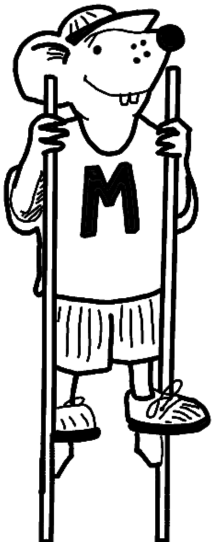
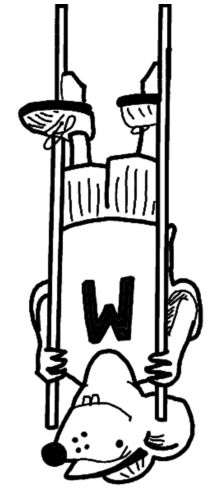



Booster Pages




# Properties of Shapes

# MathSphere

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# Notes

This module gives practice in sorting shapes according to their properties.

Children have a good knowledge of triangles, different types of quadrilaterals, pentagons, hexagons and octagons and should be able to find the perimeter and area of simple shapes.

In addition, they should know that the sum of angles around a point is $360^o$, the sum of the angles of a triangle is $180^o$, angles in an equilateral triangle are each $60^o$ and the sum of the angles in a quadrilateral is $360^o$.

They should be able to calculate angles using any of the above, e.g. one of the equal angles in an isosceles triangle is $35^o$, what are the other two angles?

They should know and recognise acute, right, and obtuse angles.

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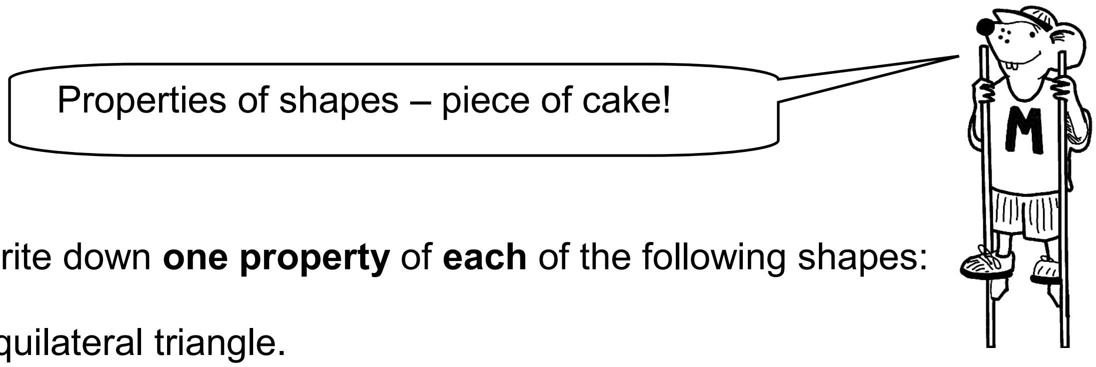


**1.** Write down **one property** of **each** of the following shapes:

**a)** Equilateral triangle.

______________________________

**b)** Isosceles triangle.

______________________________

**c)** Right angled triangle.

______________________________

**d)** Parallelogram.

______________________________

**e)** Trapezium

______________________________

**f)** Kite.

______________________________

**g)** Regular hexagon.

______________________________

**h)** Regular octagon.

______________________________

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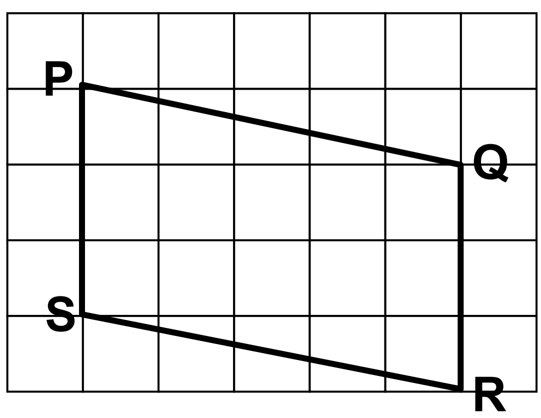
**1.** Join each shape to the sum of its interior angles

You may need to use each number more than once!

| | |
|---|---|
| | Right angled triangle |
| | Pentagon |
| $180^{\circ}$ | Trapezium |
| $360^{\circ}$ | Equilateral triangle |
| $540^{\circ}$ | Parallelogram |
| $720^{\circ}$ | Hexagon |
| $1080^{\circ}$ | Isosceles triangle |
| | Kite |
| | Octagon |
| | Square |
| | Rhombus |

**1.**




Tick the true statements and cross the false statements.

a) **PQRS** is a **rectangle**. ☐

b) **PQRS** is a **parallelogram**. ☐

c) **PQRS** is a **rhombus**. ☐

d) Angle **R** is **acute**. ☐

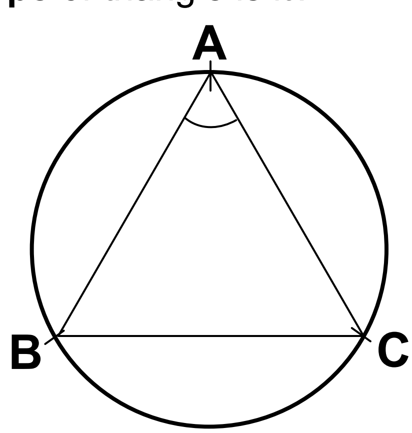
e) Angle **Q** is **acute**. ☐

f) **PS** is **parallel** to **QR**. ☐

g) Angle **P** is **greater than** angle **Q**. ☐

**2.** Three marks are spaced equally around a circle at **A, B** and **C**.
A triangle is drawn between **A, B** and **C**.

**a)** What **type** of triangle is it? ____________________




**b)** What is the **angle A**? ____________________

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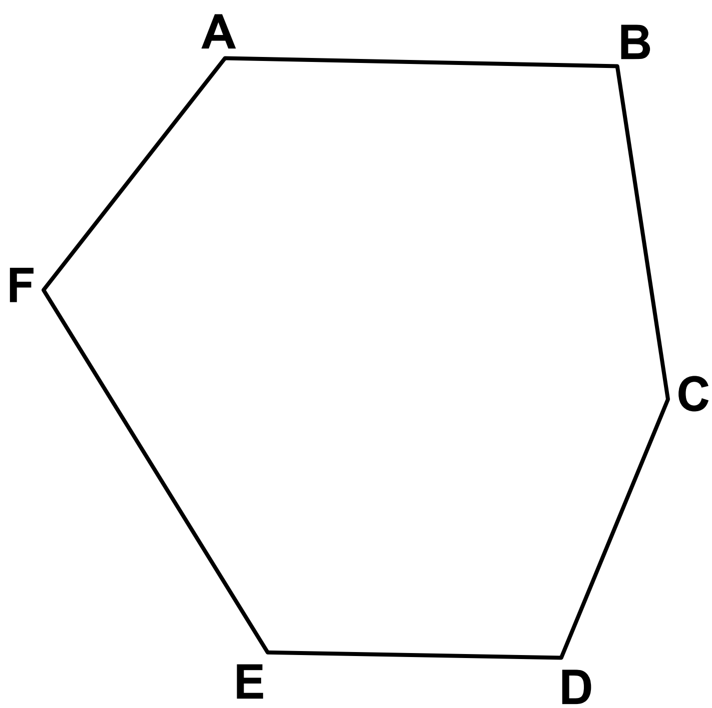
Why did the painter wear many clothes to paint the house?

Because on the tin it said put on three coats!


1. **Measure** the angles in this hexagon. Find the total of all the angles.




Angle **A** = __________

Angle **B** = __________

Angle **C** = __________

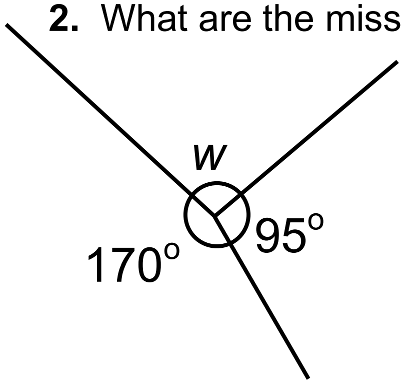
Angle **D** = __________

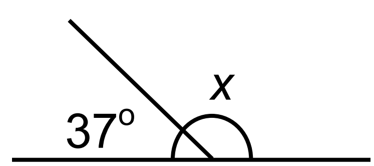
Angle **E** = __________

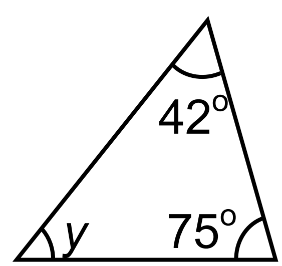
Angle **F** = __________

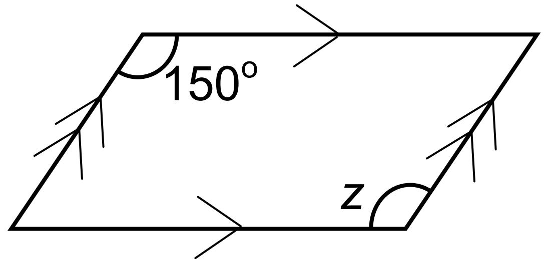
**TOTAL** = __________

2. What are the missing angles in these diagrams:




Angle **w** = __________
Angle **x** = __________
Angle **y** = __________
Angle **z** = __________

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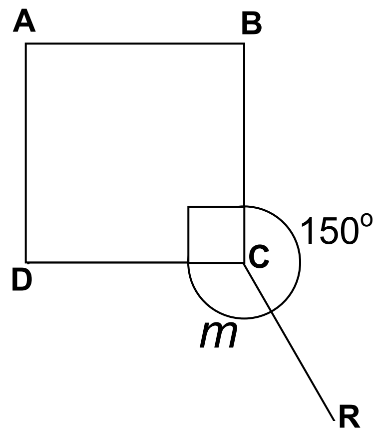
**1.**



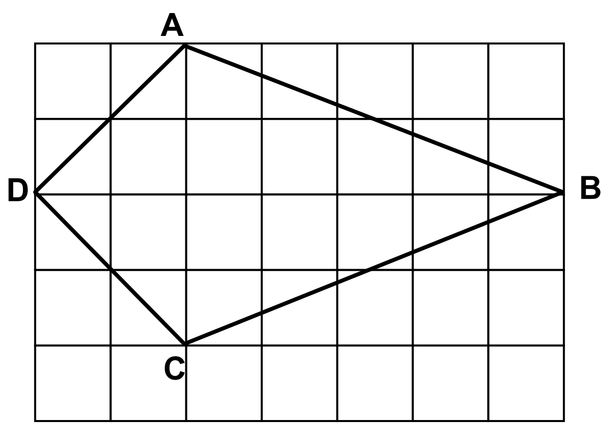

**a)** **ABCD** is a square.

What is the value of ***m*** ?

___________

**b)** The angle **DCR** is one corner of a regular polygon.
What is the name of the polygon? ________________

**2.** Here is a shape drawn on a square grid.




**a)** What is the value of angle D?

___________

**b)** What is the name of the shape?

___________

**c)** Name the group of shapes to which this shape belongs.

_______________

**d)** What is the **total** of angles A, B and C?

___________

**3.** **STUV** is a rectangle. **ST** and **VU** are the longer sides.
Draw the rectangle and draw the diagonal **SU**.
Angle **VSU** is twice angle **VUS**. What is the value of angle **UST** ?

__________

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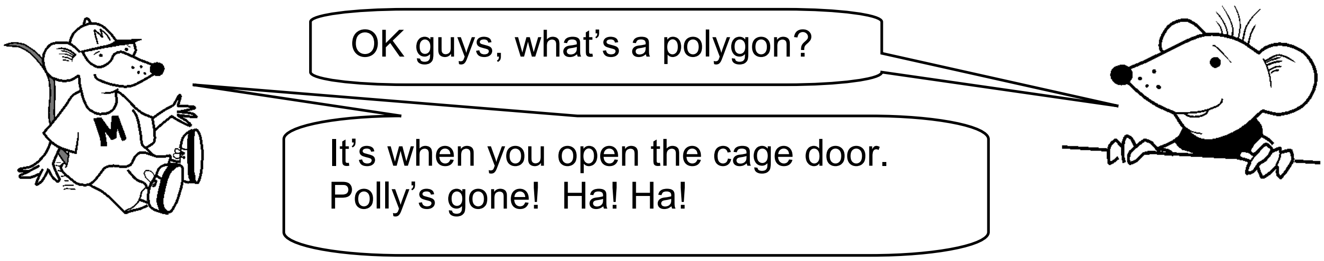
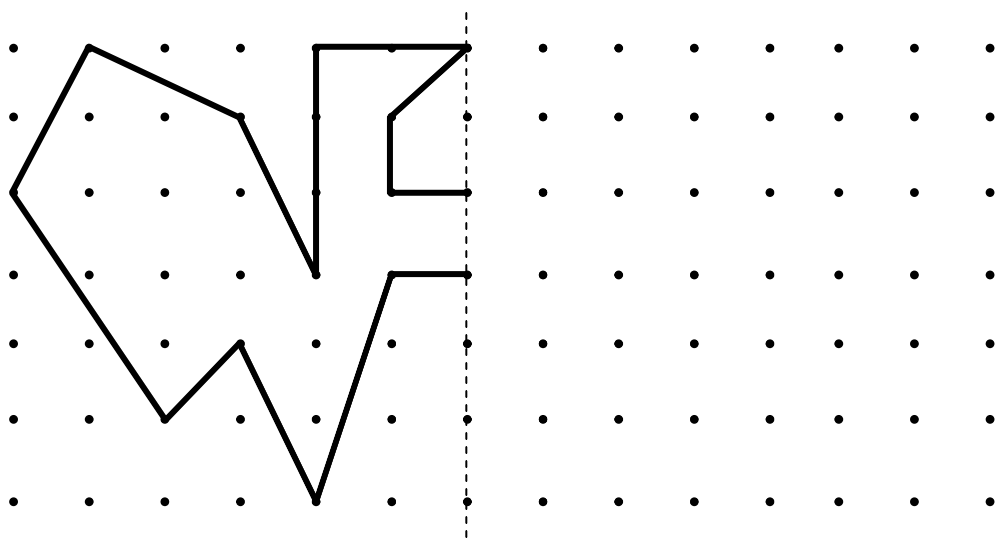
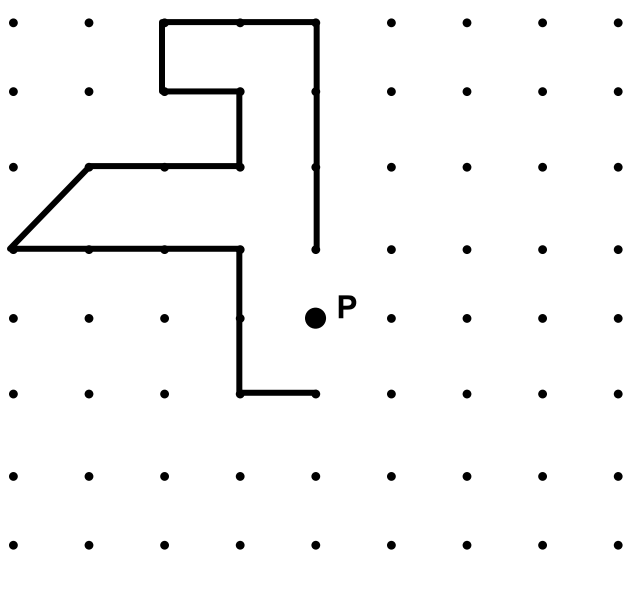



**1.** Here is half a shape drawn on a grid. The shape has **reflective symmetry** about the dotted line. **Draw the other half** of the shape.



**2.** Here is half a shape drawn on a grid. The shape has **rotational symmetry** of **order 2** about the point **P**. **Draw the other half** of the shape**.**




What is the **area** of the whole shape?

________________

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Where did Napolean keep his armies?


Up his sleevies!!!!

**1.** Can you complete this table for these quadrilaterals?

| **Name** | **Total of Angles is 360$^{o}$** | **Has one set of parallel sides** | **Has two sets of parallel sides** | **Opposite angles are equal** | **Has one pair of equal sides** | **Has four equal sides** |
|---|---|---|---|---|---|---|
| Rectangle | | | ✓ | | | |
| Square | | | | | | |
| Kite | | | | | | |
| Parallelogram | | | | | | |
| Rhombus | | | | | | |
| Trapezium | | | | | | |

**To tick or to cross, that is the question!**

**2.** Simon says he has just measured the angles of a hexagon.
The **total** of his measurements was **544$^{o}$**.

Do you think he could have made a mistake? Give a reason.

________________________________________________

________________________________________________

If he did not measure the angles of a hexagon, what shape could it have been?

____________________

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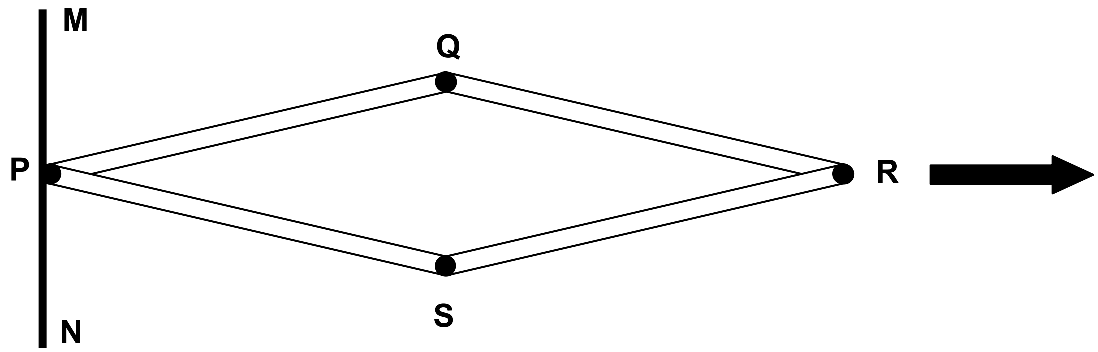
**1.**




**PQ, QR, RS** and **SP** are four equal length rods loosely connected at **P, Q, R** and **S**.

**P** is fixed to a wall **MN**.

**R** is moved in the direction of the arrow so that the angle **NPS increases** by **4$^o$**.

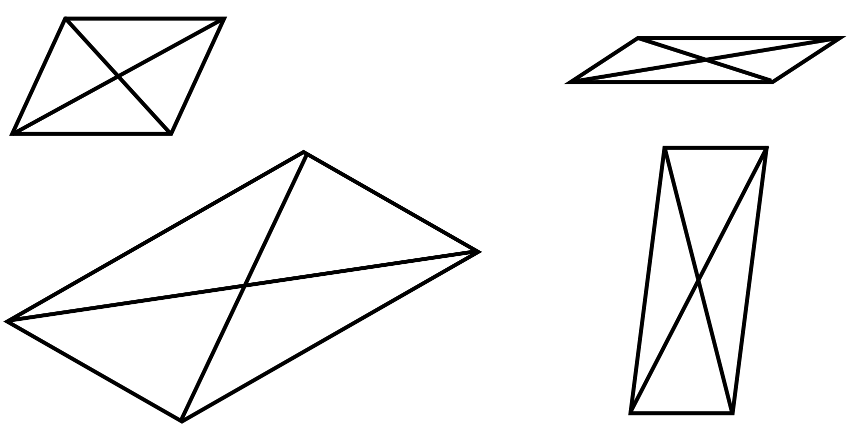
What happens to the angle **SPQ** ?

________________________________________

What happens to the angle **PSR** ?

________________________________________

**2.** Here are some parallelograms. Measure the distances from the centres to the corners of the parallelograms.



What can you conclude about the diagonals of parallelograms?

________________________________________

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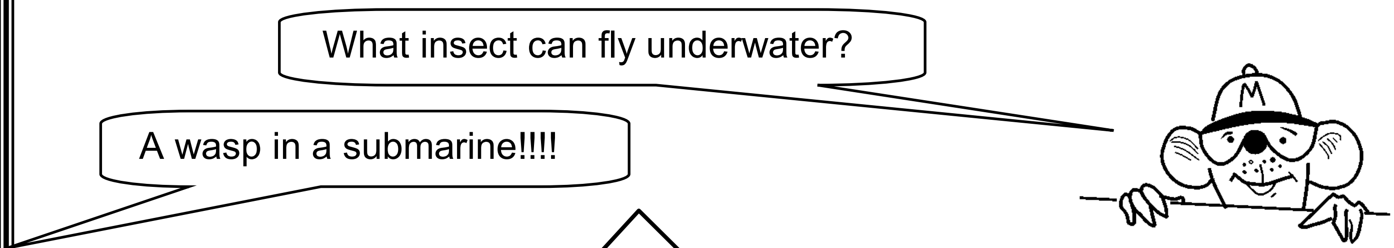
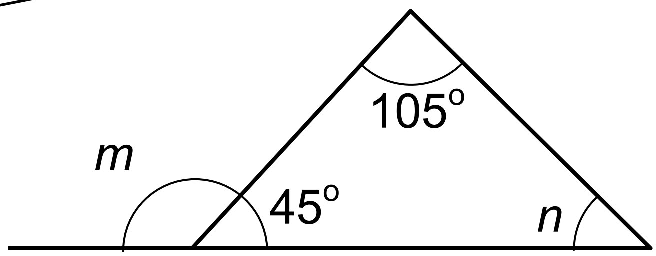



**1.**

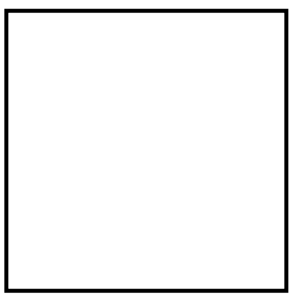



Calculate the size of angles **m** and **n**.

m = 

n = 

**2.** Here is a square. The problem is to cut off three right angled isosceles triangles to leave a pentagon.
Draw the three triangles on the diagram and shade them.



**3.** An **isosceles triangle** has one angle of **28°**.
What could the other angles be?

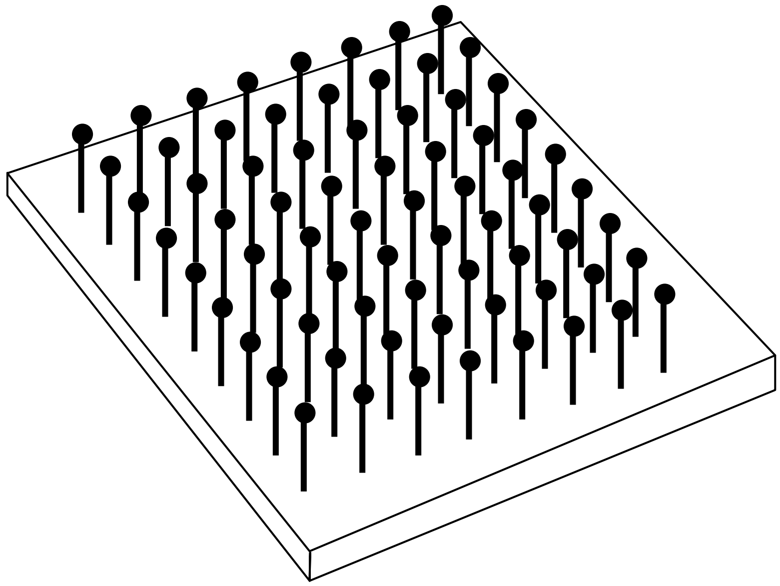
Show your working.

Angles could be ___________ and __________

**OR** _____________ and _____________

Here's a great game you can play.

You will need a pin board and several elastic bands.



**RULES:** Play in pairs. The first person makes several shapes of their own choice on the pinboard using elastic bands. The second person has a rule in mind such as "The shape must have four sides".

The second person tells the first person which of his/her shapes fit the rule, but does not say what the rule is.

The first person keeps making shapes and the second person tells him/her which shapes fit the rule.

The idea of the game is that the first person should guess the rule.

Preferably before they both fall over with exhaustion!

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# Answers

**Page 3**

**1. a)** Equilateral Triangle: All sides same length OR all angles same size.
**b)** Isosceles triangle: Two sides same length OR two angles equal.
**c)** Right angled triangle: Has one right angle.
**d)** Parallelogram: Opposite pairs of sides parallel (or equal in length) OR opposite angles equal OR diagonals bisect each other.
**e)** Trapezium: One pair of sides parallel.
**f)** Kite: Two pairs of adjacent sides equal OR one pair of opposite angles equal.
**g)** Regular hexagon: All sides same length OR all angles equal.
**h)** Regular Octagon: All sides same length OR all angles equal.
(N.B. Do not accept ‘has 6/8 sides as any hexagon/octagon has that property).

**Page 4**
**1.** $180^o$**:** Right angled triangle, Equilateral Triangle, Isosceles triangle.
$360^o$: Trapezium, Parallelogram, Kite, Square, Rhombus.
$540^o$: Pentagon.
$720^o$: Hexagon.
$1080^o$: Octagon

**Page 5**
**1. a)** False **b)** True **c)** False **d)** True **e)** False **f)** True
**g)** False

**2.** Equilateral. $60^o$

**Page 6**
**1.** A = $126^o$, B = $100^o$, C = $149^o$, D = $112^o$, E = $122^o$, F = $111^o$, TOTAL = $720^o$ or quite close, allowing for errors in measurement.

**2.** w = $95^o$, x = $143^o$, y = $63^o$, w = $150^o$,

# Answers (Contd)

**Page 7**

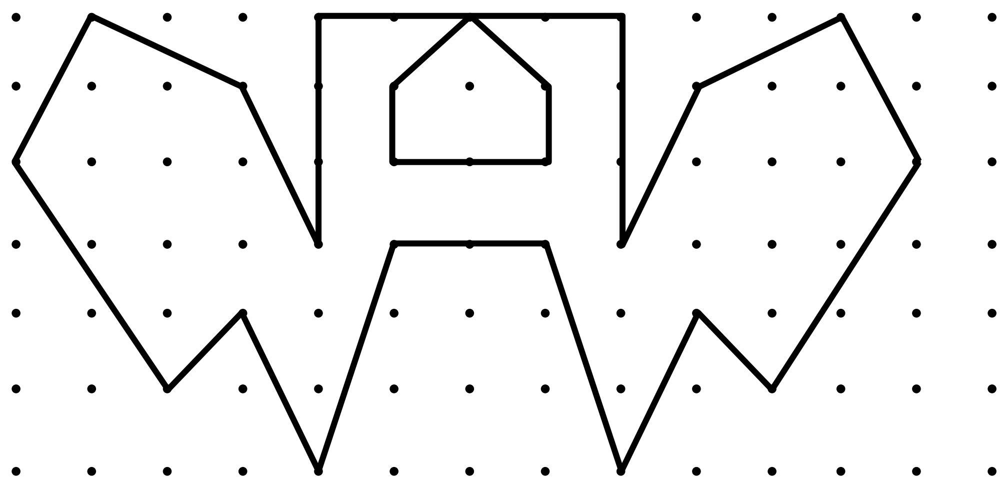
**1. a)** $120^o$ **b)** hexagon

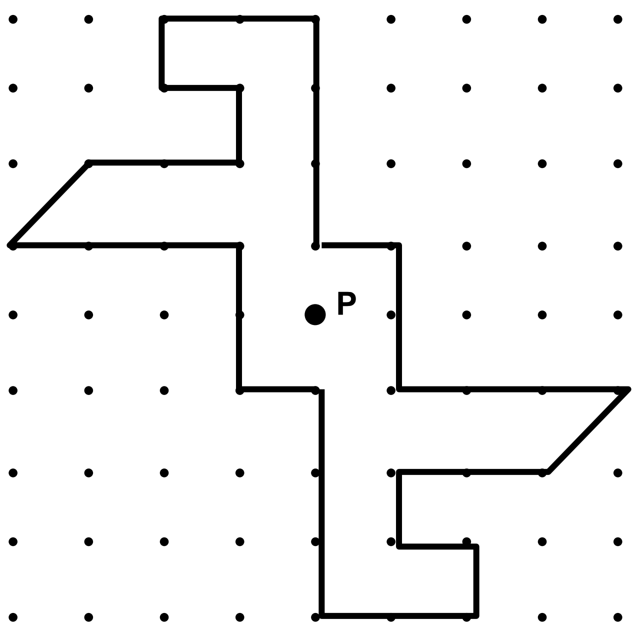
**2. a)** $90^o$ **b)** Kite **c)** Quadrilaterals **d)** $270^o$

**3.** $30^o$

**Page 8**

**1.**






Area = 17 squares

# Answers (Contd)

**Page 9**
**1.**

| **Name** | **Total of Angles is 360°** | **Has one set of parallel sides** | **Has two sets of parallel sides** | **Opposite angles are equal** | **Has one pair of equal sides** | **Has four equal sides** |
|---|---|---|---|---|---|---|
| Rectangle | ✓ | ✗ | ✓ | ✓ | ✗ | ✗ |
| Square | ✓ | ✗ | ✓ | ✓ | ✗ | ✓ |
| Kite | ✓ | ✗ | ✗ | ✓ ✗ | ✗ | ✗ |
| Parallelogram | ✓ | ✗ | ✓ | ✓ | ✗ | ✗ |
| Rhombus | ✓ | ✗ | ✓ | ✓ | ✗ | ✓ |
| Trapezium | ✓ | ✓ | ✗ | ✗ | ✓ | ✗ |

Note the tick and cross in opposite angles equal for a kite. This provides a good discussion point about the use of language in this work as a kite has one opposite pair of angles equal and one opposite pair not equal.

**2.** The total should be 720° or thereabouts for a hexagon (allowing for errors in measurement).

He probably measured a pentagon, for which the sum is 540°.

**Page 10**
**1.** Angle SPQ reduces by 8°. Angle PSR increases by 8°.

**2.** The diagonals bisect each other (cut each other in half).

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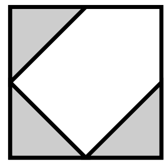
# Answers (Contd)

**Page 11**

**1.** m = 135$^o$ n = 30$^o$ **2.**



**3.** 28$^o$ and 124$^o$ OR 76$^o$ and 76$^o$

**Page 12**

This is a very good game for stimulating discussion.
Other rules that may be considered are such things as:

Opposite angles must be the same.

The shapes must be hexagons.

There must be at least one pair of parallel sides.

The teacher may also invent one rule for the whole class to guess.
He/she will have to be pretty quick on his/her feet, though!