MATHSDIY

SOLUTIONS

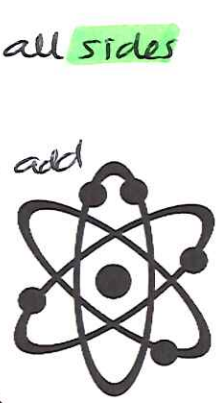
GCSE TOPIC BOOKLET

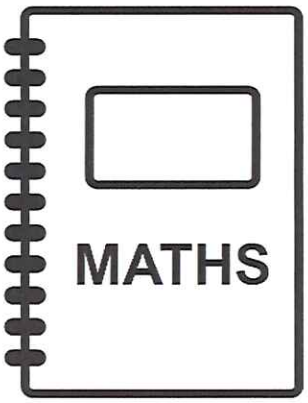
POLYGONS

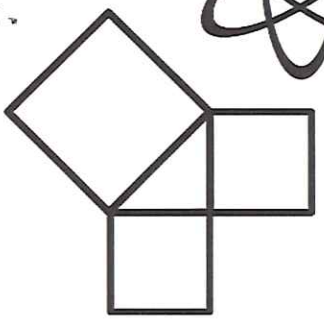
- **Regular Polygon:** All angles equal and all sides equal.
- **Exterior Angle Sum:** Exterior angles always add upto $360°$.
- **Interior Angle Sum** $= (n-2) \times 180°$

  where n is the number of sides.

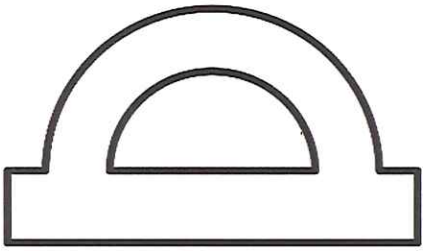
Name	Number of Sides
Pentagon	5
Hexagon	6
Heptagon	7
Octagon	8
Decagon	10

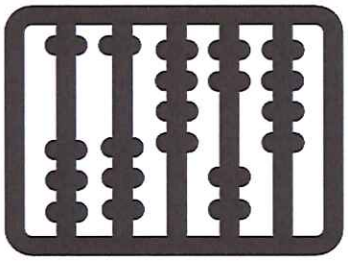


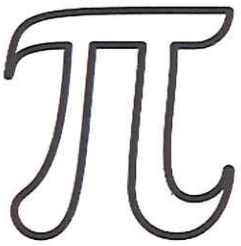


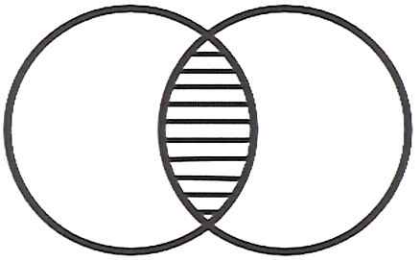


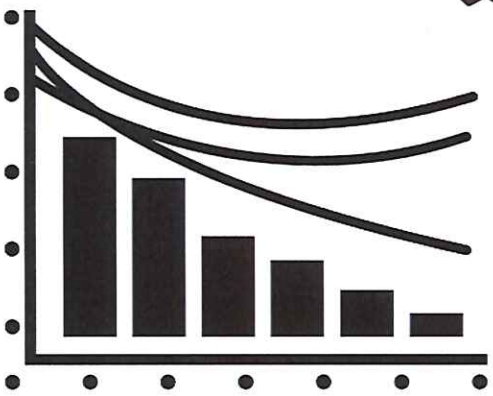
$a^2 = b^2 + c^2$

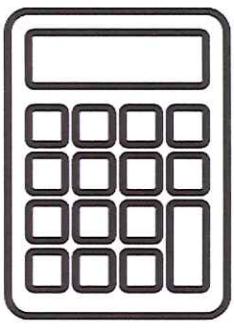


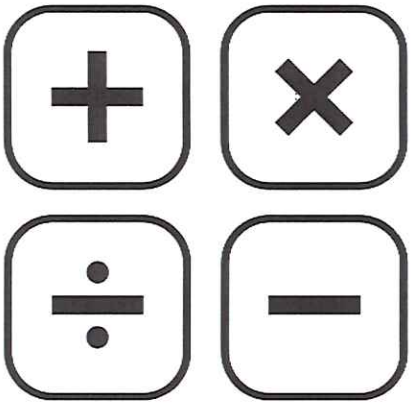












1. Calculate the size of **each** interior angle of a regular eight-sided polygon.

$n = 8$

Interior angle Sum $= (n-2) \times 180 = 6 \times 180 = 1080°$

Each interior angle $= 1080 \div 8 = 135°$

[2]

2. Calculate the size of each of the exterior angles of a regular pentagon.

Pentagon has 5 sides

Each exterior angle $= 360 \div 5 = 72°$

[3]

3. The diagram shows a regular 8-sided polygon.

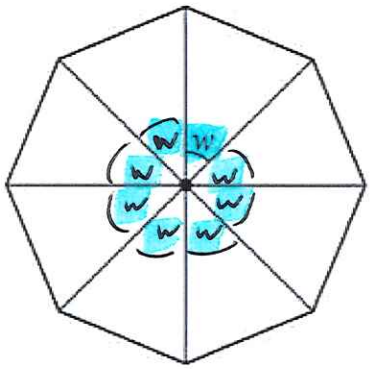


Diagram not drawn to scale.

Calculate the size of the angle marked w in the diagram.

$8w = 360°$ (angles at a point total 360°)

$w = 360 \div 8$

$w = 45°$

[2]

n=6

4. A six sided polygon is to be drawn using a computer program.
The designer has stated that three of the internal angles should be 140° each and the remaining three angles should all be acute angles.
Explain whether or not this design is possible.
Show your working and give a reason for your answer.

Total Interior Angle Sum = $(n-2)\times180 = 4\times180 = 720^\circ$

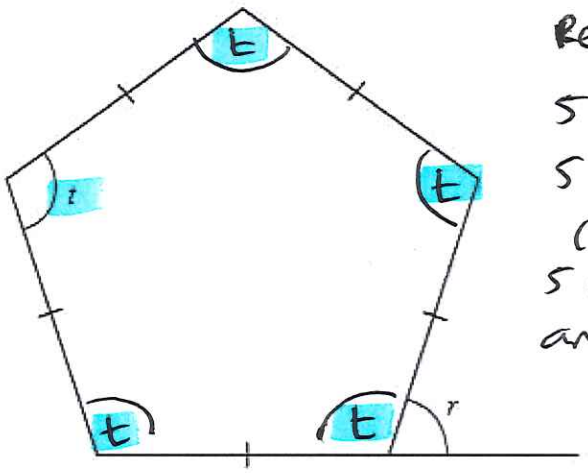
3 interior angles = $3\times140^\circ = 420^\circ$

Remaining 3 angles total = $720^\circ - 420^\circ = 320^\circ$

The design is not possible because acute angles are smaller than 90°, so three acute angles must be less than 270° and there is 320° left.

[6]

5. Find the size of each of the angles marked r and t.



Regular Pentagon
5 equal sides
5 equal exterior angles (all r)
5 equal interior angles (all t)

Diagram is not drawn to scale.

r = exterior angle = $360 \div 5 = 72^\circ$

$t + r = 180^\circ$ (angles on a straight line)

$t = 180^\circ - 72^\circ$

$r =$ 72° $t =$ 108°

[3]

6. Explain clearly why a regular polygon cannot have exterior angles of 80°.

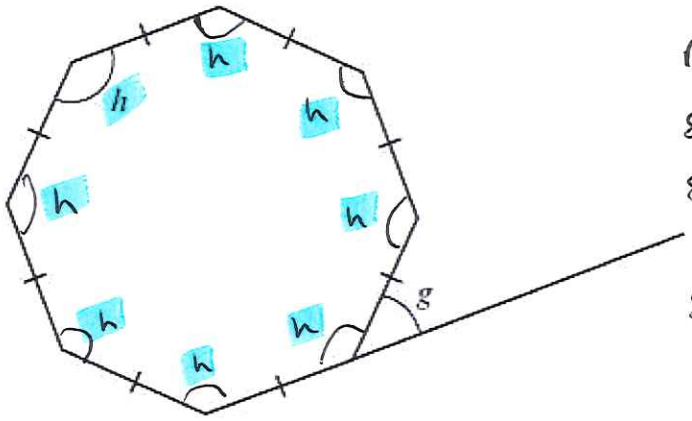
exterior angle sum = 360°

so, if the exterior angles of a regular polygon were all 80°, 80 would be a factor of 360° and it isn't.

(or if it were, the number of sides would be 360 ÷ 80 = 4.5 and you can't have 4.5 sides)

[2]

7. The diagram below shows a regular octagon.



regular octagon
8 sides (equal)
8 equal interior angles h
8 equal exterior angles g

Diagram not drawn to scale.

Find the size of each of the angles marked g and h.

g = exterior angle = $360 \div 8 = 45°$

$h + g = 180°$ (angles on a straight line)

$h = 180 - 45°$, $h = 135°$

$g =$ 45 °

$h =$ 135 °

[3]

8. Two exterior angles of a triangle are 150° and 110°. Calculate the size of the third exterior angle of the triangle.

Exterior angle sum = 360°

Remaining exterior angle = 360 − 150 − 110 = 100°

[3]

9. The diagram shows a regular hexagon. Showing all your working, calculate the size of the angle marked x.

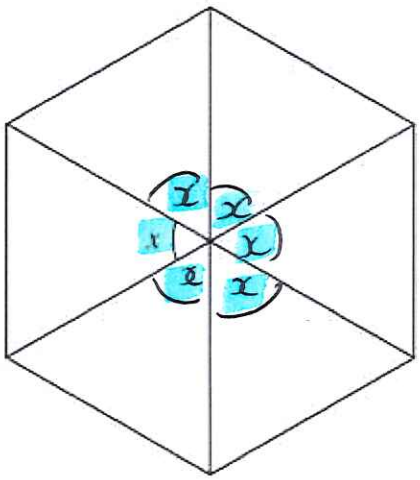


Diagram not drawn to scale.

Because it is a regular hexagon. All the sides are equal and we get 6 equal Isosceles triangles.

$6x = 360°$ (angles at a point total 360°)

$x = 360°/6$, $x = 60°$

[2]

10. Calculate the size of the interior angle of a regular 10 sided polygon.

$n = 10$

Interior Angle sum = $(n-2) \times 180$

$= 8 \times 180°$

$= 1440°$

Each interior angle = $1440 \div 10 = 144°$

[3]

11. The diagram shows a regular 8 sided polygon.

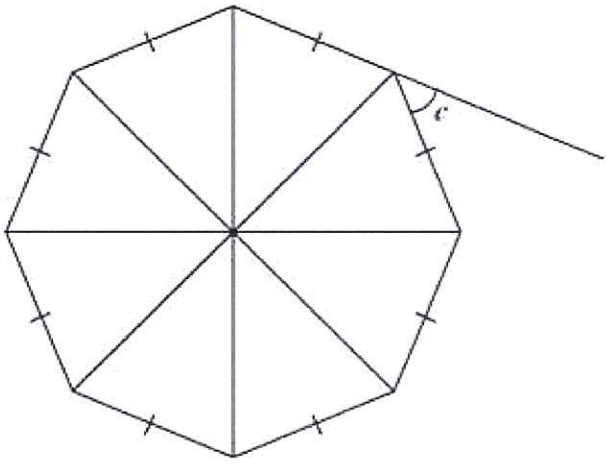


Diagram not drawn to scale

Showing all your working, calculate the size of the angle marked c in the diagram.

Exterior angle sum = 360°

8 equal exterior angles.

∴ Each exterior angle = 360 ÷ 8 = 45°

c = 45°

[2]

12. The diagram shows a regular hexagon.

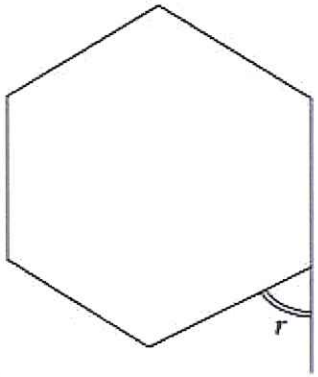


Diagram not drawn to scale

Calculate the size of the angle marked r.

Exterior angle sum = 360°

6 equal exterior angles.

∴ Each exterior angle = 360 ÷ 6 = 60°

r = 60°

[2]