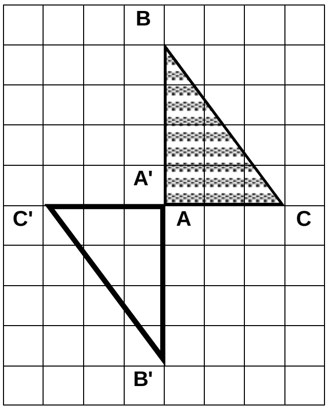
Rotating a shape and finding the centre of rotation:

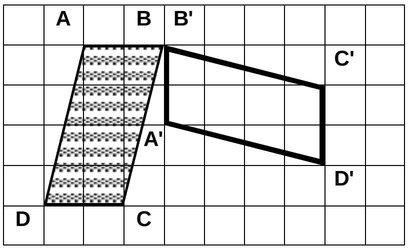
In **Task 35** pupils are to investigate rotation. For rotation to occur there must be a **centre of rotation** and an **angle of rotation**. The angles of rotation have been restricted to a ¼ turn or 90^o, a ½ turn or 180^o and ¾ turn or 270^o either in a clockwise or anti-clockwise direction. Pupils are to perform the rotations by counting squares. To find the centre of rotation, pupils can hold an object, simulate the rotation and by trial and error, the centre can be find.

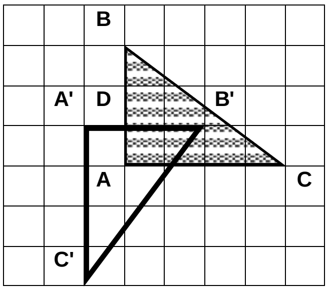
In **Task 36** pupils are to use construction skills to locate the centre of rotation. The steps are outlined on Worksheet 28. Note: Only two pairs of corresponding corners have been used where locating the centre of rotation. All angle of rotations have been noted as positive rotations, that is, an anti-clockwise direction.

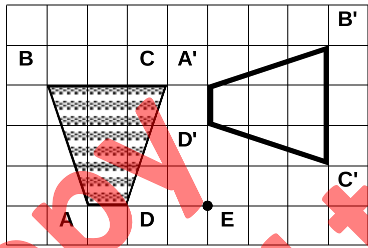
Task 35

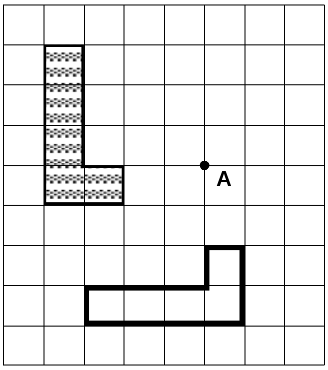
1.


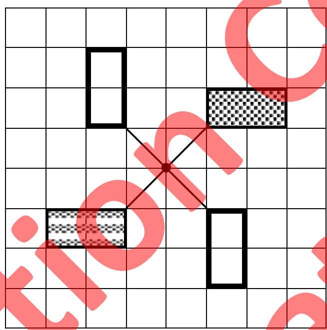
2.


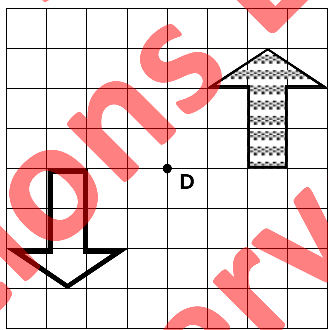
3.


4.


5.


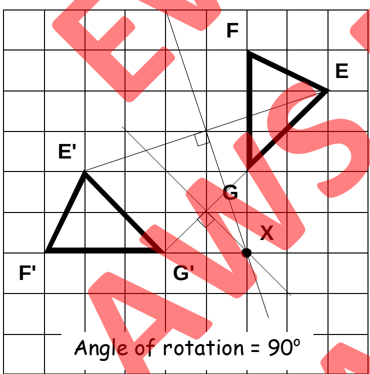
6.


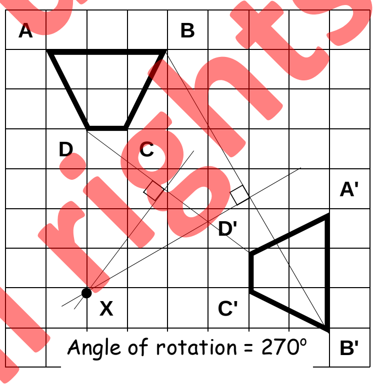
7.


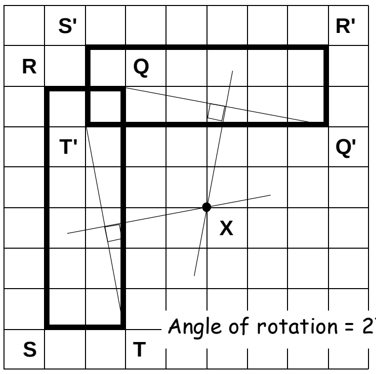
8.


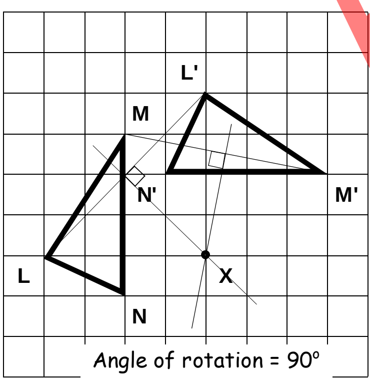
10. 180° clockwise or anti-clockwise about point B
11. 90° anti-clockwise about point B
12. 180° clockwise or anti-clockwise about point B
13. 90° clockwise about point C
14. 90° clockwise about point C

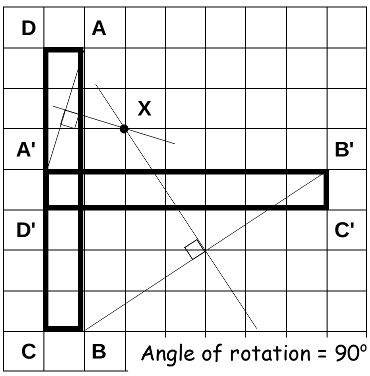
Task 36

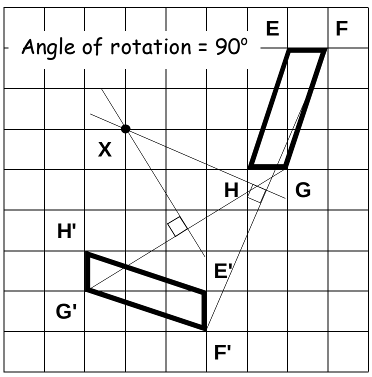
1.


2.


3.


4.


5.


6.


7. 'Things that HAVE NOT changed' would include ...
angle sizes, length of sides, area, the centre of rotation is the only point that does not move.
'Things that HAVE changed' would include ...
all points and lines change position as they turn through the angle of rotation

Worksheet 29

Describing symmetrical Designs:

In **Task 37** pupils are to create designs by reflecting, rotating or translating a series of designs. Pupils are to locate and describe everyday patterns that have been created by using one or a combination of the four tranformations - reflection, rotation, translation and enlargement.

In **Task 38** pupils are to create designs by tessellating a combination of various shapes.

Task 37 & **Task 38** No answers drawn for design exercises.

Table of Contents for the Homework / Assessment Worksheet Masters for Geometry, Level 5

Revision

Geometry

Homework / Assessment Worksheet

L5MG

1

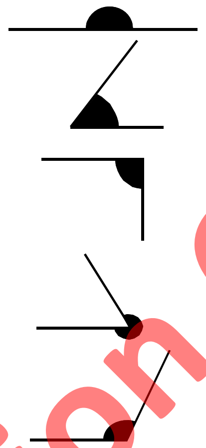
Name: **Class:** **Complete by:**

A: 10 Quick Questions

1. Find 10% of $32.60 ....
2. 63 - 4 × 12 = ...
3. Find $\sqrt{81}$ ....
4. If the temperature was 8°C, then drops 9°C, what is the new temperature? ....
5. 9.4 × 0.004 = ...
6. How many seconds in 7.5 minutes? ....
7. $3.60 × 19 = ...
8. 9.6 ÷ 0.8 = ...
9. How many weeks in $1\frac{1}{2}$ years? ....
10. Find $\frac{1}{2}$ of $17.70 ....

B: What angle is that ?

Classify the angles by matching each diagram with a word from the list below.



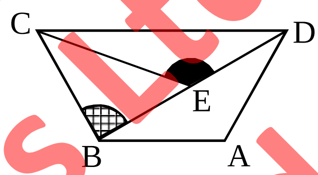
1. .... angle
2. .... angle
3. .... angle
4. .... angle
5. .... angle

acute	right	obtuse
	straight	reflex

C: Which angle is it ?

Angles are named using three letters (example: ∠BAC) , a single letter (example: Â) or a mark on a diagram.

Study the diagram, then answer the questions.

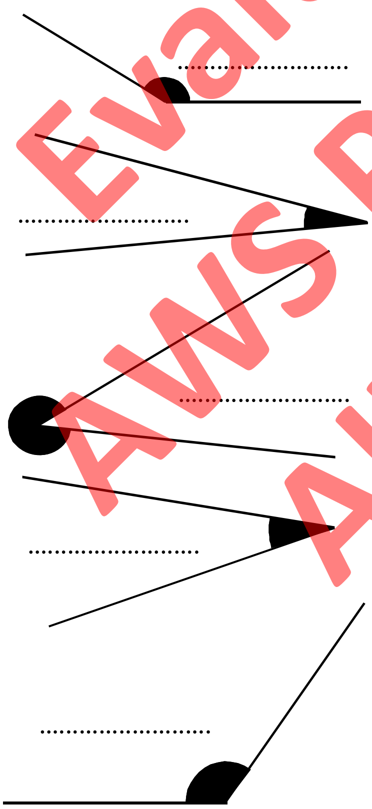


1. Name the angle marked. ....
2. Name the angle marked. ....
3. Mark on the diagram ∠ECD
4. Mark on the diagram Â.
5. Can you mark ∠B on this diagram? ....

Give a reason ....

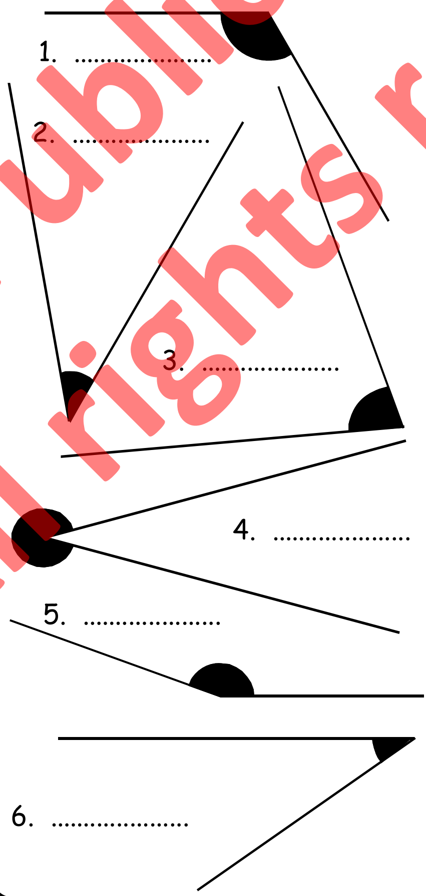
D: Guess the angle sizes

Estimate these angles to the nearest 5° (do not measure).



1. ....
2. ....
3. ....
4. ....
5. ....

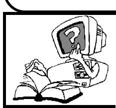
E: Measure these angles



1. ....
2. ....
3. ....
4. ....
5. ....
6. ....

F: Drawing angles

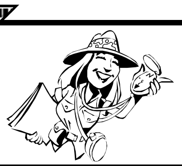
1. Draw an angle of 55°
2. Draw an angle of 125°
3. Draw an angle of 220°
4. Draw an angle of 335°



AWS

Comments: ....
....
....

Please sign:
Parent / Caregiver
....



Revision

Geometry

Homework / Assessment Worksheet

L5MG

2

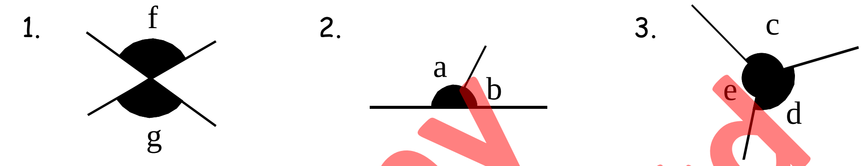
Name: Class: Complete by:

A: 10 Quick Questions

1. 31 - 7 × 5 = ...
2. Convert 5.6kL to litres ....
3. How many seconds in 5.25 minutes? ....
4. Find the area of a triangle with a base of 14cm and a height of 11cm. ....
5. Convert 0.6 to a fraction ....
6. Round off 4.024 to 2 d.p. ....
7. If 7 books cost $8.75, what does each book cost? ....
8. 3.78 × 0.09 = ...
9. How many days in 11.5 weeks? ....
10. Find 20 % of $16.40 ....

B: Which angle rule ?

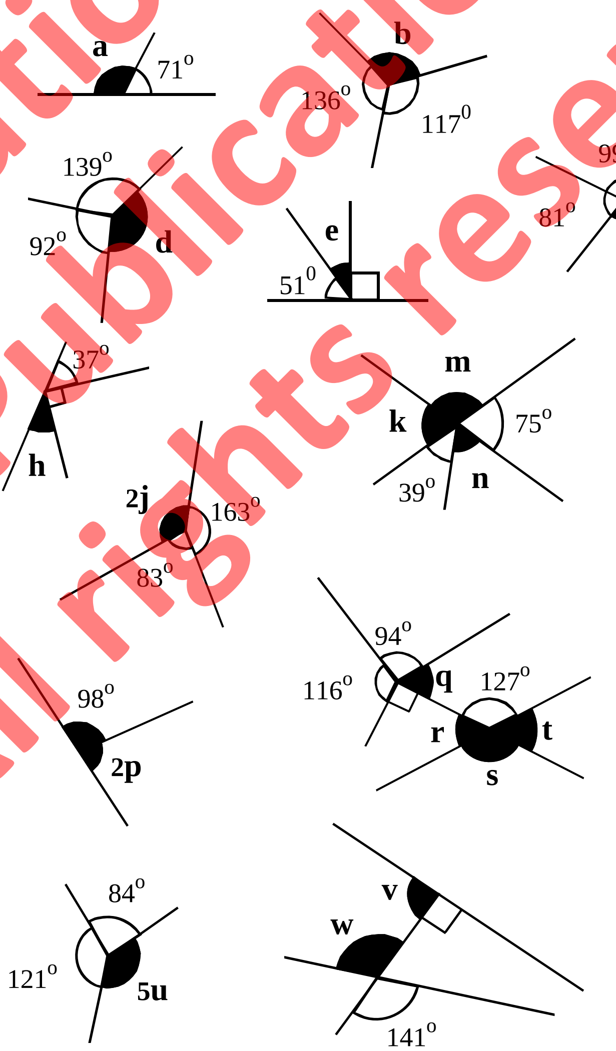
Match the angle rules below, with the diagrams.



Rule	Diagram
A. Angles at a point add to 360^0	....
B. Vertically opposite angles are equal	....
C. Adjacent angles on a straight line add to 180^0	....

C: Missing angles

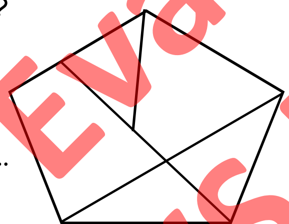
Find the value of the missing angles in these diagrams, using the rules above. The diagrams are not drawn to scale.



a = ...
b = ...
c = ...
d = ...
e = ...
f = ...
g = ...
h = ...
j = ...
k = ...
m = ...
n = ...
p = ...
q = ...
r = ...
s = ...
t = ...
u = ...
v = ...
w = ...

D: Puzzle

How many acute angles in this diagram?

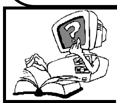


....

E: Clock angles

Calculate the smaller angle between the hands of a clock, for the given time.

1. 6.00 a.m. ....
2. 4.30 p.m. ....
3. 9.00 a.m. ....
4. 10.30 p.m. ....
5. 7.30 a.m. ....
6. 08:00 ....
7. 02:30 ....
8. 14:30 ....
9. 21:45 ....
10. 12:15 ....



AWS

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

Geometry

Revision

Homework / Assessment Worksheet

3

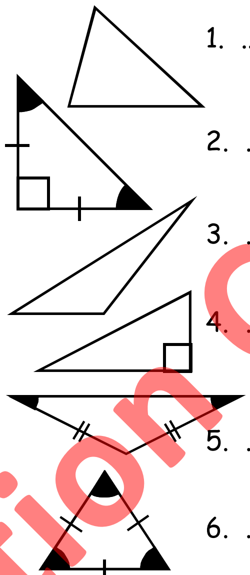
Name: **Class:** **Complete by:**

A: 10 Quick Questions

1. 7 × ⁻9 + 11 = ...
2. Convert 2450mm to metres ....
3. How many seconds in 2 hours? ....
4. Find the area of a triangle with a base of 20cm and a height of 6cm. ....
5. Convert 85% to a fraction (simplify) ....
6. Round off 4.274 to 1 d.p. ....
7. If 9 books cost $6.75, what does each book cost? ....
8. Share $70.00 in a ratio of 4 : 3 ....
9. What do adjacent angles on a straight line add up to? ....
10. Find 75% of $14.80 ....

B: Name that triangle

Match the list below with the diagrams of these triangles.

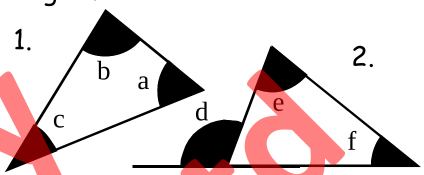


1. .... triangle
2. .... triangle
3. .... triangle
4. .... triangle
5. .... triangle
6. .... triangle

acute scalene obtuse scalene
isosceles equilateral
right - angled
right - angled isosceles

C: Angle rules

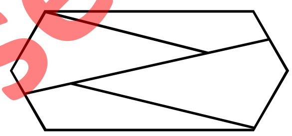
Match the rule below with the diagrams.



Rules		Diagram
A.	The sum of the interior angles of a triangle adds to 180°	....
B.	The exterior angle is equal to the sum of the interior opposite angles	....

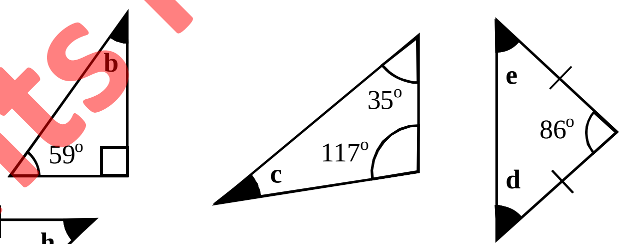
E: Puzzle

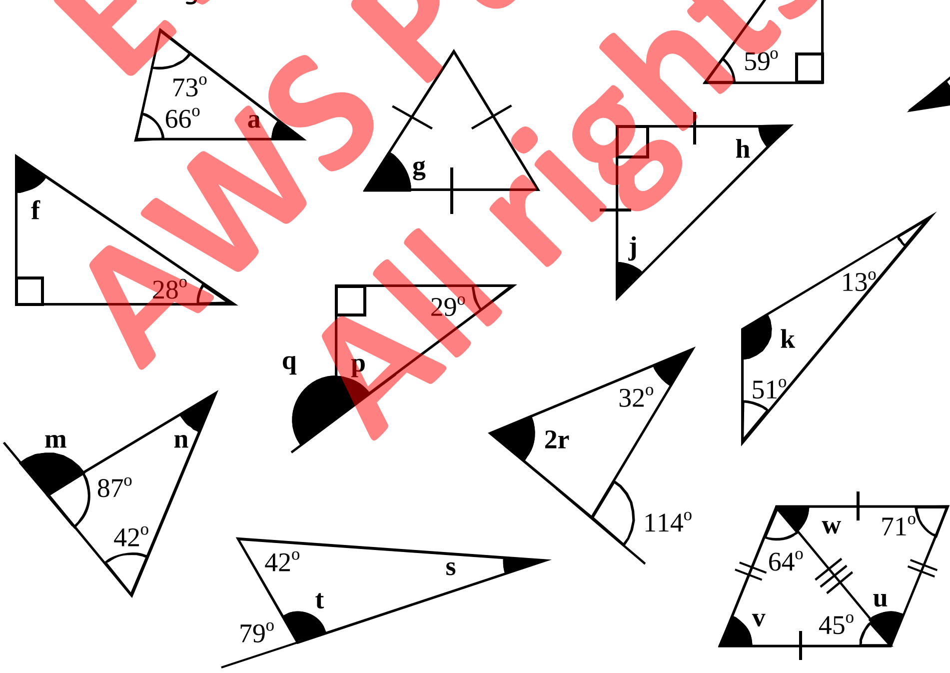
How many obtuse angles in the diagram? ....



D: Missing angles

Find the value of the missing angles using the rules above. The diagrams are not drawn to scale.





a = ... m = ...
b = ... n = ...
c = ... p = ...
d = ... q = ...
e = ... r = ...
f = ... s = ...
g = ... t = ...
h = ... u = ...
j = ... v = ...
k = ... w = ...

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

AWS

L5MG

Geometry

G1

Homework / Assessment Worksheet

4

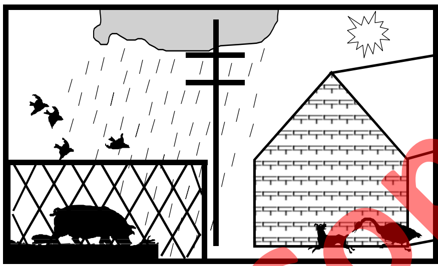
Name: Class: Complete by:

A: 10 Quick Questions

1. $5 \times {}^{-}9 - 17 =$ ....
2. Convert 435mm to cm ....
3. $7^2 + \sqrt{121} =$ ....
4. How many sides does a decagon have? ....
5. $^3/_5 + {}^4/_5 =$ ....
6. Round off 5190 to 2 significant figures ....
7. If 5kg of meat cost \$48.25 what does 1kg cost? ....
8. Share \$108.00 in a ratio of 4 : 5 ....
9. What is the area of a square with a perimeter of 44m? ....
10. Calculate the new price if a 20% discount is taken off \$27.00 ....

B: Which line ?

Perpendicular, parallel, horizontal or vertical lines.

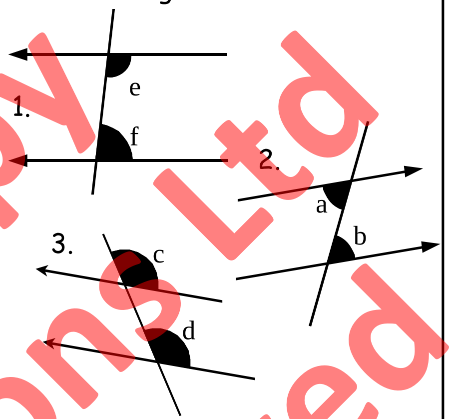


Look at this picture, then answer the following. On the diagram ...

1. draw around a pair of perpendicular lines, and label it A.
2. draw around some parallel lines and label it B.
3. draw around a line which is horizontal to the ground, label it C.
4. draw around a vertical line, label it D.

C: Which angle rule ?

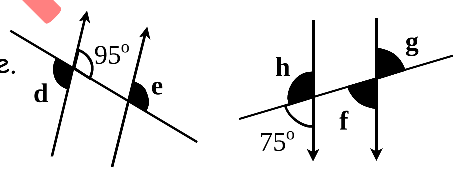
Match the angle rules for parallel lines in the box below, with the diagrams.

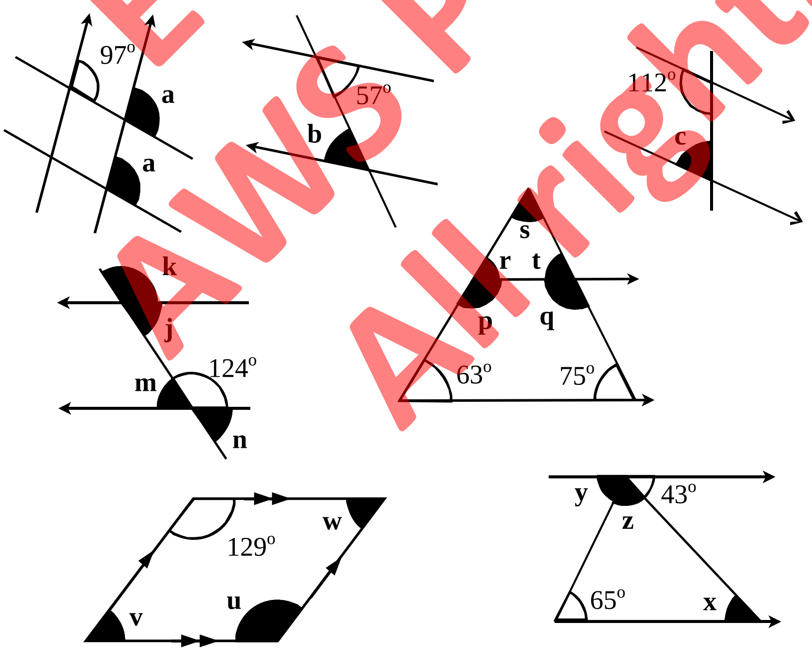


Rule		Diagram
A	Co-interior angles add to 180°	....
B	Corresponding angles are equal	....
C	Alternate angles are equal	....

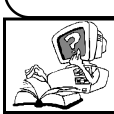
D: Missing angles

Use the angle rules for parallel lines, and other angle rules to find the values of the missing angles. The diagrams are not drawn to scale.





a = ...	p = ...
b = ...	q = ...
c = ...	r = ...
d = ...	s = ...
e = ...	t = ...
f = ...	u = ...
g = ...	v = ...
h = ...	w = ...
j = ...	x = ...
k = ...	y = ...
m = ...	z = ...
n = ...	



AWS

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

L5MG

G2

Geometry

Homework / Assessment Worksheet

5

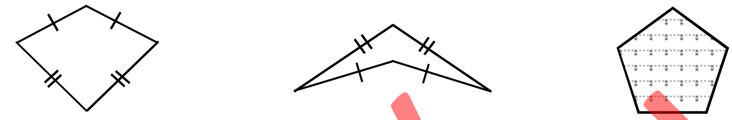
Name: **Class:** **Complete by:**

A: 10 Quick Questions

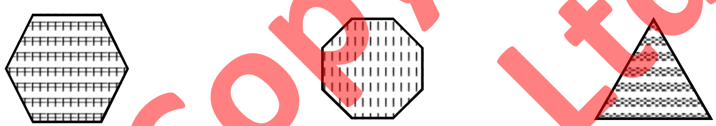
1. $^{-}8 \times {}^{-}5 - 9 =$ ....
2. Convert 63.9cm to mm ....
3. $\sqrt{4^2 + 3^2} =$ ....
4. How many seconds in 1.75 hours? ....
5. $^4/_5 + {}^1/_2 =$ ....
6. Write 560000 in standard form ....
7. If 7 kg of meat cost $55.65 what does 1kg cost? ....
8. Share $64.00 in a ratio of 1 : 3 : 4 ....
9. Convert 45% to a decimal ....
10. Calculate the new price if a 25% discount is taken off $72.00 ....

B: Lines of Symmetry / Rotational Symmetry

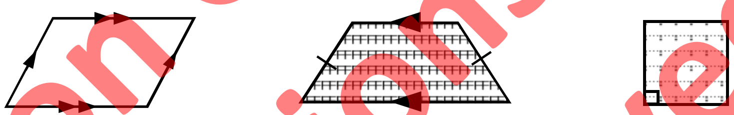
1. **Name** each shape, using the list below.



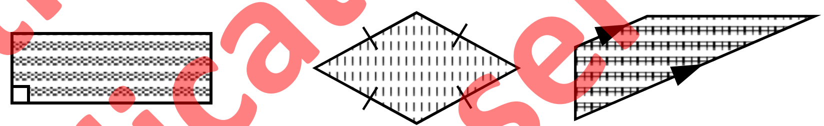
a. .... b. .... c. ....



d. .... e. .... f. ....



g. .... h. .... i. ....

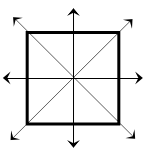


j. .... k. .... l. ....

trapezium	arrowhead	rectangle	rhombus
square	parallelogram	isosceles trapezium	kite
equilateral triangle	hexagon	octagon	pentagon

2. **Draw all lines of symmetry** on each shape above, (if they have any).

Example:
A square has 4 lines of symmetry (mirror lines).

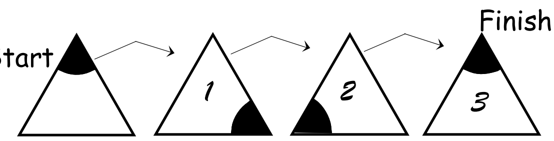


Enter the order of line symmetry for each shape in **Column A** in the table opposite.

3. Work out the **order of rotational symmetry** for each shape, then enter the order in **Column B**, in the table opposite.

Example:
An equilateral triangle has an order of rotational symmetry of 3.

Rotate for one revolution, and count each time it looks the same, as it did at the start.



C: Order of Symmetry

Shape	A	B
equilateral triangle		*3*
square	*4*	
rectangle		
parallelogram		
rhombus		
trapezium		
isosceles trapezium		
kite		
arrowhead		
pentagon		
hexagon		
octagon		

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

AWS

Geometry

G2

Homework / Assessment Worksheet

6

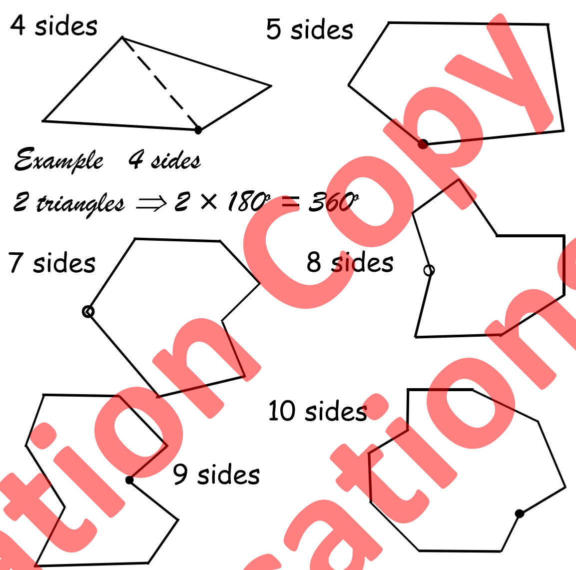
Name: **Class:** **Complete by:**

A: 10 Quick Questions

1. $^{-}12 \times {}^{-}4 - 27 =$ ....
2. $0.064 \times 0.059 =$ ....
3. Divide \$42.00 in a ratio of 4 : 3 ....
4. How many minutes in 495 seconds? ....
5. Convert $^{41}/_{6}$ to a mixed number ....
6. Write 0.0007 in standard form ....
7. Convert 9.47kL to litres ....
8. Solve $5y + 9 = 39$
   $y =$ ....
9. What is the next number in the pattern? 14, 8, 2, ...
10. Calculate $\sqrt{6^2 + 8^2}$ ....

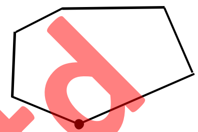
B: Interior angles of non-regular polygons

Divide the polygons into triangles, from **one** corner only (labelled with a dot). Use this to calculate the interior angle sum, based on the number of triangles in each shape, then complete the table.



Example 4 sides
2 triangles $\Rightarrow 2 \times 180° = 360°$

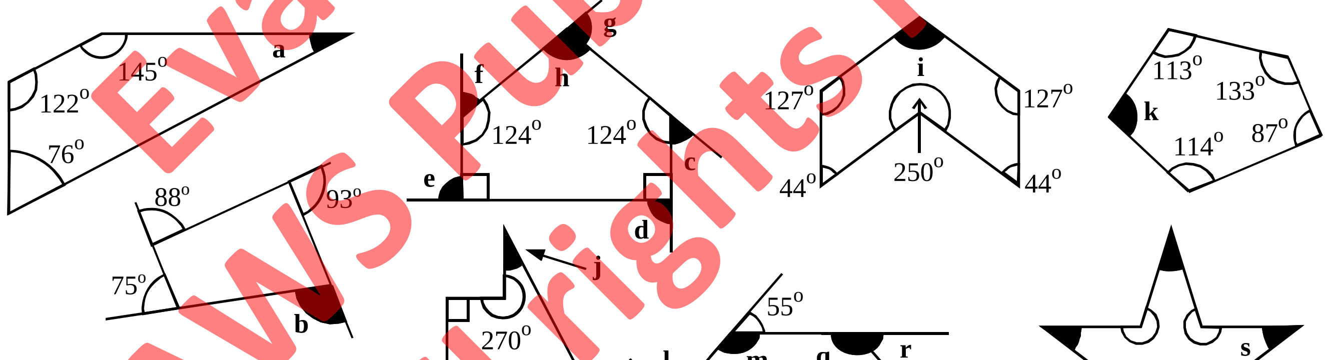
6 sides

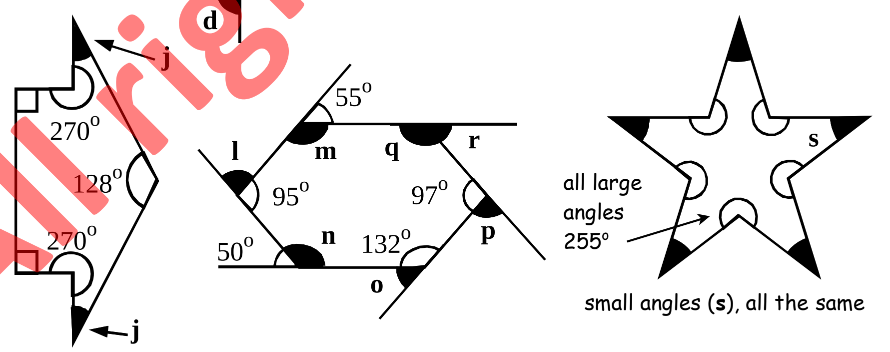


Number of sides	Interior angle sum
4	360^0
5	
6	
7	
8	
9	
10	

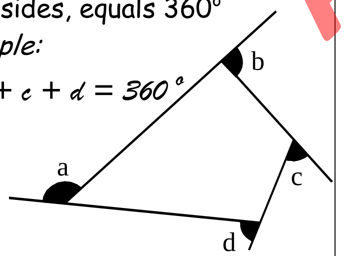
C: Missing angles

Use the angle rule below for the exterior angle sum, and the table values above, to calculate the missing angles in these diagrams (not drawn to scale). Other angle rules may also be used where necessary.





Angle rule:
The sum of the exterior angles of any polygon, no matter how many sides, equals 360°
Example:
$a + b + c + d = 360°$



a = ...	f = ...	k = ...	p = ...
b = ...	g = ...	l = ...	q = ...
c = ...	h = ...	m = ...	r = ...
d = ...	i = ...	n = ...	s = ...
e = ...	j = ...	o = ...	

Comments: ....
....
....

Please sign:
Parent / Caregiver

AWS

G3

Geometry
Homework / Assessment Worksheet

L5MG

7

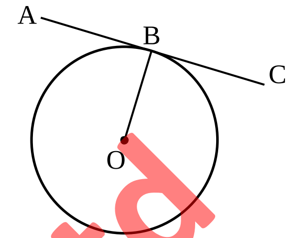
Name: **Class:** **Complete by:**

A: 10 Quick Questions

1. $9 \times {}^{-}8 + 12 =$ ....
2. Convert 2130mm to metres ....
3. How many seconds in 2.25 hours? ....
4. Find the area of a triangle with a base of 16cm and a height of 11cm. ....
5. Convert 80% to a fraction (simplify) ....
6. Round off 3.865 to 1 d.p. ....
7. If 9 books cost $13.05, what does each book cost? ....
8. Share $72.00 in a ratio of 5 : 3 ....
9. How many degrees in a right angle? ....
10. Find 75% of $19.80 ....

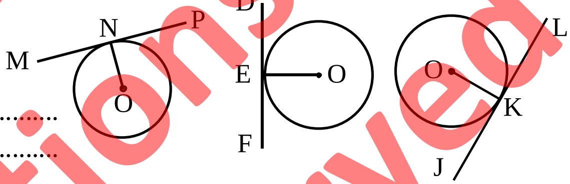
B: Angle between a tangent and a radius

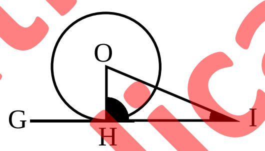
Use the diagram and the words in the box to complete each sentence.



tangent	radius
centre	right angle

1. Point O is the .... of the circle.
2. Line OB is a .... of this circle.
3. Line AC is a .... to this circle.
4. The tangent to a circle and the radius of the circle form a ....
5. Name **all** the right-angles in these 3 diagrams.
....
....
....



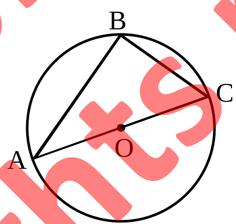


In this diagram, ∠HOI = 68°.

6. What is the size of ∠OHI? ....
7. What is the size of ∠OIH? ....
8. What is the size of ∠GHO? ....

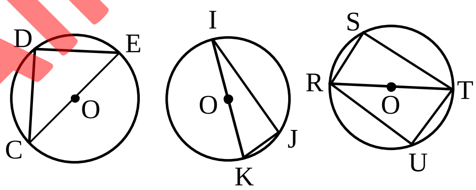
C: Angle in a semi-circle

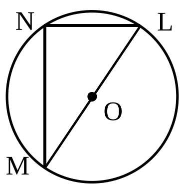
Use the diagram and the information in the box to complete each sentence.



diameter	90°
semi-circle	centre
circumference	

1. Point O is the .... of the circle.
2. Line AC is a .... of this circle.
3. Point B touches the .... of this circle.
4. ∠ABC is said to be the angle in a ....
5. An angle in a semi-circle is equal to ....
6. Name **all** the angles in a semi-circle in these 3 diagrams.
....
....





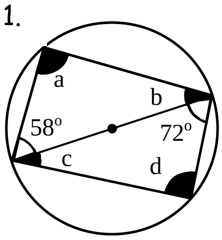
In the triangle LMN, ∠MLN = 62°.

7. What is the size of ∠MNL? ....
8. What is the size of ∠LNM? ....

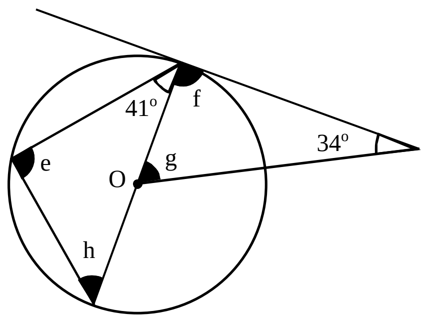
D: Missing angles

Find the size of the angles in these diagrams. Diagrams are not drawn to scale.

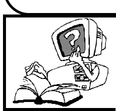
1.



a = ...
b = ...
c = ...
d = ...



2. e = ... f = ...
g = ... h = ...



Comments: ....
....
....

Please sign:
Parent / Caregiver
....

AWS

Geometry

Homework / Assessment Worksheet

G4 L5MG 8

Name: **Class:** **Complete by:**

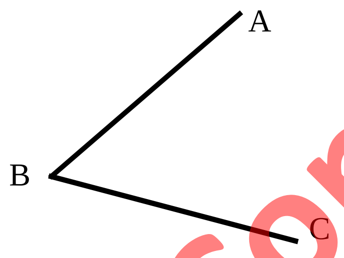
A: 10 Quick Questions

1. $^{-}8 + {}^{-}4 \times 7 =$ ....
2. $14.68 \div 0.02 =$ ....
3. 75% of \$64 = ...
4. How many hours in 7.25 days? ....
5. Convert $7^{3}/_{4}$ to an improper fraction ....
6. Write 4.8×10^5 as an ordinary number ....
7. Convert 0.63km to metres ....
8. Solve $\frac{1}{2}y = 17$ y = ...
9. What is the next number in the pattern 3, 6, 12, ...
10. Calculate 3^4 ....

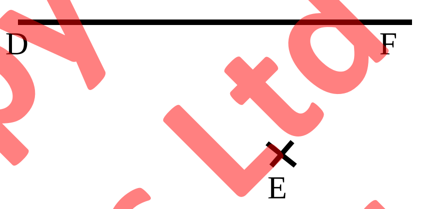
B: Angles and lines

Construct the following. Show construction marks.

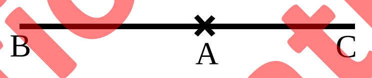
1. Bisect ∠ABC.



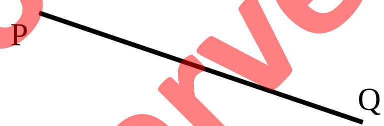
3. Construct a line through E that is parallel to DF.



2. Construct a line through A that is perpendicular to line BC.



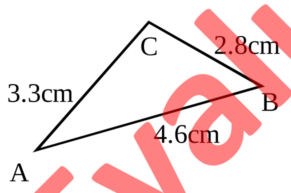
4. Bisect line PQ.



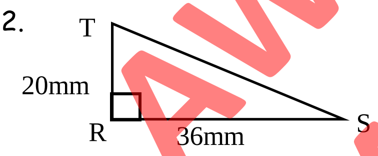
C: Triangles

Accurately draw these triangles.

1.



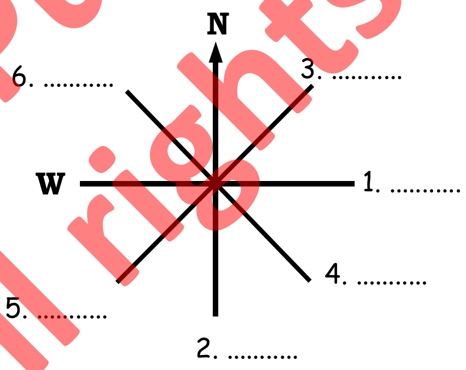
2.

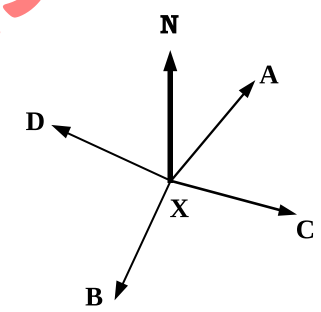


3. How long is line TS? ....

D: Compass bearings

Write the common compass directions, that correspond to the lines drawn below.



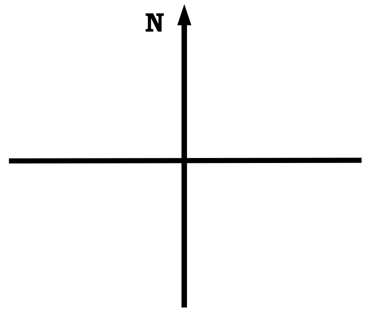


Find the bearing of each point from the point X.

7. X to A ....
8. X to B ....
9. X to C ....
10. X to D ....

Draw and label the following bearings on the compass diagram.

11. 050 label it A
12. 145 label it B
13. 245 label it C
14. 300 label it D



Comments: ....
....
....

Please sign: Parent / Caregiver

AWS

Geometry

Homework / Assessment Worksheet

G5

L5MG

9

Name: **Class:** **Complete by:**

A: 10 Quick Questions

1. $1.2 \times 0.7 + 9.3 =$ ....
2. $4.92 + 0.6 \times 1.5 =$ ....
3. $\frac{3}{4}$ of \$56 = ...
4. How many grams in 6.27kg? ....
5. Convert $7^5/_8$ to an improper fraction ....
6. Write 7.3×10^{-3} as an ordinary number ....
7. Convert 0.84m to cm ....
8. Solve $\frac{1}{4}x = 12$ $x =$ ....
9. List a prime number between 50 and 60 ....
10. Calculate 2^6 ....

B: Squares / square roots

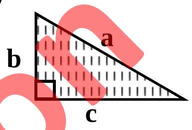
Calculate (round to 2 d.p. if answers are not whole numbers).

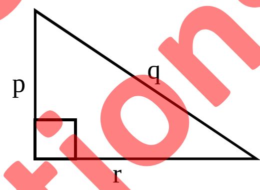
1.	6^2 = ...	5.	$\sqrt{64}$ = ...	9.	$\sqrt{7^2+5^2}$ = ...
2.	13^2 = ...	6.	$\sqrt{144}$ = ...	10.	$\sqrt{8^2+11^2}$ = ...
3.	$5^2 + 3^2$ = ...	7.	$\sqrt{41.6}$ = ...	11.	$\sqrt{9^2+5^2}$ = ...
4.	$7^2 + 4^2$ = ...	8.	$\sqrt{13.52}$ = ...	12.	$\sqrt{4^2+8^2}$ = ...

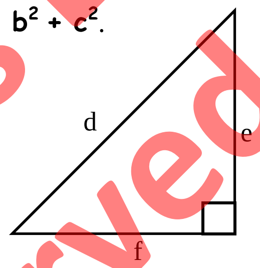
C: Pythagoras' theorem

Carefully measure the sides of these triangles (mm), then see if they approximately fit the **Pythagoras rule** $a^2 = b^2 + c^2$.

Example







q = ...mm $q^2 = p^2 + r^2$ d = ...mm $d^2 = e^2 + f^2$

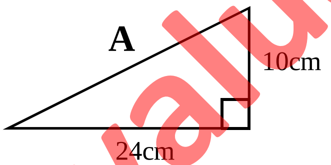
p = ...mm .... e = ...mm ....

r = ...mm .... f = ...mm ....

D: Missing sides

Use the **Pythagoras rule** to find the missing sides.

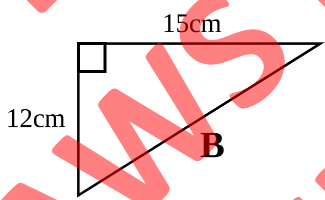
1.



....

....

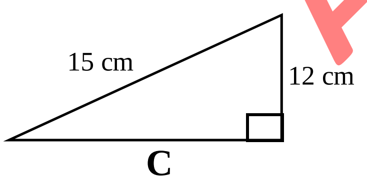
2.



....

....

3.

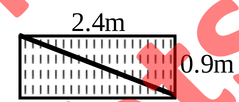


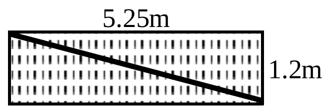
....

....

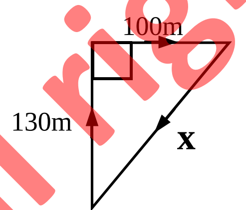
E: Word problems (round to 2 d.p.)

1. A farmer is to make two gates, as in the diagrams. Work out how long to cut each diagonal rod. How long will they be?



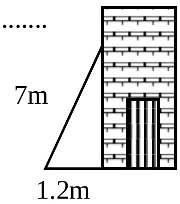


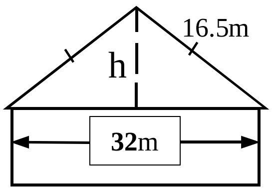
....



2. Johnny runs around a triangular field, as shown in the diagram. How far is it across the field (x)? ....
3. How far did he run altogether? ....

4. A 7m ladder is 1.2m out from the bottom of a building. How high up the building will the ladder reach? ....





5. A builder needs to calculate the height of a roof, above the ceiling, as shown in the diagram. How high will it be (h)? ....

Comments: ....

Please sign:
Parent / Caregiver

AWS

Geometry

Homework / Assessment Worksheet

Name: **Class:** **Complete by:**

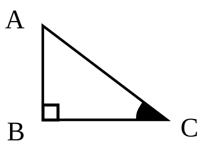
A: 10 Quick Questions

1. List the factors of 28 ....
2. 4(25 ÷ 8 + 6) = ...
3. Find $33.\dot{3}$% of \$120.60 ....
4. How many milligrams in 7.6g? ....
5. $^-9 + 5 - {}^-7$ = ...
6. Simplify the ratio \$3 : 50c ....
7. Find the volume of a cube with sides of 4cm ....
8. Shade in 60% of the shapes

9. Round off 14.764 to 2 d.p. ....
10. Calculate $(^-5)^3$ ....

B: Naming sides

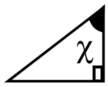
Name each side of the triangle using the words **Opposite**, **Adjacent** and **Hypotenuse**, for the marked angle C.
(use Opp, Adj and Hyp).



AB = ...
BC = ...
AC = ...

C: SOHCAHTOA?

What does this mean?
Fill in the missing words below to complete the trig ratios.



1. Sin χ = ________________
2. Cos χ = ________________
3. Tan χ = ________________

D: Calculator or Tables

Use the calculator or trig tables to find the value of these trig ratios (round to 4 d.p.).

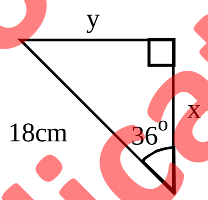
1. tan 65° ....
2. sin 25° ....
3. cos 80° ....
4. tan 51.8° ....
5. cos 21.4° ....
6. sin 72.8° ....
7. cos 53.1° ....
8. tan 9.8° ....
9. sin 86.9° ....

Find the angle Q, using calculator or trig tables (round to 1 d.p.).

10. cos Q = 0.9063 ....
11. sin Q = 0.8660 ....
12. tan Q = 3.7321 ....
13. sin Q = 0.3007 ....
14. cos Q = 0.4226 ....
15. tan Q = 0.1317 ....
16. sin Q = 0.8780 ....
17. cos Q = 0.7218 ....
18. tan Q = 6.535 ....

E: Missing sides

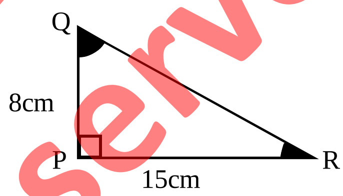
Calculate the unknown sides using a trig ratio (round to 2 d.p.).



1. side x ....
....
2. side y ....
....

F: Missing angles

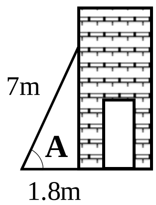
Calculate the unknown angles using a trig ratio (round to 1 d.p.).

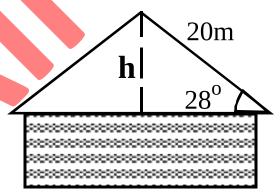


1. ∠PQR ....
....
2. ∠QRP ....
....

G: Word Problems

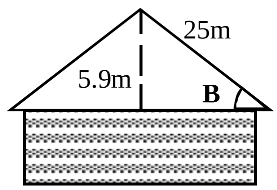
1. A ladder is placed against a building as shown in the diagram. What angle (A) does the ladder make with the ground? (round to 1 d.p.)
....





2. This diagram shows part of a house plan. How high is the roof peak above the ceiling (h)? (round to 2 d.p.)
....

3. This diagram shows part of a house plan. Calculate the angle (B) of the roof. (round to 2 d.p.)
....



Comments: ....

Please sign: Parent / Caregiver

Geometry

G6

Homework / Assessment Worksheet

L5MG

11

Name: **Class:** **Complete by:**

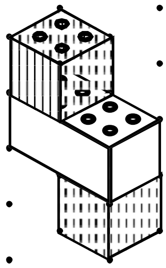
A: 10 Quick Questions

1. $^-9 \times {^-4} - 11 =$ ....
2. Convert 87.3cm to mm ....
3. $\sqrt{5^2 + 12^2}$ = ...
4. How many seconds in 1.25 hours? ....
5. $^3/_5 + {^2/_3} =$ ....
6. Write 812000 in standard form ....
7. If 9 kg of meat cost \$53.55 what does 1kg cost? ....
8. Share \$48.00 in a ratio of 2 : 5 : 1 ....
9. Convert 37.5% to a decimal ....
10. Calculate the new price if a 40% discount is taken off \$300.00 ....

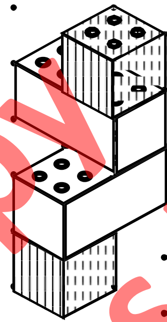
B: Drawing on isometric paper

Copy each block diagram in the space provided.

1.

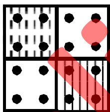
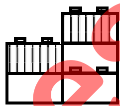
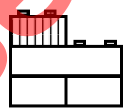
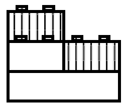
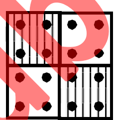
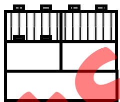
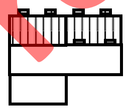
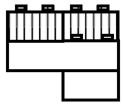
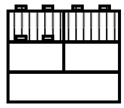


2.



C: Constructing 3D block structures

Study the view diagrams below **and build** each block structure.

	Top	Front	Left side	Right side	Back
1.					
2.					

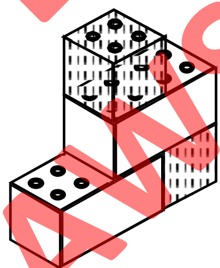
Draw each block structure above on isometric paper.

1.

2.

D: Drawing view diagrams

Study this diagram of a block structure made from 2 4-pin and 2 8-pin blocks.



Draw the view diagram for the block structure.

Top	Front	Left side	Right side	Back

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

AWS

Geometry

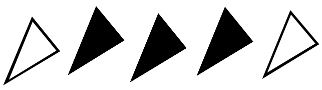
Homework / Assessment Worksheet

G7 / G10

Name: Class: Complete by:

A: 10 Quick Questions

1. List the factors of 36 ....
2. $^{-}4(3 \times 6 - 9)$ = ...
3. Find 120 % of $80.00 ....
4. How many centimetres is 628mm? ....
5. $^{-}10 - {^{-}8} + 7$ = ...
6. Convert 0.58 to a percentage ....
7. Find the perimeter of a square with sides of 13cm ....
8. What fraction of the shapes is shaded? ....

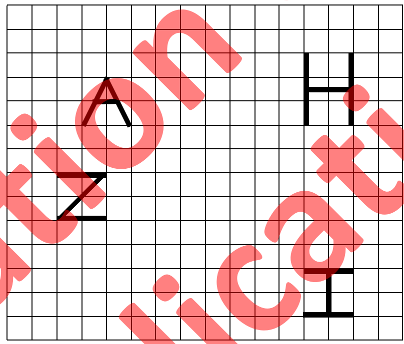


9. Round off 0.5276 to 3 d.p. ....
10. Calculate $(^{-}4)^3$ ....

B: The shapes moved?

Count the squares to move the shapes and draw the new position.

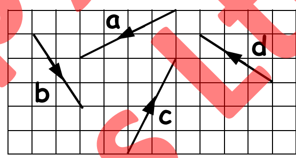
1. Move A, 4 squares to the right and 2 squares up.
2. Move H, 2 squares to the left and 3 squares down.
3. Move Z, 2 squares to the right and 4 squares down.
4. Move I, 4 squares to the left and 2 squares up.



C: Name or draw vectors

Study the vector diagrams, then write the vectors in the form of

$\begin{pmatrix} x \\ y \end{pmatrix}$ where and x = left or right, y = up or down



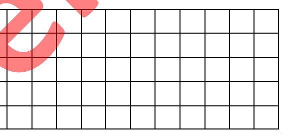
$\underset{\sim}{d} = \begin{pmatrix} \quad \end{pmatrix}$ $\underset{\sim}{c} = \begin{pmatrix} \quad \end{pmatrix}$

$\underset{\sim}{a} = \begin{pmatrix} \quad \end{pmatrix}$ $\underset{\sim}{b} = \begin{pmatrix} \quad \end{pmatrix}$

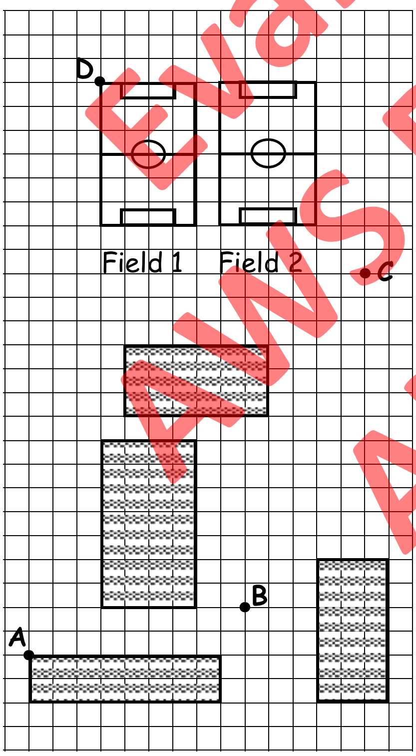
Draw and label the vectors,

$\underset{\sim}{e} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$ $\underset{\sim}{f} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$ $\underset{\sim}{g} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$

on this grid



D: Word Problems



This grid shows a map of part of the St. Albans school grounds. Use this to answer these questions.

Steven has to run from point A to B to C to D as a warm-up for a sports practice.

1. **Draw** the vectors, for each part of the run, on the diagram.
2. **Write** down the translation vectors for each part of the run.

A to B = $\begin{pmatrix} \quad \end{pmatrix}$ B to C = $\begin{pmatrix} \quad \end{pmatrix}$ C to D = $\begin{pmatrix} \quad \end{pmatrix}$

3. **Add** the translation vectors in question 2 above.

$\underset{\sim}{AB} + \underset{\sim}{BC} + \underset{\sim}{CD} = \begin{pmatrix} \quad \end{pmatrix}$

4. Andrew is late for practice so runs directly from A to D. **Draw** this on the diagram, then **write** down the translation vector for this run. Is it the same as the answer in question 3 above? ....

$\underset{\sim}{AD} = \begin{pmatrix} \quad \end{pmatrix}$

Comments: ....
....
....

Please sign: Parent / Caregiver

AWS

L5MG

G8

Geometry

Homework / Assessment Worksheet

13

Name: **Class:** **Complete by:**

A: 10 Quick Questions

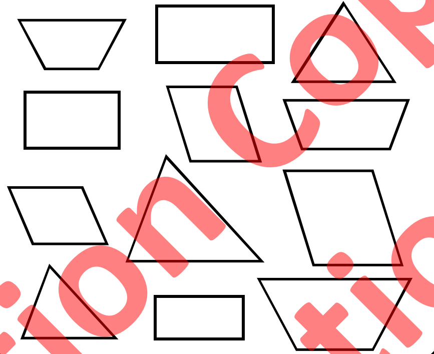
1. List the factors of 22 ....
2. $^-2(15 \div 3 - 7)$ = ...
3. Find 200 % of \$84.00 ....
4. How many millimetres is 81.6cm? ....
5. $^-17 - {}^-9 + 7$ = ...
6. Convert 0.09 to a percentage ....
7. Find the perimeter of a square with sides of 16cm ....
8. What fraction of the shapes are shaded? ....

9. Round off 0.0537 to 2 s.f. ....
10. Calculate $(^-6)^3$ ....

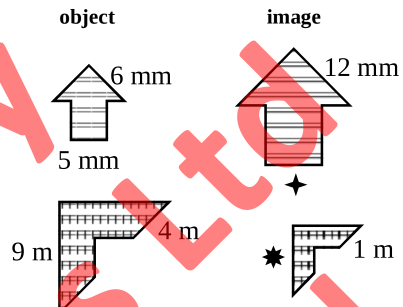
B: Similar Figures

Find the following **pairs** of similar shapes and label with the letters as stated,

1. triangles, label them ***A***
2. rectangles,label them **B**
3. trapeziums, label them ***C***
4. parallelograms, label them **D**



C: Missing sides / scale factors for similar figures



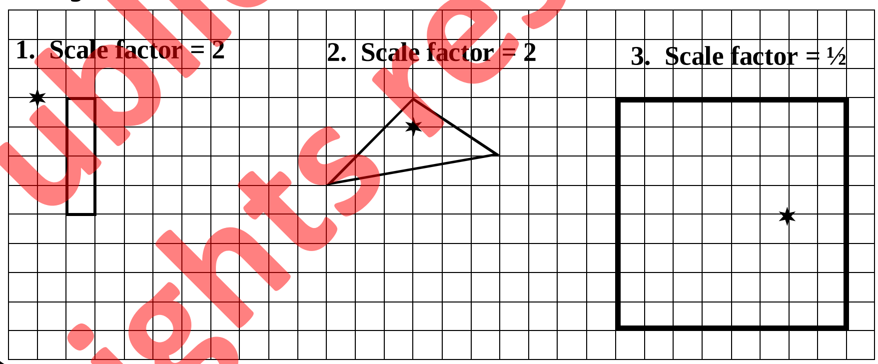
1. ✦ = ... 2. ✸ = ...

Find the scale factors for the enlargements above (object on the left, image on the right)

3. (✦)............ 4. (✸)............

E: Drawing enlargements

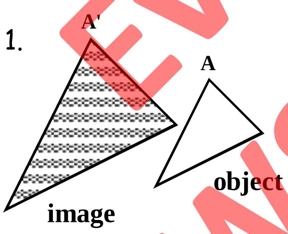
Enlarge each shape by the scale factor given. The centre of each enlargement is marked with a ✶.



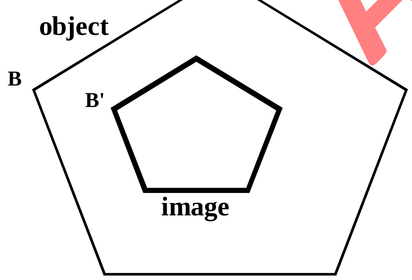
D: Draw lines to find the centre of each enlargement

Mark each centre with a C.

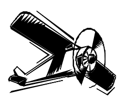
1.



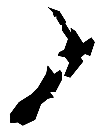
2.



F: Word problems



1. An aerial photo of a building is enlarged by a scale factor of 4. If the building in the photo measured 9.5cm how long is it in the enlargement? ....



2. A map of New Zealand is 40cm wide. How wide is the map after it has been enlarged by a scale factor $\frac{1}{4}$? ....

3. A 30cm high road sign is to be enlarged by a scale factor of $2\frac{1}{2}$. How high is the enlarged sign? ....

4. A landscape plan was enlarged by a scale factor of 3. If a rose garden on the enlarged plan is 63cm long, how long was it on the original plan? ....

Comments: ....
....
....

Please sign:
Parent / Caregiver

AWS

Geometry

G11

Homework / Assessment Worksheet

14

Name: **Class:** **Complete by:**

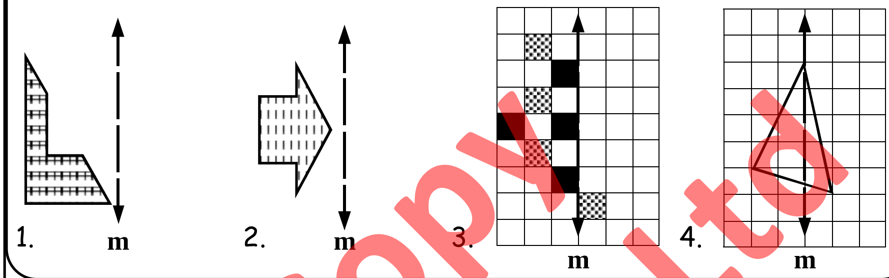
A: 10 Quick Questions

1. List the first 4 multiples of 12 ....
2. 7(24 ÷ 6 - 7) = ...
3. Find 80% of $70.00 ....
4. How many millimetres is 63.9cm? ....
5. ⁻14 + ⁻5 + 9 = ...
6. Convert 0.95 to a fraction (simplify) ....
7. Find the area of a square with sides of 15cm ....
8. What percentage of the shapes is shaded? ....

9. Round off 6.976 to 2 d.p. ....
10. Calculate $(^{-}7)^3$ ....

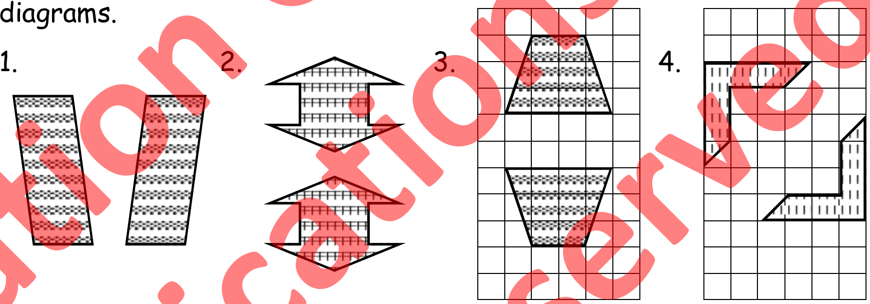
B: Drawing reflections

Each figure is reflected in the mirror line (m). Draw the image figure.



C: Draw in the mirror lines for each reflection

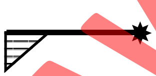
Draw in **all** of the lines of symmetry (mirror lines) for each pair of diagrams.



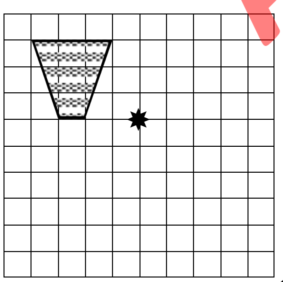
D: Rotation

For rotation we need a **centre of** rotation and an **angle of** rotation. A positive angle of rotation is **anti-clockwise**. Rotate the following shapes given the angle, and the centre (✷) of rotation.

1. angle of rotation, 90°

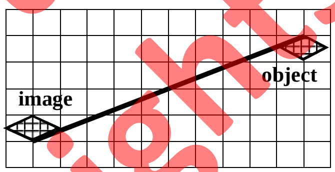


2. angle of rotation, 180°

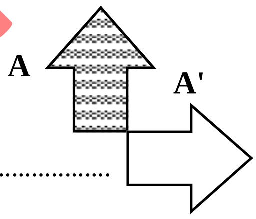


E: Find the centre and angle of rotation

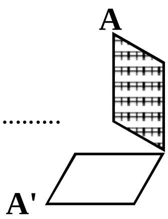
Mark the centre of rotation with a ✶ and find the angle of rotation (either 90°, 180°, or 270°).

1.


angle = ...

2.


angle = ...

3.


angle = ...

F: Word problems

A driver of a car sees **AMBULANCE** the correct way around when looking at it, in the rear-vision mirror. How would the word Ambulance look on the front of the Ambulance, when you are not looking at it using a mirror?

1. ....
2. Write your name as it would look in a mirror.

....

When doing up a nut and bolt, which way (clockwise or anticlockwise), do you have to turn it, to tighten the nut up?

3. ....

Is this the same for wood screws and bottle tops?

4. ....

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

AWS

L5MG

G11

Geometry

15

Homework / Assessment Worksheet

Name: **Class:** **Complete by:**

A: 10 Quick Questions

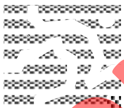
1. $2.2 \times 0.7 + 7.3 =$ ....
2. $3.01 + 0.9 \times 2.7 =$ ....
3. $\frac{3}{4}$ of \$96 = ...
4. How many grams in 5.26kg? ....
5. Convert $8^5/_7$ to an improper fraction ....
6. Write 7.2×10^{-3} as an ordinary number ....
7. Convert 0.58m to cm ....
8. Solve $\frac{1}{4}x = 12$ $x =$ ....
9. List a prime number between 70 and 80 ....
10. Calculate $(0.5)^3$ ....

B: How did they draw that?

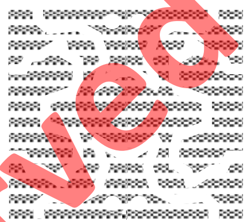
Look at each drawing and determine if it involves a translation, reflection, rotation, enlargement, or a combination of transformations, then answer the questions that follow.

1. Miri drew this kowhaiwhai pattern. What type of transformation does this involve ? ....
2. Draw lines between the repeating pattern above.

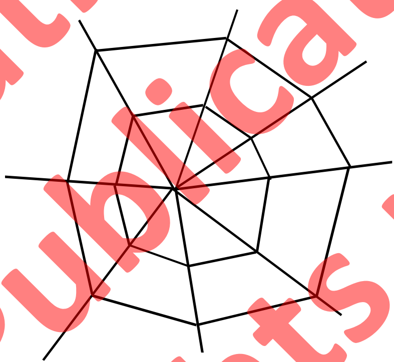
Steven used the pattern below to draw the pattern on the right.



3. What type of transformation does this involve ? ....



4. Draw lines between the repeating patterns of Steven's drawing (lines of symmetry).

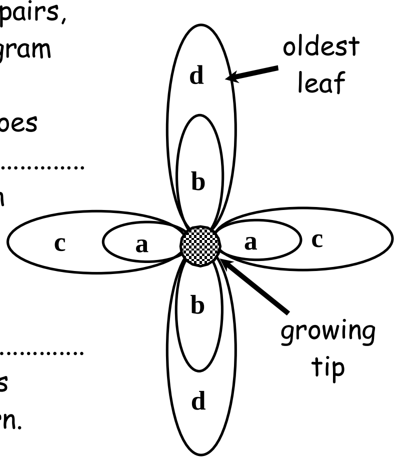


Rangi drew a spider's web.

5. What type of transformation does it best represent? ....
6. As the spider web gets bigger, are there any points that would appear not to move ? ....
7. Draw one more ring to the web, as if the spider was adding to his web.

The leaves of the Hebe plant grow in pairs, and in layers (labelled a to d, this diagram shows four layers of paired leaves).

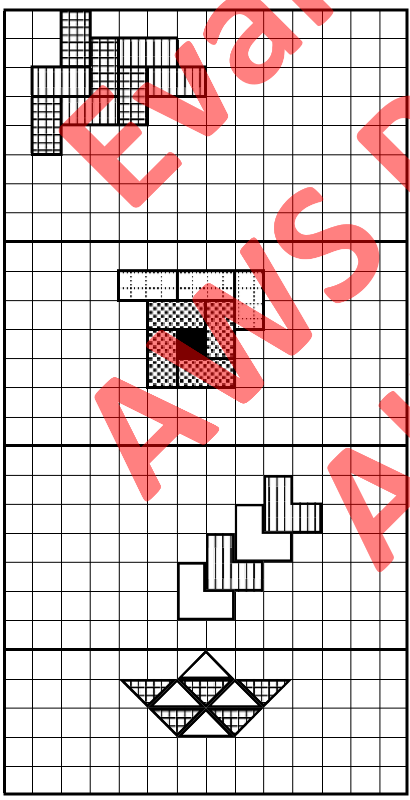
8. What type of transformation does this represent? ....
9. What is the angle between each pair of leaves? ....
10. How is one pair of leaves related to the pair below? ....
11. Find out why the Hebe plant has its leaves growing in this pattern. ....
12. Draw in the position of where the next layer of leaves would be.

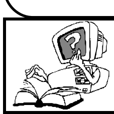


This diagram is looking down on a growing stem.

C: Tile designs

Many tile designs involve some form of transformation. Copy the tile patterns to create a design (called tessellating).





AWS

Comments: ....
....
....

Please sign:
Parent / Caregiver
....

Homework / Assessment Worksheet

Answers

Worksheet 1

A:

1. \$3.26   2. 15   3. 9   4. -1°C   5. 0.0376   6. 450 seconds   7. \$68.40   8. 12   9. 78 weeks
10. \$8.85

B:

1. straight   2. acute   3. right   4. reflex   5. obtuse

C:

1. ∠CED or ∠DEC   2. ∠CBE or ∠EBC, ∠CBD or ∠DBC   3. -   4. -   5. No, because there are two angles at point B

D:

1. 150° 2. 20° 3. 40° 4. 30° 5. 130°

E:

1. $119^\circ \pm 1^\circ$ 2. $39^\circ \pm 1^\circ$ 3. $75^\circ \pm 1^\circ$ 4. $329^\circ \pm 1^\circ$ 5. $160^\circ \pm 1^\circ$ 6. $36^\circ \pm 1^\circ$

Worksheet 2

A:

1. -4   2. 5600L   3. 315 seconds   4. $77cm^2$ 5. $^{6}/_{10}$ or $^{3}/_{5}$ 6. 4.02   7. \$1.25   8. 0.3402   9. 80.5 days
10. \$3.28

B:

A = 3, B = 1, C = 2

C:

a = 109° b = 107° c = 127° d = 129° e = 39° f = 81° g = 99° h = 53° j = 57° k = 75°
m = 105° n = 27° p = 41° q = 60° r = 53° s = 127° t = 53° u = 31° v = 90° w = 141°

D:

12 acute angles

E:

1. 180° 2. 45° 3. 90° 4. 135° 5. 45° 6. 120° 7. 105° 8. 105° 9. 22.5° 10. 82.5°

Worksheet 3

A:

1. -52   2. 2.45m   3. 7200 seconds   4. $60cm^2$ 5. $^{85}/_{100}$ or $^{17}/_{20}$ 6. 4.3   7. \$0.75   8. \$40:\$30   9. 180°
10. \$11.10

B:

1. acute scalene   2. right angled isosceles   3. obtuse scalene   4. right angled   5. isosceles   6. equilateral

C:

A = 1, B = 2

D:

a = 41° b = 31° c = 28° d = 47° e = 47° f = 62° g = 60° h = 45° j = 45° k = 116° m = 93°
n = 51° p = 61° q = 119° r = 41° s = 37° t = 101° u = 64° v = 71°
w = 45°

E:

10 obtuse angles

Worksheet 4

A:

1. -62 2. 43.5cm 3. 60 4. 10 sides 5. $^{7}/_{5}$ or $1^{2}/_{5}$ 6. 5200 7. $9.65 8. $48:$60 9. $121m^2$
10. $21.60

C:

1. A 2. C 3. B

D:

a = 97^o b = 57^o c = 68^o d = 95^o e = 95^o f = 75^o g = 105^o h = 105^o j = 56^o k = 124^o m = 56^o
n = 56^o p = 117^o q = 105^o r = 63^o s = 42^o t = 75^o u = 129^o v = 51^o
w = 51^o x = 43^o y = 65^o z = 72^o

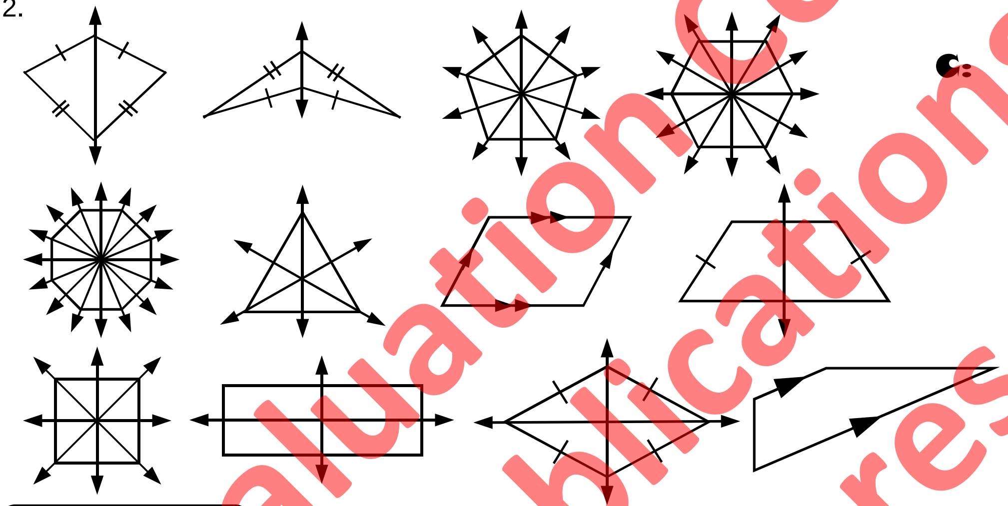
Worksheet 5

A:

1. 31 2. 639mm 3. 5 4. 6300 seconds 5. $^{13}/_{10}$ or $1^{3}/_{10}$ 6. 5.6×10^5 7. $7.95 8. $8:$24:$32
9. 0.45 10. $54.00

B:

1. a = kite b = arrowhead c = pentagon d = hexagon e = octagon f = equilateral triangle
g = parallelogram h = isosceles trapezium i = square j = rectangle k = rhombus l = trapezium
2.



C:

Shape	A	B
equilateral triangle	3	3
square	4	4
rectangle	2	2
parallelogram	0	2
rhombus	2	2
trapezium	0	1
isosceles trapezium	1	1
kite	1	1
arrowhead	1	1
pentagon	5	5
hexagon	6	6
octagon	8	8

Worksheet 6

A:

1. 21 2. 0.003776 3. $24:$18 4. 8.25 minutes 5. $6^{5}/_{6}$ 6. 8.0×10^{-4} 7. 9470L 8. y = 6 9. -4
10. 10

B:

4 sides = 360^o 5 sides = 540^o 6 sides = 720^o 7 sides = 900^o 8 sides = 1080^o 9 sides = 1260^o
10 sides = 1440^o

C:

a = 17^o b = 104^o c = 56^o d = 90^o e = 90^o f = 56^o g = 68^o h = 112^o i = 128^o j = 26^o k = 93^o
l = 85^o m = 125^o n = 130^o o = 48^o p = 83^o q = 141^o r = 39^o s = 39^o

Worksheet 7

A:

1. -60 2. 2.13m 3. 8100 sec 4. $88cm^2$ 5. 80/100, 4/5 6. 3.9 7. $1.45 8. $45:$27
9. 90^o 10. $14.85

B:

1. centre 2. radius 3. tangent 4. right-angle 5. ∠MNO (∠ONM), ∠ONP (∠PNO), ∠DEO (∠OED), ∠OEF (∠FEO), ∠JKO (∠OKJ), ∠OKL (∠LKO) 6. 90^o 7. 22^o 8. 90^o

C:

1. centre 2. diameter 3. circumference 4. semi-circle 5. 90^o 6. ∠CDE (∠EDC), ∠KJI (∠IJK), ∠RST (∠TSR), ∠RUT (∠TUR) 7. 90^o 8. 90^o

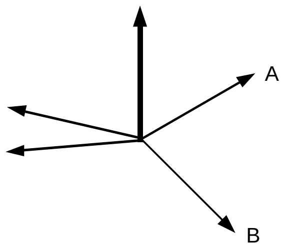
D:

1. a = 90^o b = 32^o c = 18^o d = 90^o 2. e = 90^o f = 90^o g = 56^o h = 49^o

Worksheet 8

A:

1. -36 2. 734 3. $48 4. 174 hours 5. $^{31}/_{4}$ 6. 480000
7. 630m 8. y = 34 9. 24 10. 81



B:

1, 2, 3 & 4. no answers supplied

C:

1 & 2. no answers supplied 3. 40mm

D:

1. E 2. S 3. NE 4. SE 5. SW 6. NW 7. 040 8. 200 9. 105 10. 290
11 to 14 see diagram

Worksheet 9

A:

1. 10.14 2. 5.82 3. $42 4. 6270g 5. $^{61}/_{8}$ 6. 0.0073 7. 84cm 8. x = 48 9. 53, 59 10. 64

B:

1. 36 2. 169 3. 34 4. 65 5. 8 6. 12 7. 6.45 8. 3.68 9. 8.60 10. 13.60 11. 10.30
12. 8.94

C:

q = 35mm p = 19mm r = 30mm $35^2 = 1225$ & $19^2 + 30^2 = 1261$, therefore it almost fits the rule
d = 41mm e = 29mm f = 29mm $41^2 = 1681$ & $29^2 + 29^2 = 1682$, therefore it almost fits the rule

D:

1. $A^2 = 10^2 + 24^2$, $A^2 = 676$, A = 26cm 2. $B^2 = 12^2 + 15^2$, $B^2 = 369$, B = 19.21cm
3. $15^2 = C^2 + 12^2$, $C^2 = 225 - 144$, $C^2 = 81$, C = 9cm

E:

1. 2.56m, 5.39m 2. 164.01m 3. 394m 4. 6.9m 5. 4.03m (2 d.p.)

Worksheet 10

A:

1. 2, 4, 7, 14, 28 2. 36.5 3. $40.20 4. 7600mg 5. 3 6. 6:1 7. $64cm^3$ 8. any 3 shapes 9. 14.76
10. -125

B:

AB = Opp, BC = Adj, AC = Hyp

C:

Sin x = $^{O}/_{H}$ Cos x = $^{A}/_{H}$ Tan = $^{O}/_{A}$

D:

1. 2.1445 2. 0.4226 3. 0.1736 4. 1.2708 5. 0.9311 6. 0.9553 7. 0.6004 8. 0.1727 9. 0.9985
10. 25.0^o 11. 60.0^o 12. 75.0^o 13. 17.5^o 14. 65.0^o 15. 7.5^o 16. 61.4^o 17. 43.8^o 18. 81.3^o

E:

1. Cos 36^o = $^{x}/_{18}$, x = 14.56cm 2. Sin 36^o = $^{Y}/_{18}$, y = 10.58cm

F:

1. Tan Q = $^{15}/_{8}$, Tan Q = 1.875, Q = 61.9^o 2. Tan R = $^{8}/_{15}$, Tan Q = 0.5333, Q = 28.1^o

G:

1. Cos A = $^{1.8}/_{7}$, A = 75.1^o 2. Sin 32^o = $^{h}/_{20}$, h = 9.39m 3. Sin B = $^{5.9}/_{25}$, B = 13.65^o

Worksheet 11

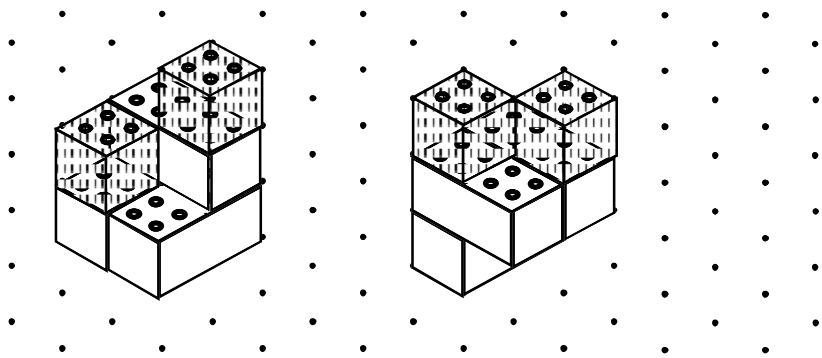
A:

1. 25 2. 873mm 3. 13 4. 4500 sec 5. $^{9}/_{15} + ^{10}/_{15} = ^{19}/_{15} = 1^{4}/_{15}$ 6. 8.12 x 10^5 7. $5.95
8. $12:$30:$6 9. 0.375 10. $180

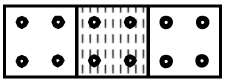
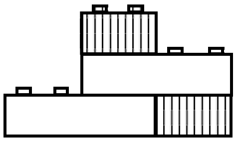
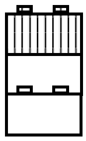
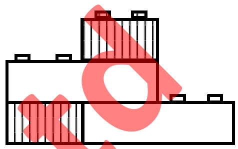
B:

check diagrams

C:



D:

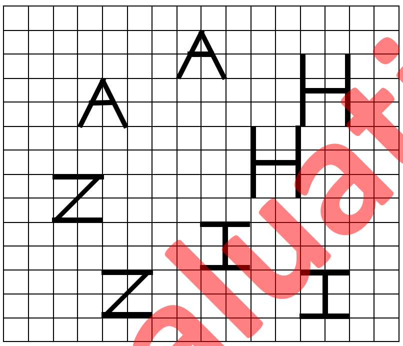
Top	Front	Left side	Right side	Back
				

Worksheet 12

A:

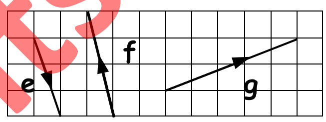
1. 2, 3, 4, 6, 9, 12, 18, 36   2. -36   3. \$96   4. 62.8cm   5. 5   6. 58%   7. 52cm   8. $^3/_5$ 9. 0.528
10. -64

B:



C:

$\underset{\sim}{a} = \begin{pmatrix}-4\\-2\end{pmatrix}$ $\underset{\sim}{b} = \begin{pmatrix}2\\-3\end{pmatrix}$ $\underset{\sim}{c} = \begin{pmatrix}2\\4\end{pmatrix}$ $\underset{\sim}{d} = \begin{pmatrix}-3\\2\end{pmatrix}$



D:

1. check diagram   2. $\underset{\sim}{\text{A to B}} = \begin{pmatrix}9\\2\end{pmatrix}$ $\underset{\sim}{\text{B to C}} = \begin{pmatrix}5\\14\end{pmatrix}$ $\underset{\sim}{\text{C to D}} = \begin{pmatrix}-11\\8\end{pmatrix}$ 3. $\begin{pmatrix}3\\24\end{pmatrix}$

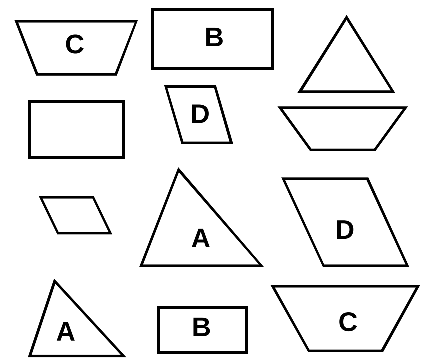
4. yes

Worksheet 13

A:

1. 2, 11, 22 2. 4 3. \$168 4. 816mm 5. -1 6. 9% 7. 64cm 8. $^4/_5$ 9. 0.1
10. -216

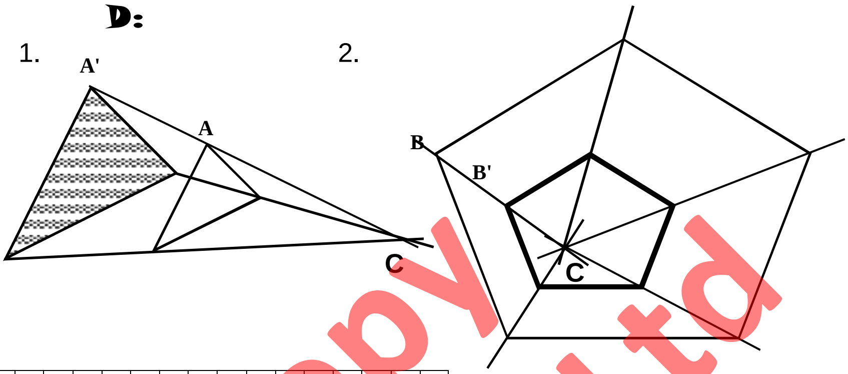
B:



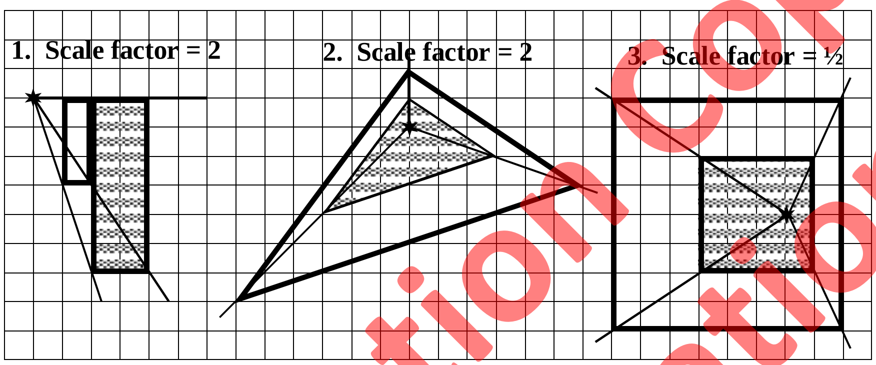
C:

1. 10mm 2. 2.25m 3. scale factor = 2 4. $^1/_4$

D:



E:



F:

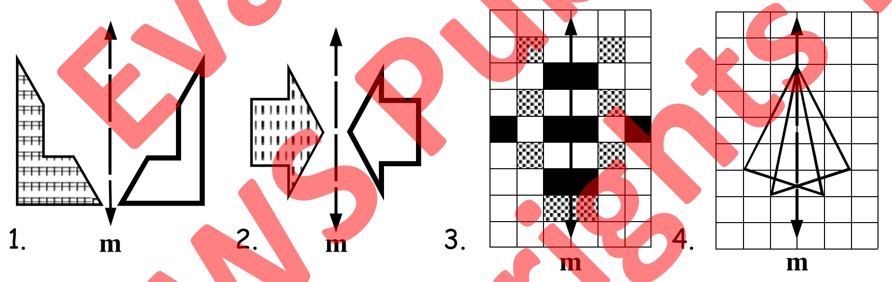
1. 38cm
2. 10cm
3. 75cm
4. 21cm

Worksheet 14

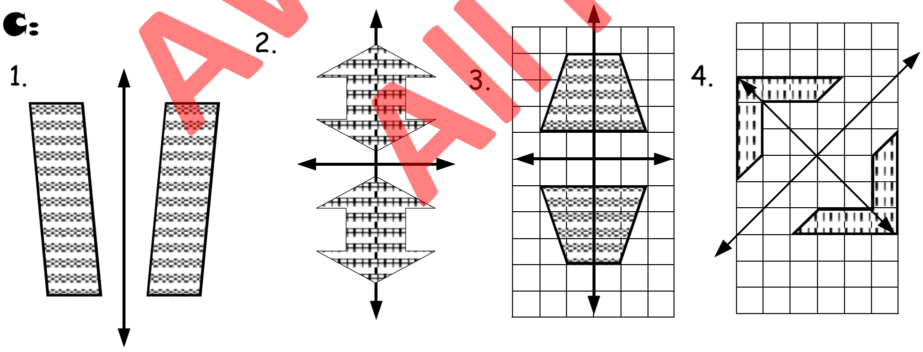
A:

1. 24, 36, 48, 60 2. -21 3. \$56 4. 639mm 5. -10 6. $^{95}/_{100}$ or $^{19}/_{20}$ 7. 225cm^2 8. 80% 9. 6.98
10. -343

B:

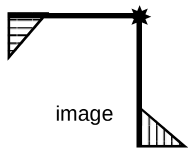


C:

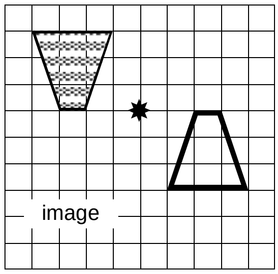


D:

1.

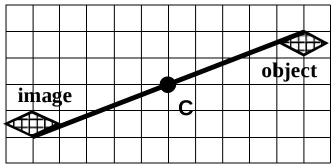


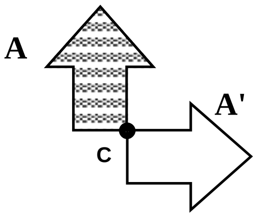
2.

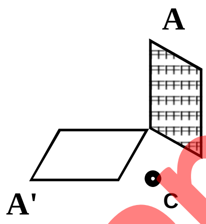


E:

1. 180^o 2. 270^o or -90^o 3. 90^o or -270^o







F:

1. - 2. -
3. clockwise 4. yes

Worksheet 15

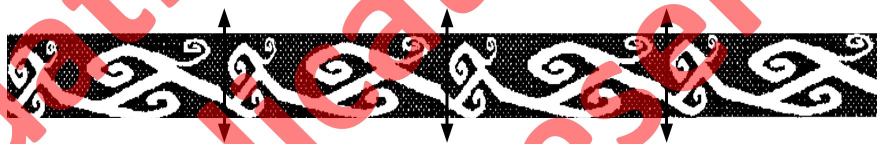
A:

1. 8.84 2. 5.44 3. $72 4. 5260g 5. $^{71}/_{7}$ 6. 0.0072 7. 58cm 8. x = 48 9. 71, 73, 79
10. 0.125

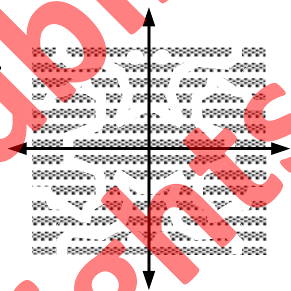
B:

1. translation
3. reflection
5. enlargement
6. centre
8. rotation & enlargement
9. 180^o 10. rotated 90^o
11. To maximise sunlight
12. Draw leaves above leaves a and b

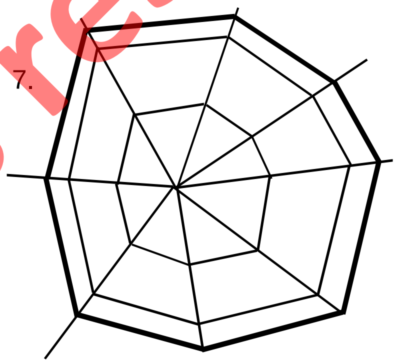
2.



4.



7.



Tracking Sheet: ‘In-class’ Activity Sheets

Comments

Worksheet	Objectives
14	G4
13	G4
12	G4
11	G3
10	G3
9	G2
8	G2
7	G2
6	G1
5	G1
4	R
3	R
2	R
1	R

Geometry

Name

Tracking Sheet: 'In-class' Activity Sheets

Geometry

Comments

Name

Worksheet	Objectives
29	G9 / G11
28	G4 / G11
27	G9
26	G9 / G11
25	G9
24	G8 / G11
23	G8
22	G7
21	G7 / G11
20	G6
19	G6
18	G5
17	G5
16	G5
15	G5

Tracking Sheet: Homework / Assessment Worksheets

Comments

Worksheet	Objectives
15	G11
14	G11
13	G8
12	G7 / G10
11	G6
10	G5
9	G5
8	G4
7	G3
6	G2
5	G2
4	G1
3	R
2	R
1	R

Geometry

Name