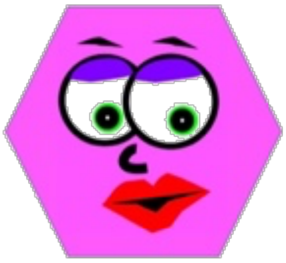
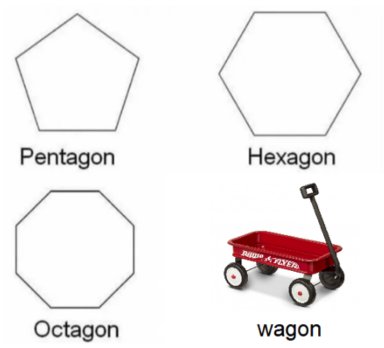
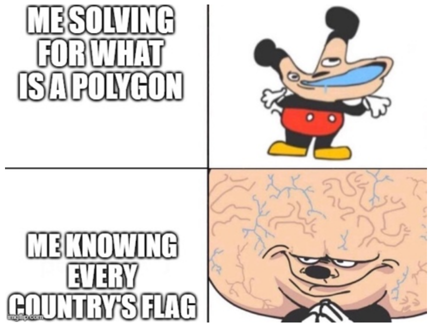


Polygons Questions By Topic:







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Formulae Reminders

Let n = number of sides

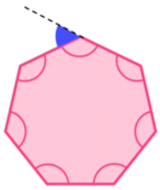
Sum Of All Interior Angles

$180(n-2)$

1 Interior Angle

$\frac{180(n-2)}{n}$

1 Exterior Angle

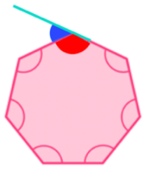


$\frac{360}{n}$

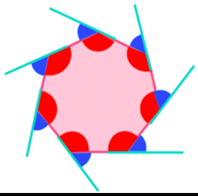
We can also use the formula

$180 - \text{interior angle}$

Why can we use the second formula? This is because the interior and exterior angles are straight line angles



Interior + exterior = 180°



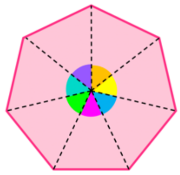
Number Of Sides

$\frac{360}{\text{exterior angle}}$

We can also use the formula

$\frac{360}{180 - \text{interior angle}}$

Angles At The Centre

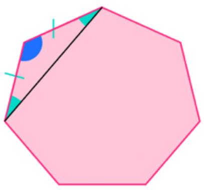


Each angle at the centre

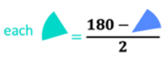
$\frac{360}{n}$

You may also need to use some angle rules:

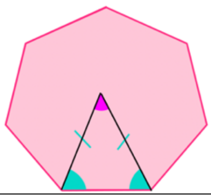
Isosceles Triangle



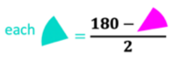
The base angles are equal



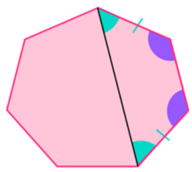
Isosceles Triangle

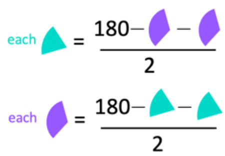


The base angles are equal

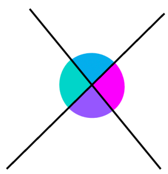


Isosceles Trapezoid

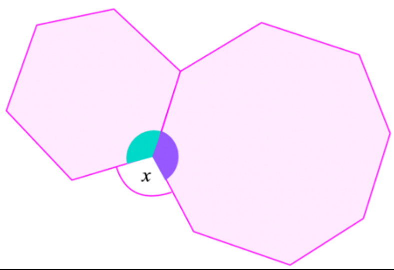




You may also need to deal with multiple polygons



Angles at a point add to 360°



$\frac{180(5-2)}{5} = 108°$

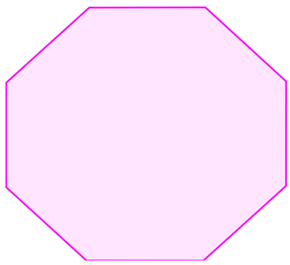
$\frac{180(8-2)}{8} = 135°$

$360 - 108 - 135 = 117°$

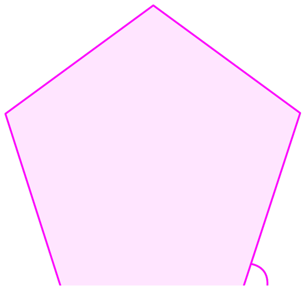
1 Bronze

1.1 Working Out Angles

1) Work out the size of an exterior angle of a regular octagon.

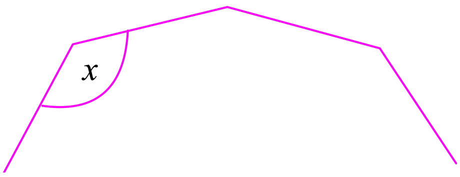


2) Work out the size of an exterior angle of a regular pentagon

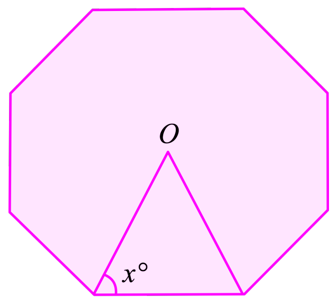


3) Find the sum of the interior angles of a polygon with 7 sides.

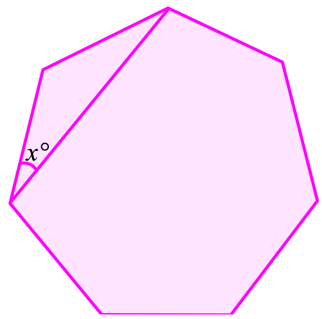
4) The diagram shows part of a regular 10-sided polygon. Work out the size of the angle marked x.



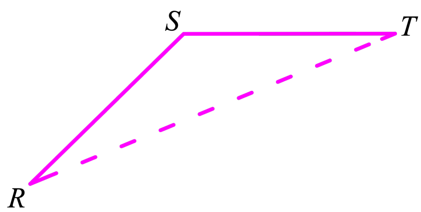
5) The diagram shows a regular octagon, with centre O. Work out the value of $x°$.



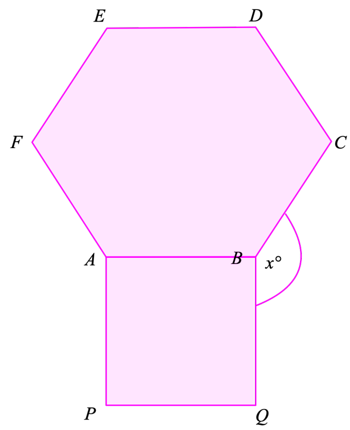
6) The diagram shows a regular polygon with 7 sides. Write out the value of x.



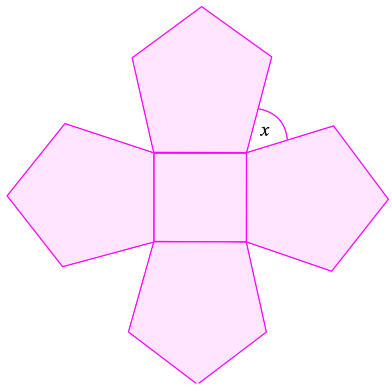
7) RS and ST are 2 sides of a regular 12-sided polygon. RT is a diagonal of a polygon. Work out the size of angle of STR.



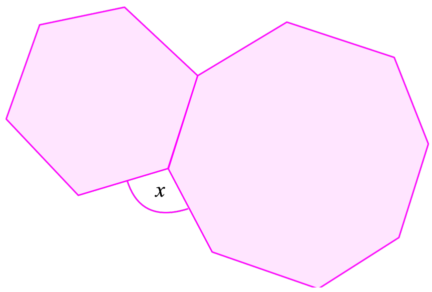
8) ABCDEF is a regular hexagon and ABQP is a square. Angle CBQ $= x°$. Work out the value of x



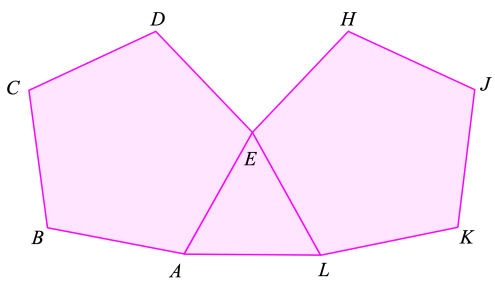
9) The diagram shows a square and 4 regular pentagons. Work out the size of the angle marked x.



10) The diagram shows a regular hexagon and a regular octagon. Calculate the size of the angle marked x. You must show all your working.



11) ABCDE and EHJKL are regular pentagons. AEL is an equilateral triangle. Work out the size of angle DEH.



1.2 Working Out The Number Of Sides

12) Each exterior angle of a regular polygon is 30°. Work out the number of sides of the polygon.

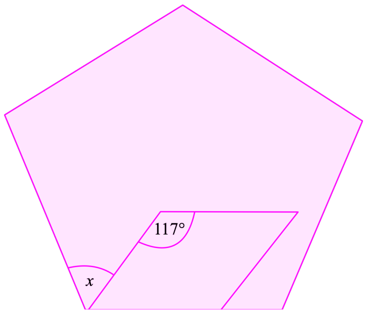
13) The size of each exterior angle of a regular polygon is $18°$
    i. Work out how many sides the polygon has
    ii. Work out the sum of the interior angles of the polygon

14) The size of each interior angle of a regular polygon is 156°. Work out the number of sides of the polygon

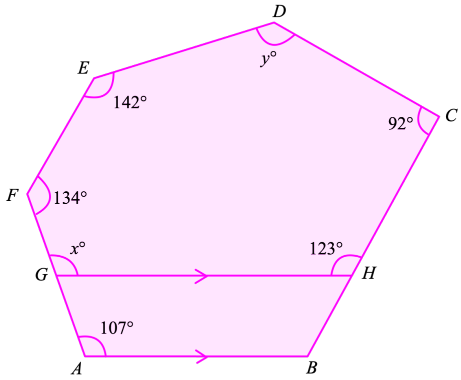
2 Silver

2.1 Working Out Angles

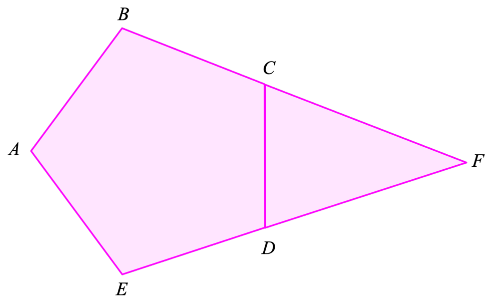
15) The diagram shows a regular pentagon and parallelogram. Work out the size of the angle marked x.



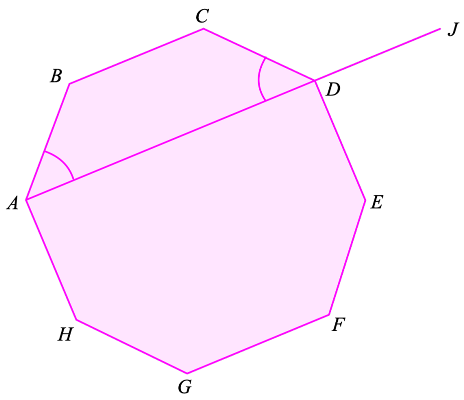
16) ABCDEF is a hexagon. G is a point on AF and H is a point on BC. GH is parallel to AB.
    i. Give a reason why $x = 107$
    ii. Work out the value of y



17) ABCDE is a regular pentagon. BCF and EDF are straight lines. Work out the size of angle CFD.

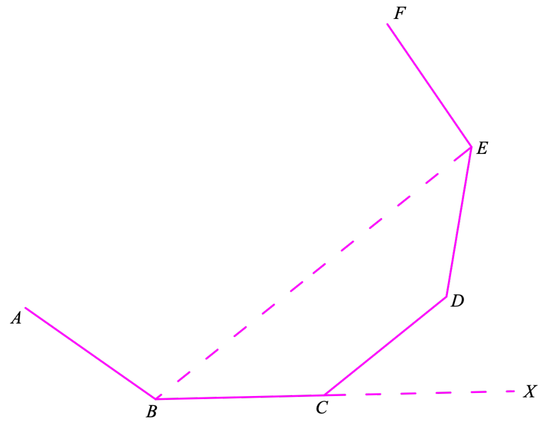


18) *ABCDEFGH* is a regular octagon. *ADJ* is a straight line.



angle *BAD* = angle *CDA*
Show that angle *CDJ* = 135°

19) ABCDEF is part of a regular nonagon. BC is extended to X. B is joined to E. Calculate the size of

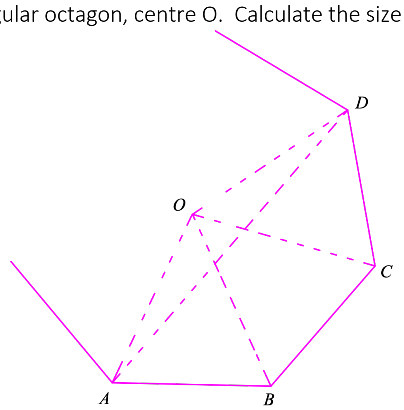


i. Angle DCX
ii. Angle BCD
iii. Angle ABE

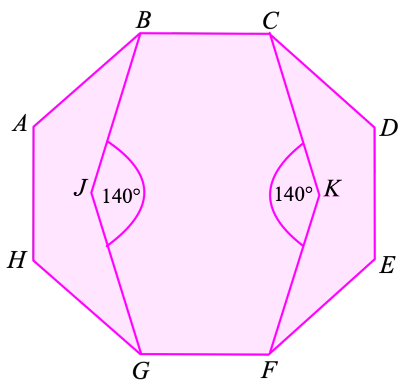
3 Gold

3.1 Working Out Angles

20) ABCD forms three sides of a regular octagon, centre O. Calculate the size of angle BOC, OBC and OAD

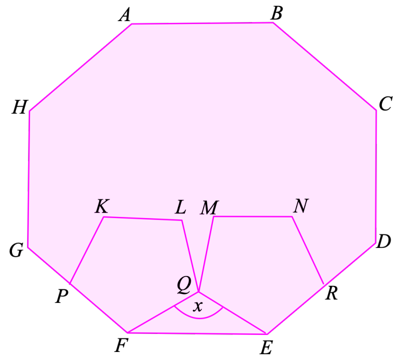


21) ABCDEFGH is a regular octagon

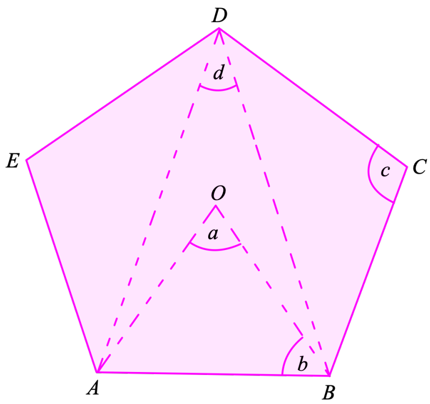


BCKFGJ is a hexagon
JK is a line of symmetry of the hexagon
Angle BJG = angle $CKF = 140°$
Work out the size of angle KFE

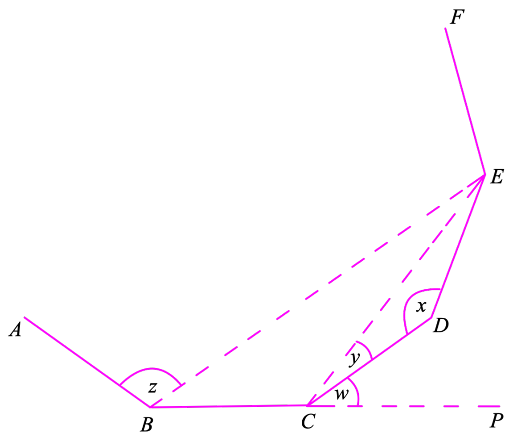
22) ABCDEFGH is a regular octagon. KLQFP and MNREQ are two identical regular pentagons. Work out the size of the angle marked x



23) ABCDE is a regular polygon, centre O. Calculate the size of each of the angles marked a,b,c and d.

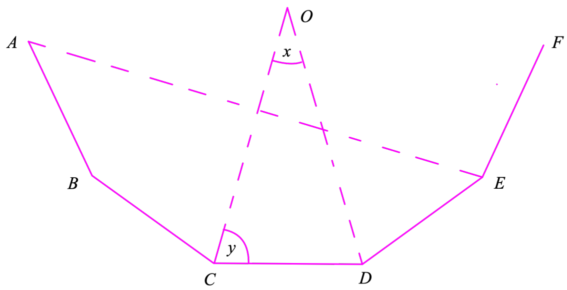


24) ABCDEF is part of a regular polygon with 10 sides. BCP is a straight line. Calculate the size of each of the angles marked $w, x, y,$ and z

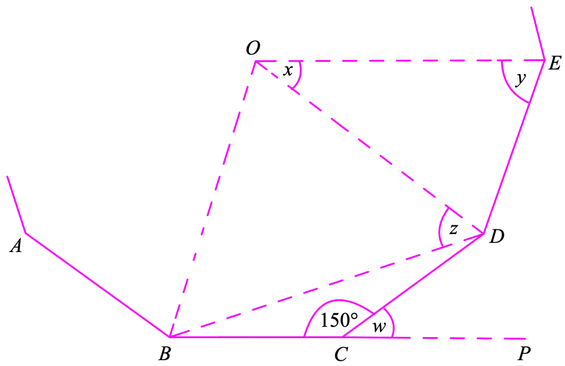


25) ABCDEF is part of a regular polygon, centre O. The size of angle COD and OCD are in the ratio 1:2. Calculate the size of angle

i. COD
ii. CDE
iii. AED

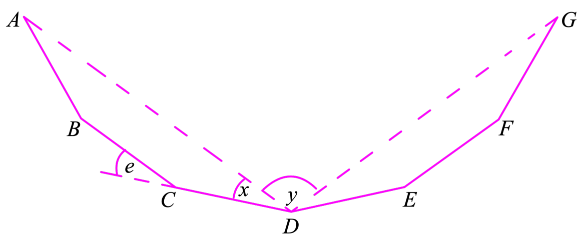


26) A, B, C, D and E are corners of a regular polygon with centre O. BC is extended to P



i. Calculate the size the angle marked w
ii. How many sides does the polygon have
iii. Calculate the size of each of the angles marked x, y, and z
iv. What type of triangle is OBD?

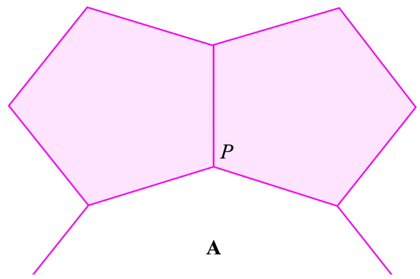
27) ABCDF is part of a regular 15-sided polygon. CD is extended to Z. Calculate



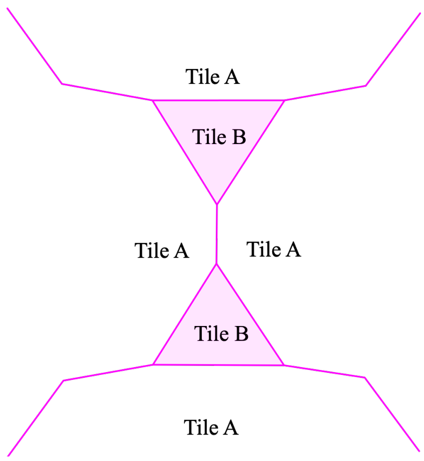
i. the size of an exterior angle, e
ii. the size of an interior angle
iii. the size of angle x
iv. the size of angle y

3.2 Working Out The Number Of Sides

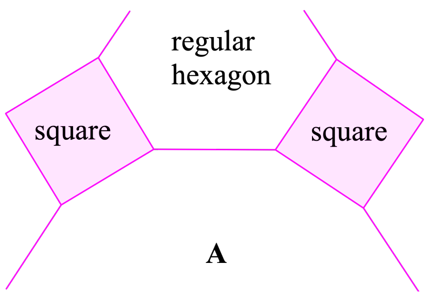
28) The diagram shows two congruent regular pentagons and part of a regular n-sided polygon **A**. Two sides of each of the regular pentagons and two sides of **A** meet at the point P. Calculate the value of n. show all your working clearly.



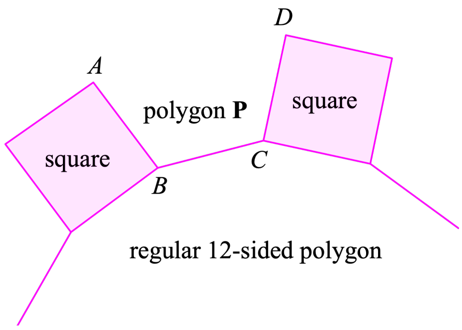
29) The diagram shows part of a pattern made from tiles. The pattern is made from two types of tiles, tile A and tile B. Both tile A and tile B are regular polygons. Work out the number of sides tile A has.



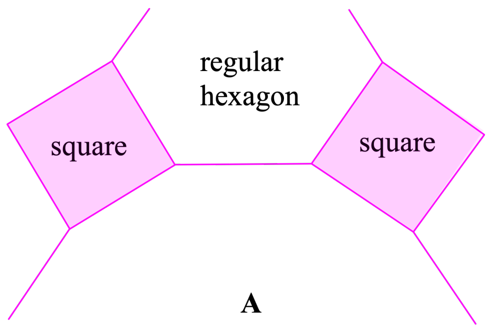
30) The diagram shows part of a tiling pattern. The tiling pattern is made from three shapes. Two of the shapes are squares and regular hexagons. The third shape is a regular n −sided polygon A. Work out the value of n



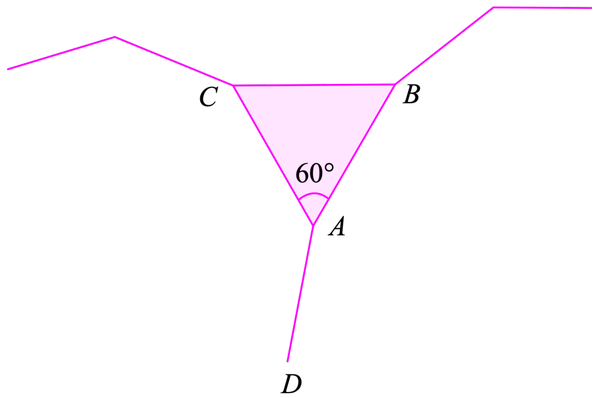
31) AB, BC and CD are three sides of a regular polygon P. Show that polygon P is a hexagon. Show your working



32) The diagram shows part of a tiling pattern. The tiling pattern is made from three shapes. Two of the shapes and regular hexagons. The third shape is a regular *n-sided* polygon **A**. Work out the value of *n*.



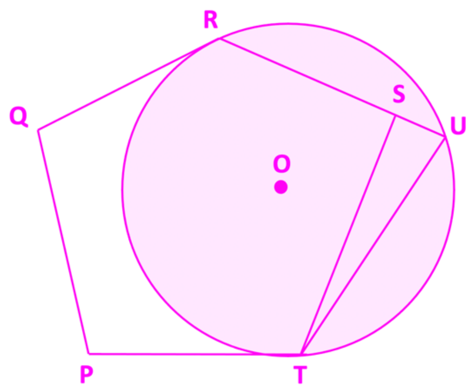
33) The sides of an equilateral triangle ABC and two regular polygons meet at the point A. AB and AD are adjacent sides of a regular 10-sided polygon. AC and AD are adjacent sides of a regular n sided polygon. Work out the value of n



34) A regular pentagon, a square and one other regular shape meet at a point and perfectly fit together leaving no gap. How many sides does this third mystery shape have and what is the sum of the interior angles?

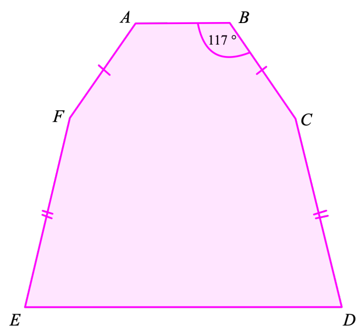
3.3 With Circle Theorems

35) PQRST is a regular pentagon. R, U and T are points on circle, centre O. QR and PT are tangents to the circle. RSU is a straight line. Prove that ST=UT.
Hint: prove isosceles triangle by base angles being equal



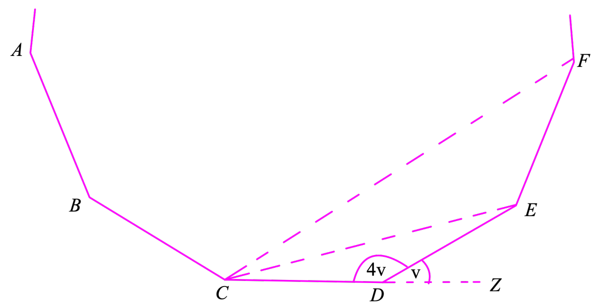
4 Diamond

36) The diagram shows a hexagon with 1 line of symmetry.
FA=BEF=CD
Angle ABC=$117°$
Angle $BDC = 2$ x angle CDE
Work out the size of angle AFE.



37) ABCDEF is part of a regular polygon. CD is extended to Z

i. Calculate the size of the angle marked v
ii. Write down the number of sides of the regular polygon
iii. Calculate the size of the angle DCE
iv. Calculate the size of the angle FEC
v. Calculate the size of the angle EFC



38) A Polygon has an interior angle exactly 6.5 times the size of an exterior angle. Determine if this shape could be a regular polygon.

39) An irregular polygon has 5 of its angles as $79°, 42°49°, 52°$ and $97°$. Explain why this shape cannot be a hexagon.

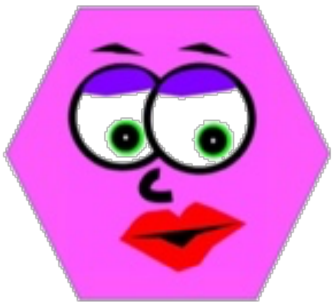
40) The diagram shows an incomplete regular polygon. The size of each interior angle is 140 degrees greater than the size of each exterior angle. Work out the number of the sides the regular polygon has.

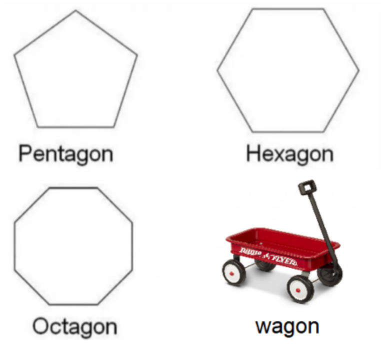
41) The diagram shows part of a regular polygon. The interior angle and the exterior angle at a vertex are marked. The size of the interior angle is 7 times the size of the exterior angle.

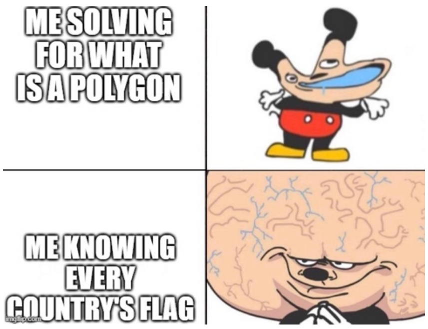
Work out the number of sides of the polygon.

42) The size of each interior angle of a regular polygon is 11 times the size of each interior angle. Work out the number of sides the polygon has.

Polygons Questions By Topic Solutions







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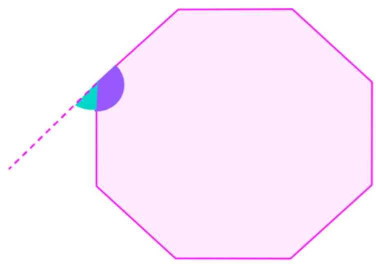
1.1 Working Out Angles

1)



Way 1: Use formula for sum of interior angles $180(n-2)$

sum of all angles $= 180(8-2)$
$= 180(6)$
$= 1080$

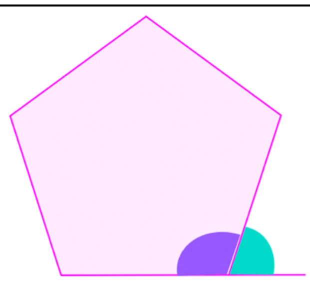
1 interior angle$= \frac{1080}{8} = 135°$

Exterior $= 180$ −interior$= 180 - 135 = 45°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle$= \frac{360}{8} = 45°$

2)



Way 1: Use formula for sum of interior angles $180(n-2)$

sum of all angles $= 180(5-2)$
$= 180(3)$
$= 540$

1 interior$= \frac{540}{5} = 108°$

Exterior $= 180$ −interior$= 180 - 108 = 72°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

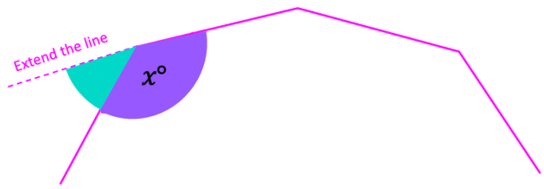
Exterior angle$= \frac{360}{5} = 72°$

3)

Use formula for sum of interior angles $\mathbf{180(n-2)}$

sum of all angles $= 180(7-2)$
$= 180(5)$
$= 900\,°$

4)



Way 1: Use formula for sum of interior angles $\mathbf{180(n-2)}$

sum of all angles $= 180(10-2)$
$= 180(8)$
$= 1440$

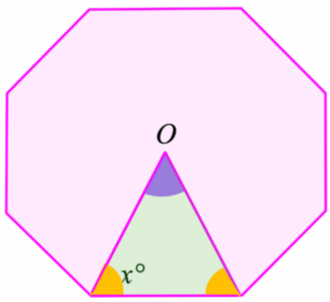
1 interior$= x = \frac{1440}{10} = 144°$

Way 2: Use formula for exterior angle $\frac{\mathbf{360}}{\mathbf{n}}$

Exterior angle$= \frac{360}{10} = 36°$

Interior angle$= x = 180°$ −exterior
$= 180 - 36 = 144°$

5)



Angle at the centre $= \frac{360}{8} = 45°$

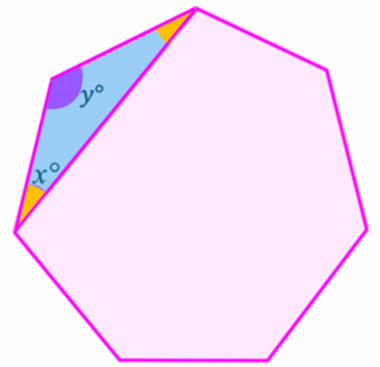
We have an isosceles triangle

Angles of a triangle add to 180°

Base angles of an isosceles triangle are equal

$$x = \frac{180 - 45}{2} = 67.5°$$

6)



Way 1: Use formula for sum of interior angles $180(n-2)$

sum of all angles $= 180(7-2)$
$= 180(5)$
$= 900$

1 interior$= y = \frac{900}{7} = 128.571°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle$= \frac{360}{7} = 51.429°$

Interior angle$= y = 180° -$exterior

$= 180 - 51.429 = 128.571$

Now that we have the interior angle y we can work out x by looking at the triangle

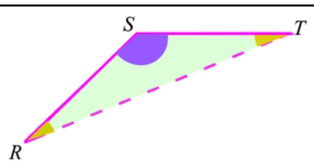
We have an isosceles triangle (since both sides of the triangle are the same length)

Angles of a triangle add to 180°

Base angles of an isosceles triangle are equal

$$x = \frac{180 - 128.571}{2} = 25.715$$

7)



Way 1: Use formula for sum of interior angles $180(n-2)$

sum of all angles $= 180(12-2)$
$= 180(10)$
$= 1800$

1 interior$= \angle RST = \frac{1800}{12} = 150°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle$= \frac{360}{12} = 30°$

Interior angle$== \angle RST = 180° -$exterior$= 180 - 30 = 150°$

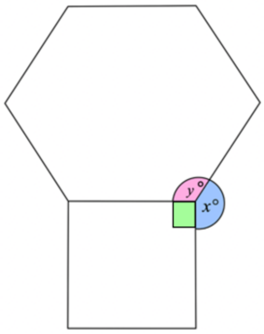
We have an isosceles triangle RST

Angles of a triangle add to 180°

Base angles of an isosceles triangle are equal

$$\angle STR = \frac{180 - 150}{2} = 15°$$

8)



Firstly, we consider the hexagon and find the interior angle y

Way 1: Use formula for sum of interior angles $180(n-2)$

sum of all angles $= 180(6-2)$
$= 180(4)$
$= 720$

1 interior $= y = \frac{720}{6} = 120°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle$= \frac{360}{6} = 60°$

Interior angle $y = 180°$ −exterior
$= 180 - 60 = 120°$

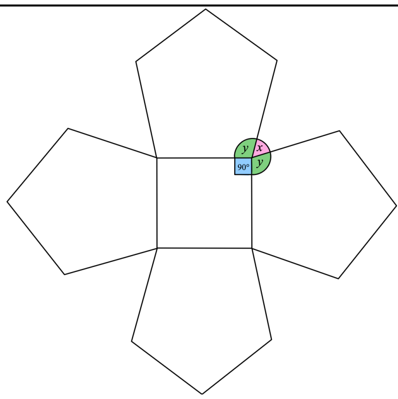
We have a pentagons connected to a square

ABPQ is a square so angle ABQ$= 90°$

We also know that angles at a point add to $360°$

$x = 360 - 90 - 120 = 150°$

9)



Firstly, we **consider the pentagon** and find the interior angle y

Way 1: Use formula for sum of interior angles $180(n-2)$

sum of all angles $= 180(5-2)$
$= 180(3)$
$= 540$

1 interior $= y = \frac{540}{5} = 108°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle $x = \frac{360}{5} = 72°$

Interior angle$= 180°$ −exterior$= 180 - 72 = 108°$

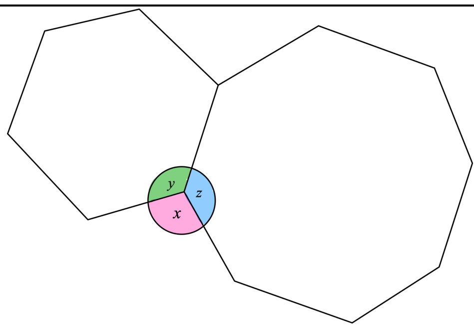
We have two pentagons connected to a square

Each interior angle of a square inside is $90°$

We also know that angles at a point add to $360°$

$x = 360 - 108 - 108 - 90 = 54°$

10)



We consider the hexagon and the octagon to find the interior angles y and z

Way 1: Use formula for sum of interior angles $180(n-2)$

Hexagon: sum of all angles $= 180(6-2)$
$= 180(4)$
$= 720$

1 interior $= y = \frac{720}{6} = 120°$

Octagon: sum of all angles $= 180(8-2)$
$= 180(6)$
$= 1080$

1 interior $= z = \frac{1080}{8} = 135°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Hexagon: Exterior angle $= \frac{360}{6} = 60°$

1 interior $= y = 180°$ − exterior
$= 180 - 60 = 120°$

Octagon: Exterior angle $= \frac{360}{8} = 45°$

1 interior $= z = 180°$ − exterior
$= 180 - 45 = 135°$

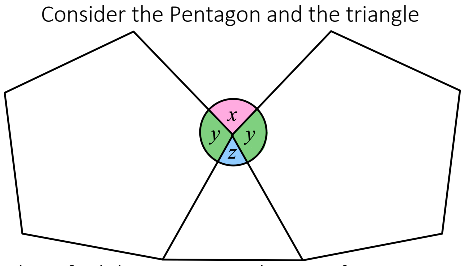
We have an octagon and a hexagon connected together.

We also know that angles at a point add to $360°$

$x = 360 - 120 - 135 = 105°$

11)

Consider the Pentagon and the triangle



We consider the pentagon and the triangle to find the interior angles y and z

Way 1: Use formula for sum of interior angles $180(n-2)$

Pentagon: sum of all angles $= 180(5-2)$
$= 180(3)$
$= 540$

1 interior $= y = \frac{540}{5} = 108°$

Triangle: sum of all angles $= 180(3-2)$
$= 180(1)$
$= 180$

1 interior: $= z = \frac{180}{3} = 60°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Pentagon: Exterior angle $= \frac{360}{5} = 72°$

Interior angle $= y = 180°$ − exterior $= 180 - 72 = 108°$

Triangle: Exterior angle $= \frac{360}{3} = 120°$

Interior angle z: $180°$ − exterior $= 180 - 120 = 60°$

We have two pentagons and an equilateral triangle connected together.

We also know that angles at a point add to 360°

$x = 360 - 108 - 108 - 60 = 84°$

1.2 Working Out The Number of Sides

12) .

Way 1: Use formula for sum of interior angles $180(n-2)$

Interior angle $= 180 -$exterior angle

Interior angle $= 180 - 30 = 150°$

1 interior: $\frac{180(n-2)}{n} = 150$

Solve for n:

$$\frac{180n - 360}{n} = 150$$

$$180n - 360 = 150n$$

$$30n = 360$$

$$n = \frac{360}{30} = 12$$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle$= \frac{360}{30} = 12$

13)

Way 1: Use formula for sum of interior angles $180(n-2)$

1 interior: $\frac{180(n-2)}{n} = 156$

Solve for n:

$$\frac{180n - 360}{n} = 156$$

$$180n - 360 = 156n$$

$$24n = 360$$

$$n = \frac{360}{24} = 15$$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle $= 180 -$interior angle

Interior angle $= 180 - 156 = 24°$

Exterior angle$= \frac{360}{24} = 15$

14)

i.

Way 1: Use formula for sum of interior angles $180(n-2)$

Interior angle $= 180 -$exterior angle

Interior angle $= 180 - 18 = 162°$

1 interior: $\frac{180(n-2)}{n} = 150$

Solve for n:

$$\frac{180n - 360}{n} = 162$$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Exterior angle$= \frac{360}{18} = 20$

<table>
<tr><td>

$$180n - 360 = 162n$$

$$18n = 360$$

$$n = \frac{360}{18} = 20$$

</td><td></td></tr>
<tr><td colspan="2">

ii.

Use formula for sum of interior angles $180(n-2)$

$$\text{sum of all angles} = 180(20-2) = 180(18) = 3240°$$

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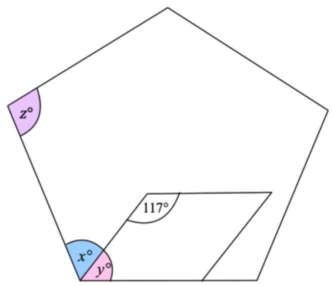
</table>

2 Silver

2.1 Working Out Angles

15)



Consider the Pentagon first

Way 1: Use formula for sum of interior angles $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
sum of all angles $= 180(5-2)$ $= 180(3)$ $= 540$ 1 interior $= z = \frac{540}{5} = 108°$	Exterior angle $= \frac{360}{5} = 72°$ Interior angle $= z = 180° -$ exterior $= 180 - 72 = 108°$

Now consider the parallelogram. Adjacent angles of a parallelogram add up to 180° (same side/co-interior angles)

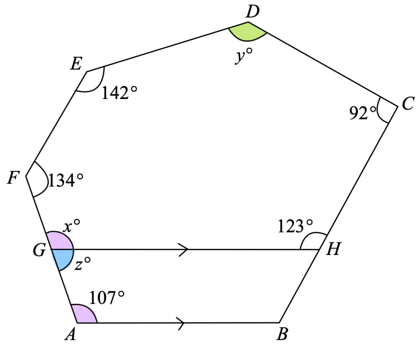
$y = 180 - 117 = 63°$

We know that entire interior angle is 108°

$x = 108 - 63 = 45°$

16)

Consider the ABCDEF



i. Lines GH and AB are parallel

Way 1: $x = 107°$ since the angles are corresponding angles

Way 2. $z = 180 - 107 = 73°$ since same side/co-interior angles

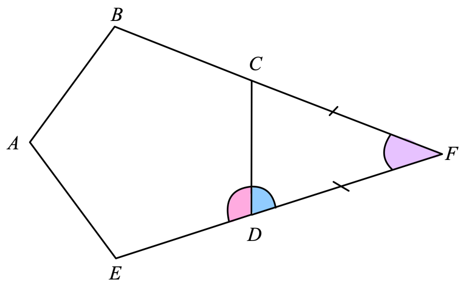
$x = 180 - 73 = 107°$ since straight lines angles add to $180°$

ii. Use formula for sum of interior angles $180(n-2)$

sum of all angles of GHCDEF $= 180(6-2)$
$= 180(4)$
$= 720$

$y = 720 - 92 - 123 - 107 - 134 - 142 = 122°$

17)



Consider the Pentagon

Way 1: Use formula for sum of interior angles $180(n-2)$

Pentagon: sum of all angles $= 180(5-2)$
$= 180(3)$
$= 540$

1 interior= $\angle CDE = \frac{540}{5} = 108°$

Exterior angle $= \angle CDF = 180 - 108 = 72°$

CDF is an isosceles triangle, therefore the base angles are equal

The sum of the angles in a triangle is 180°.

$\angle CFD = 180 - 72 - 72 = 36°$

Way 2: Use formula for exterior angle $\frac{360}{n}$

Pentagon:

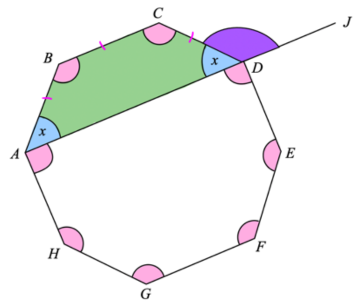
Exterior angle $= \angle CDF = \frac{360}{5} = 72°$

CDF is an isosceles triangle, therefore the base angles are equal

The sum of the angles in a triangle is 180°.

$\angle CFD = 180 - 72 - 72 = 36°$

18)



Firstly, we consider the Octagon

Way 1: Use formula for sum of interior angles $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
sum of all angles $= 180(8-2)$ $= 180(6)$ $= 1080$ 1 interior= $\frac{1080}{8} = 135°$	Exterior angle= $\frac{360}{8} = 45°$ Interior angle $= 180° -$exterior $= 180 - 45 = 135°$

Next, we consider the green quadrilateral

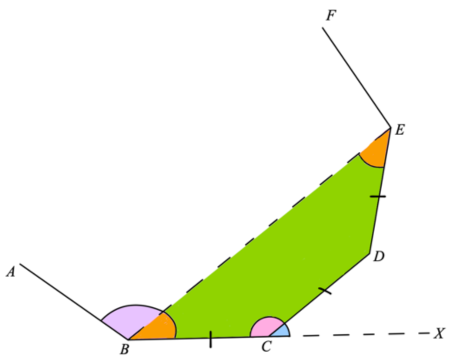
ABCD is a quadrilateral. Therefore, the sum of angles is 360° and the base angles x are equal since ABCD is an isosceles trapezoid

$$x = \frac{360 - 135 - 135}{2} = 45°$$

Angles on a straight line add to 180°

∠CDJ $= 180 - 45 = 135°$

19)



Firstly, we consider the nonagon

i. Use formula for exterior angle $\frac{360}{n}$	ii. Use formula for interior angle
1 exterior= $\frac{360}{9} = 40°$ angle $DCX = 40°$	Interior angle $= 180° -$exterior Interior angle $= 180° -$exterior $= 180 - 40 = 140°$ angle BCD= 140°

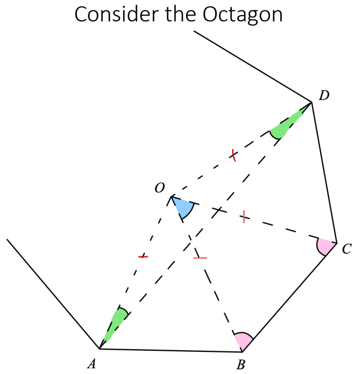
iii.	Now we look at BCDE which is a quadrilateral. Therefore, sum of angles is 360° and base angles are equal. ● $\angle CBE = \angle BED = \frac{360-140-140}{2} = 40°$ ● $\text{Angle } ABE = 140 - 40 = 100°$

3 Gold

3.1 Working Out Angles

20)

Consider the Octagon



$\angle BOC = \frac{360}{8} = 45°$

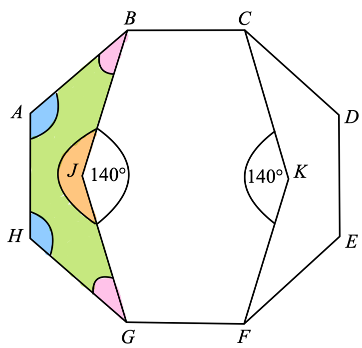
$\angle OBC = \frac{180-45}{2} = 67.5°$ (isosceles triangle)

$\angle AOD = 3(45) = 135°$

$\angle OAD = \frac{180-135}{2} = 22.5°$ (isosceles triangle)

21)

Consider the ABCDEF



$\angle BJG = 360 - 140 = 220°$ (angles at a point add to 360°)

$\frac{180(8-2)}{8} = 135°$ (interior angles of a hexagon)

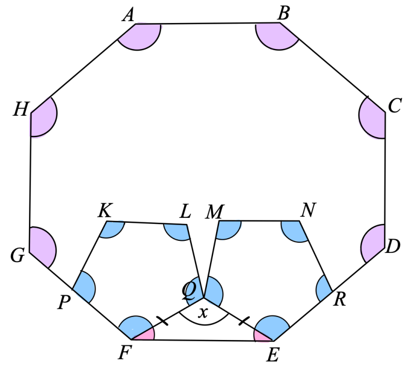
ABJGH is a pentagon therefore,

Sum of interior angles $= 180(5-2) = 540°$

$\frac{540-220-135-135}{2} = 25°$

22)

Consider the Octagon



Way 1: Use formula for sum of interior angles $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
Octagon: sum of all angles $= 180(8-2)$ $= 180(6)$ $= 1080$ 1 interior $= \frac{1080}{8} = 135°$ Pentagon: sum of all angles $= 180(5-2)$ $= 180(3)$ $= 540$ 1 interior $= \frac{540}{5} = 108°$	Octagon: Exterior angle $= \frac{360}{8} = 45°$ Interior angle $= 180° -$exterior $= 180-45 = 135°$ Pentagon: Exterior angle $= \frac{360}{5} = 72°$ Interior angle $= 180° -$exterior $= 180-72 = 108°$

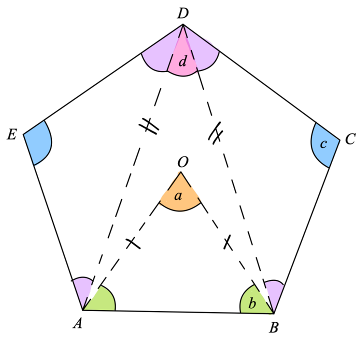
QEF is an isosceles triangle. Therefore, sum of angles is 180° and the base angles are equal

∠QFE = ∠QEF $= 135 - 108 = 27$
z

∠EQF $= x = 180 - 27 - 27 = 126°$

23)

Consider the Octagon



Use formula for exterior angle $\frac{360}{n}$

$$a = \frac{360}{5} = 72°$$

$$b = \frac{180 - 72}{2} = 54°$$

$$c = \frac{180(5-2)}{5} = 108°$$

$$e = \frac{180-108}{2} = 36°$$

$$d = 108 - 36 - 36 = 36°$$

Note: We could have also looked at triangle ADB for find d

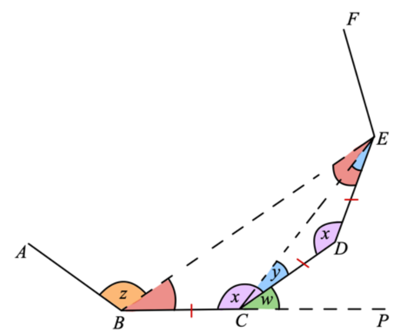
Angle OBD=angle DAO= $108 - 54 - 36 = 18$ (we know the full exterior angle is 108)

Reflex angle AOB= $360 - 72 = 288$ (angles at a point add to $360°$)

$$360 - 288 - 18 - 18 = 36°$$

24)

Consider the Decagon



$x = \frac{180(10-2)}{10} = 144°$ (interior angles of a decagon)

$y = \frac{180-144}{2} = 18°$ (isosceles triangle)

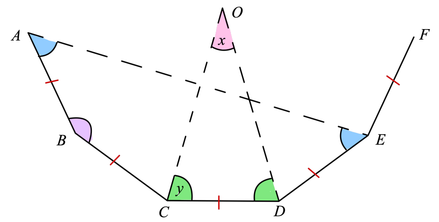
exterior angle of decagon $= \frac{360}{n} = \frac{360}{10} = 36°$

$$w + y = 36$$
$$w = 36 - y = 36 - 18$$
$$= 18$$

BCDE is an isosceles trapezium $\angle CBE = \angle BED = \frac{360-144-144}{2} = 36°$

$$z = 144 - 36 = 108°$$

25)



i. $x : y = 1 : 2$

This means:
$\frac{x}{y} = \frac{1}{2}$

Re – arranging gives:
$y = 2x$

We know the sum of the angles of a triangle is 180° so we can form an equation:

$2x + 2x + x = 180$

$5x = 180$

$x = 36°$

ii. The angle at the centre $x = \frac{360}{n}$ where n =number of sides

$36 = \frac{360}{n}$

Solving for n gives

$n = 10$

We can plug this in the formula for an interior angle

$\frac{180(10-2)}{10} = 144°$

iii. ABCDE is a 5-sided shape

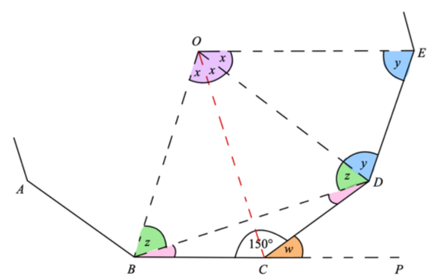
$180\ (5-2) = 540°$(sum of interior angles)

The base angles of this 5-sided shape are equal

$\frac{540 - 3(144)}{2} = 54°$

26)

Consider the Polygon



i. $w = 180 - 150 = 30°$ (angles on a straight line)

ii. $\frac{360}{30} = 12$

iii.

$x = \frac{360}{12} = 30°$

ODE is an isosceles triangle, so base angle are equal

$$y = \frac{180 - 30}{2} = 75°$$

$$\frac{180 - 150}{2} = 15$$

$z = \frac{180 - 30 - 30}{2} = 60°$ using isosceles triangle OBD

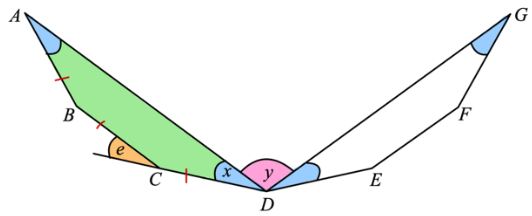
or

$z = 150 - 75 - 15 = 60°$ using angle D$= 150°$

iv. Equilateral

27)

Consider the Polygon



i. $e = \frac{360}{15} = 24°$

ii. $180 - 24 = 156°$

iii. ABCD is a quadrilateral therefore, the sum of all angles is 360

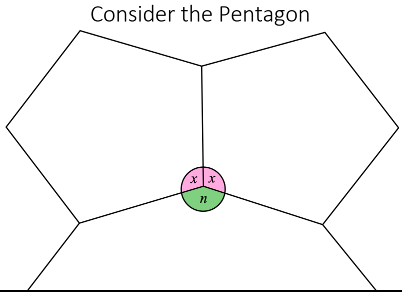
$x = \frac{360 - 156 - 156}{2} = 24°$

iv. $y = 156 - 24 - 24 = 108°$

3.2 Working Out The Number Of Sides

28)

Consider the Pentagon



Way 1: Use formula for sum of interior angles $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
sum of all angles $= 180(5-2)$ $= 180(3)$ $= 540$ 1 interior$= x = : \frac{540}{5} = 108°$	Exterior angle$= \frac{360}{5} = 72°$ Interior angle$= x = 180°$ −exterior$= 180 - 72 = 108°$

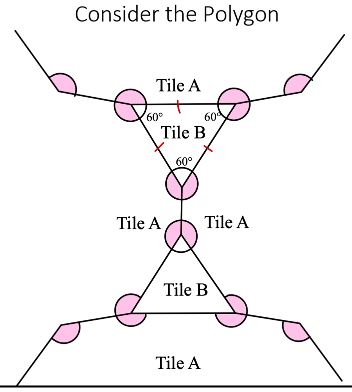
We have two pentagons connected to polygon A at point P.
We also know that angles at a point add to $360°$ and
Interior angle of A$= n = 360 - 108 - 108 = 144°$

Exterior angle of A $= 180 - 144 = 36°$

Therefore, n$= \frac{360}{36} = 10$

29)

Consider the Polygon



Tile B (triangle) must be equilateral since it is a regular triangle.

$$360 - 60 = 300°$$

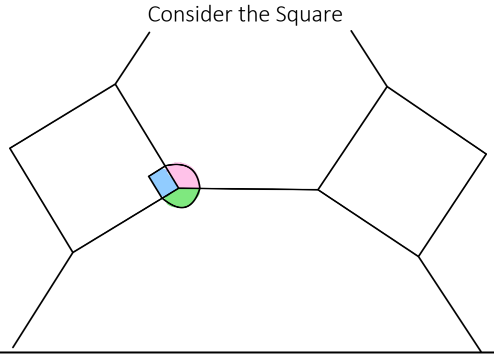
$$1 \text{ interior } = \frac{300}{2} = 150°$$

$$1 \text{ exterior } 180 - 150 = 30°$$

$$n = \frac{360}{exterior\ angle} = \frac{360}{30} = 12$$

30)

Consider the Square



We have a square so the we have a 90° angle.

$$\text{Interior angles of hexagon} = \frac{180(6-2)}{6} = 120°$$

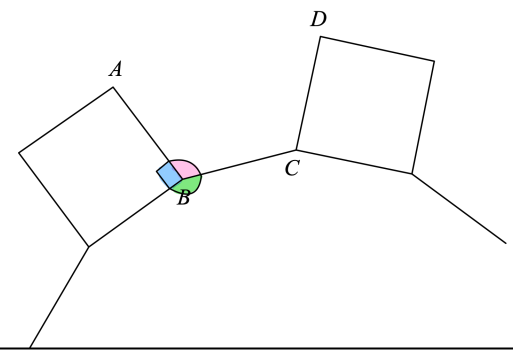
$$1 \text{ interior of n sided shape} = 360 - 120 - 90 = 150°$$

$$1 \text{ exterior } 180 - 150 = 30°$$

$$n = \frac{360}{exterior\ angle} = \frac{360}{30} = 12$$

31)

Consider the Square



We have a square so the we have a perpendicular angle.

Interior of 12-sided polygon$= \frac{180(12-2)}{12} = 150°$

$1 \text{ interior} = 360 - 150 - 90 = 120°$

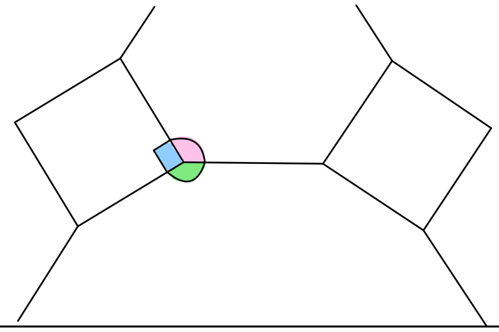
$1 \text{ exterior of P} = 180 - 120 = 60°$

$n = \frac{360}{exterior\ angle} = \frac{360}{60} = 6$

therefore, we have a hexagon.

32)

Consider the Square



We have a square so the we have a perpendicular angle.

Interior of hexagon$= \frac{180(6-2)}{6} = 120°$

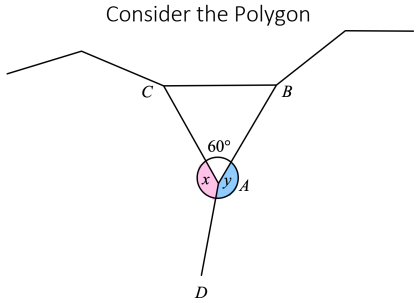
$1 \text{ interior} = 360 - 120 - 90 = 150°$

$1 \text{ exterior } 180 - 150 = 30°$

$n = \frac{360}{exterior\ angle} = \frac{360}{30} = 12$

33)

Consider the Polygon



$$y = \frac{180(10-2)}{10} = 144°$$

$$x = 360 - 144 - 60 = 156°$$

1 exterior $180 - 156 = 24°$

$$n = \frac{360}{exterior\ angle} = \frac{360}{24} = 15$$

34)

Angles at a point add up to 360°

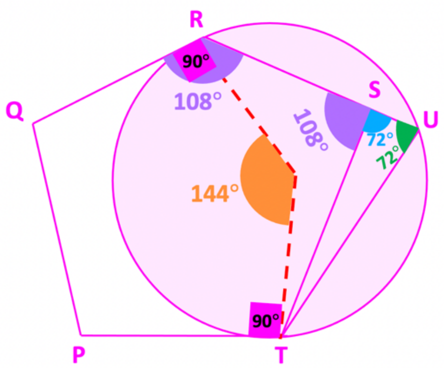
remaining angle at the centre $= 360 - 108 - 90 = 162°$

Exterior angle of the shape $= 180 - 162 = 18°$

$$\text{number of sides} = \frac{360}{\text{exterior angle}} = \frac{360}{18} = 20 \text{ sides}$$

sum of interior angles $= 180(20-2) = 3240°$

35)



Interior angle of a regular pentagon $\frac{180(5-2)}{5} = 108°$

Angle TSU= $180 - 108 = 72°$ (angles on a straight line add to 180°)

Form the 2 lines OR and OT

Angle QRO=Angle PTO= 90° (a tangent meets a radius at 90°)

Angle ROT= $540 - (90 + 90 + 108 + 108) = 144°$ (angles in Pentagon PQRST add to 540°)

Angle RUT= $\frac{144}{2} = 72°$ (angle at the centre is twice the angle at the circumference)

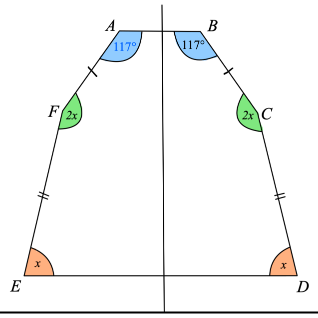
So, we have angle RUT= 72° and that Angle RUT $= 72°$

Hence the base angles of triangle SUT are equal, so SUT is an isosceles triangle$\Longrightarrow ST = UT$

4 Diamond

36)

Consider the ABCDEF



Let angle CDE be *x*.
This means that BCD is:

$$\text{Angle BCD} = 2\ (\text{angle CDE})$$
$$= 2x$$

These are added to the diagram along with the line of symmetry. And due to the line of symmetry,

angle A = angle B
angle F = angle C
angle E = angle D

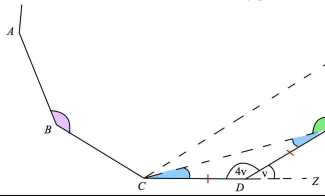
Use formula for sum of interior angles $180(n-2)$

$$180(6-2) = 720$$
$$117 + 117 + 2x + 2x + x + x = 720$$
$$234 + 6x = 720$$
$$6x = 486$$
$$x = 81^\circ$$

$$\angle \text{AFE} = 2x = 2(81) = 162^\circ$$

37)

Consider the Polygon



i. $4v + v = 180°$ $5v = 180°$ $v = 36°$	ii. $\frac{360}{36} = 10$
iii. $\frac{180-4(36)}{2} = 18°$	iv. $\frac{180(10-2)}{10} = 144°$ or $4v = 4(36) = 144°$ $144 - 18 = 126°$
v. CDEF is a quadrilateral (isosceles trapezoid with equal base angles) $\frac{360-144-144}{2} = 36°$	

38)

Way 1: Use formula for an interior angle $\frac{180(n-2)}{n}$ and an exterior angle is $\frac{360}{n}$	Way 2: Use fact that interior angle + exterior angle adds to $180°$
Exterior angle $\frac{360}{n}$ Interior angle $180 - \frac{360}{n}$ $180 - \frac{360}{n} = 6.5\left(\frac{360}{n}\right)$ $180 - \frac{360}{n} = \frac{2340}{n}$ $180 = \frac{2700}{n}$ $180n = 2700$ $n = \frac{270}{180} = 15$ sides Yes since n is a whole number. Each interior angle is $156°$ and each exterior angle is $24°$	Call an exterior angle x An interior angle is $6.5x$ We know these angles add to $180°$ since they lie on a straight line $x + 6.5x = 180$ $7.5x = 180$ $x = 24°$ Yes. Each interior angle is $156°$ and each exterior angle is $24°$. All interior angles are the same and all exterior angles are the same, therefore the shape is regular

39)

The sum of the interior angles of a hexagon $180(6-2) = 720°$

Sum of angles given$= 79 + 42 + 49 + 52 + 97 = 319°$

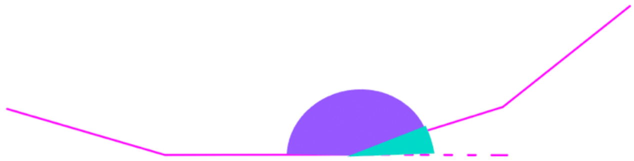
$720 - 319 = 401°$

So the 6th angle is $401°$

Interior + exterior $=180°$ so it is not possible for either an interior or exterior angle to be $180°$ or more.

There $401°$ is not a possible answer for an interior angle, hence the shape cannot be a hexagon

40) .



Way 1: Use formula for an interior angle $\frac{180(n-2)}{n}$ and an exterior angle is $\frac{360}{n}$

$$\frac{180(n-2)}{n} = 140 + \frac{360}{n}$$

$$\frac{180n-360}{n} = 140 + \frac{360}{n}$$

Multiply all terms by n

$$180n - 360 = 140n + 360$$

$$180n - 140n = 360 + 360$$

$$40n = 720$$

$$n = 18$$

Way 2: Use fact that interior angle + exterior angle adds to $180°$

Call
an interior angle x
an exterior angle y

We can build 2 equations
①: $x + y = 180$
②: $x = y + 140$

Solve simultaneously
$y + 140 + y = 180$
$2y + 140 = 180$
$2y = 40$
$y = 20$

So we have an exterior angle is 20
We know the formula for an exterior angle is $\frac{360}{n}$
$\frac{360}{20} = 18$

Way 3: Use formula for an interior angle $\frac{180(n-2)}{n}$ and an exterior angle is 180 − interior angle

$$\frac{180(n-2)}{n} = 140 + \left(180 - \frac{180(n-2)}{n}\right)$$

$$\frac{180n-360}{n} = 140 + \left(180 - \frac{180n-360)}{n}\right)$$

Multiply all terms by n

$$180n - 360 = 140n + 180n - (180n - 360)$$

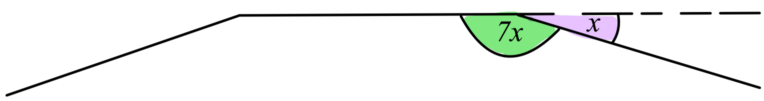
$$180n - 360 = 140n + 180n - 180n + 360$$

$$180n - 140n - 140n = 360 + 360$$

$$40n = 720$$

$$n = 18$$

41)



$$7x + x = 180°$$
$$8x = 180°$$

$$x = 22.5°$$

$$n = \frac{360}{exterior\ angle}$$

$$n = \frac{360}{22.5} = 16$$

42)

$$11x + x = 180°$$
$$12x = 180°$$
$$x = 15°$$

$$n = \frac{360}{exterior\ angle}$$

$$n = \frac{360}{15} = 24$$