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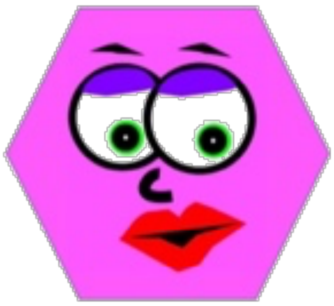
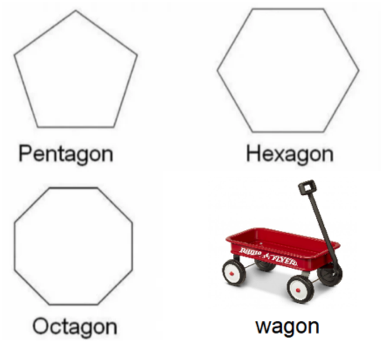
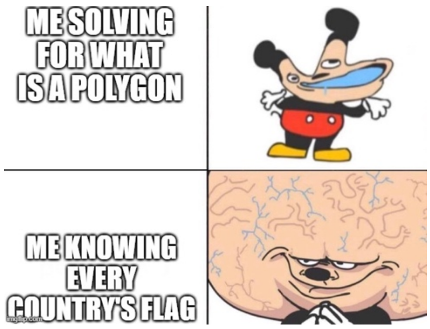
Polygons Questions By Topic Solutions







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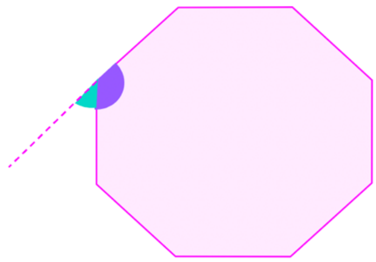
1.1 Working Out Angles

1)



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

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

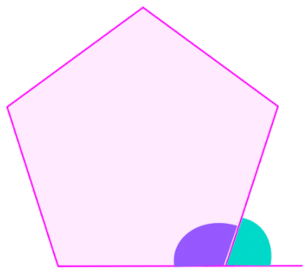
1 interior angle$= \frac{1080}{8} = 135°$

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 $\frac{360}{n}$

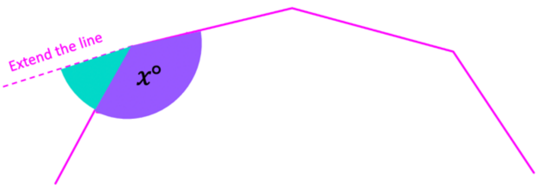
Exterior angle$= \frac{360}{5} = 72°$

3)

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

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

4)



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

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

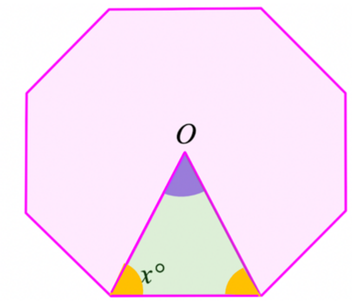
1 interior$= x = \frac{1440}{10} = 144°$

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

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

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

5)



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

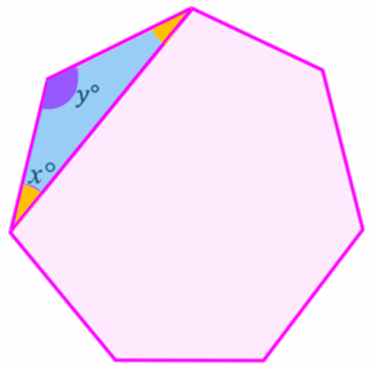
We have an isosceles triangle

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

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 $\frac{\mathbf{360}}{\boldsymbol{n}}$

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

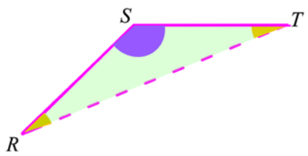
We have an isosceles triangle (since both sides of the triangle are the same length)

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

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 $\frac{\mathbf{360}}{\boldsymbol{n}}$

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

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

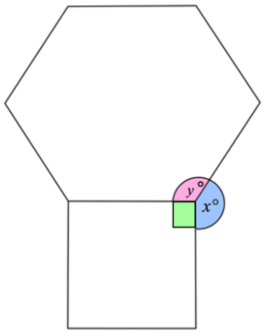
We have an isosceles triangle RST

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
$= 180 - 60 = 120°$

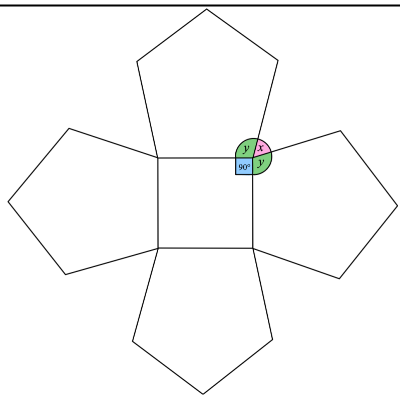
We have a pentagons connected to a square

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$= 180 - 72 = 108°$

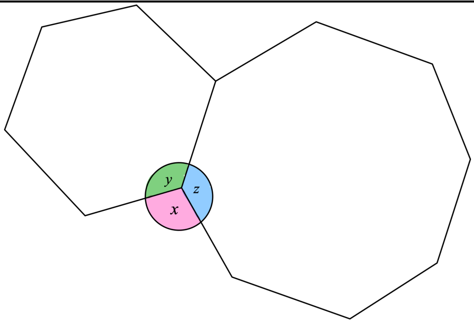
We have two pentagons connected to a square

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
$= 180 - 45 = 135°$

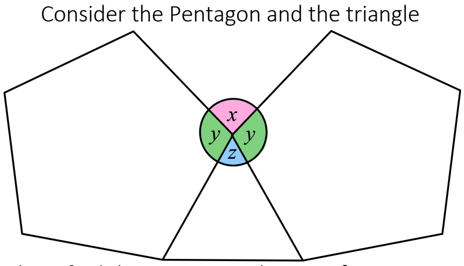
We have an octagon and a hexagon connected together.

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 $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
Interior angle $= 180 -$exterior angle Interior angle $= 180 - 30 = 150°$ 1 interior: $\frac{180(n-2)}{n} = 150$ Solve for n: $\frac{180n - 360}{n} = 150$ $180n - 360 = 150n$ $30n = 360$ $n = \frac{360}{30} = 12$	Exterior angle$= \frac{360}{30} = 12$

13)

Way 1: Use formula for sum of interior angles $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
1 interior: $\frac{180(n-2)}{n} = 156$ Solve for n: $\frac{180n - 360}{n} = 156$ $180n - 360 = 156n$ $24n = 360$ $n = \frac{360}{24} = 15$	Exterior angle $= 180 -$interior angle Interior angle $= 180 - 156 = 24°$ Exterior angle$= \frac{360}{24} = 15$

14)

i.

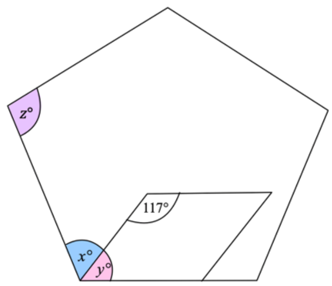
Way 1: Use formula for sum of interior angles $180(n-2)$	Way 2: Use formula for exterior angle $\frac{360}{n}$
Interior angle $= 180 -$exterior angle Interior angle $= 180 - 18 = 162°$ 1 interior: $\frac{180(n-2)}{n} = 150$ Solve for n: $\frac{180n - 360}{n} = 162$	Exterior angle$= \frac{360}{18} = 20$

$180n - 360 = 162n$ $18n = 360$ $n = \frac{360}{18} = 20$	
ii. Use formula for sum of interior angles $180(n-2)$ sum of all angles $= 180(20-2)$ $= 180(18)$ $= 3240°$	

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)

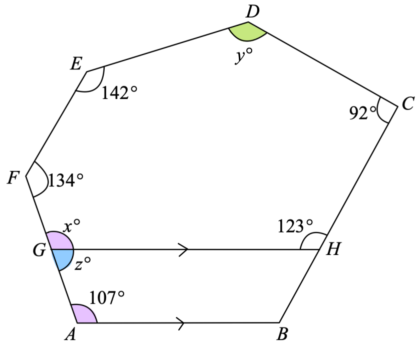
$y = 180 - 117 = 63°$

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

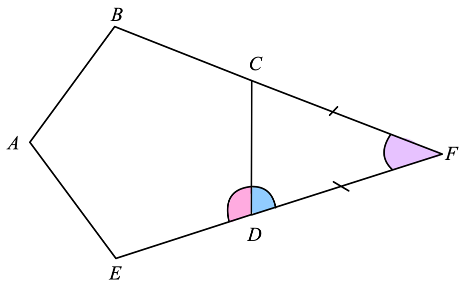
$x = 180 - 73 = 107°$ since straight lines angles add to $180°$

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:

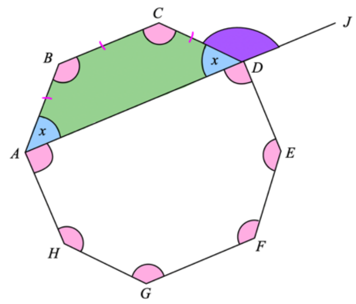
Exterior angle $= \angle CDF = \frac{360}{5} = 72°$

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

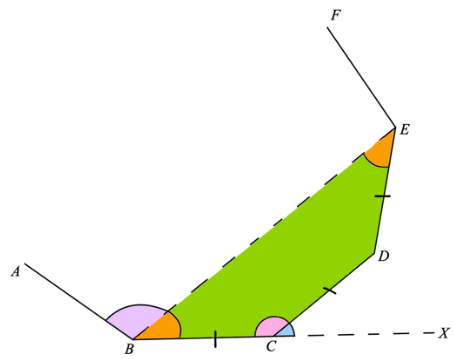
ABCD is a quadrilateral. Therefore, the sum of angles is 360° and the base angles x are equal since ABCD is an isosceles trapezoid

$$x = \frac{360-135-135}{2} = 45°$$

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 Interior angle $= 180° -$exterior
1 exterior= $\frac{360}{9} = 40°$ angle $DCX = 40°$	Interior angle $= 180° -$exterior $= 180 - 40 = 140°$ angle BCD= 140°

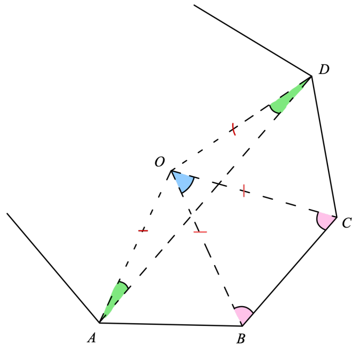
iii.	Now we look at BCDE which is a quadrilateral. Therefore, sum of angles is 360° and base angles are equal. • $\angle CBE = \angle BED = \frac{360-140-140}{2} = 40°$ • $\text{Angle ABE} = 140 - 40 = 100°$

3 Gold

3.1 Working Out Angles

20)

Consider the Octagon



$\angle BOC = \frac{360}{8} = 45°$

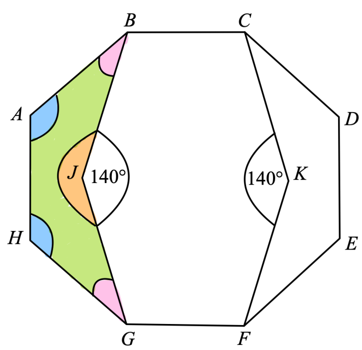
$\angle OBC = \frac{180-45}{2} = 67.5°$ (isosceles triangle)

$\angle AOD = 3(45) = 135°$

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

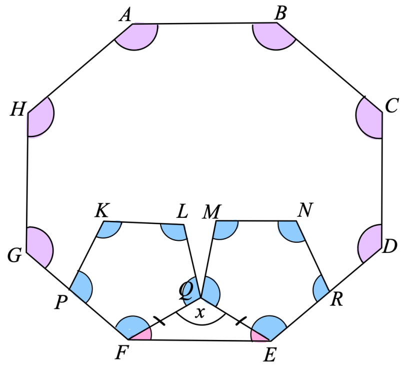
ABJGH is a pentagon therefore,

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 $180(n-2)$

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$= \frac{540}{5} = 108°$

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

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

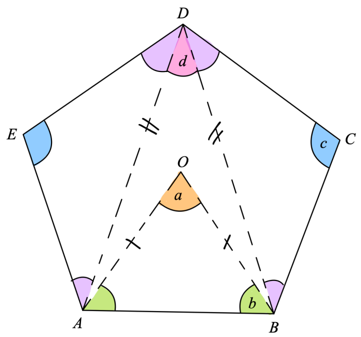
∠QFE =∠QEF $= 135 - 108 = 27$

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

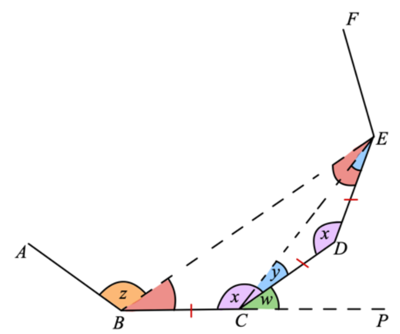
Angle OBD=angle DAO= $108 - 54 - 36 = 18$ (we know the full exterior angle is 108)

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)

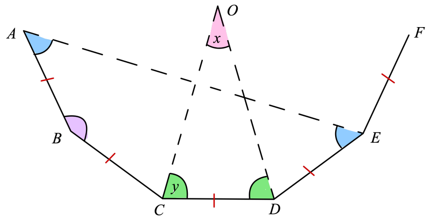
exterior angle of decagon $= \frac{360}{n} = \frac{360}{10} = 36°$

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

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

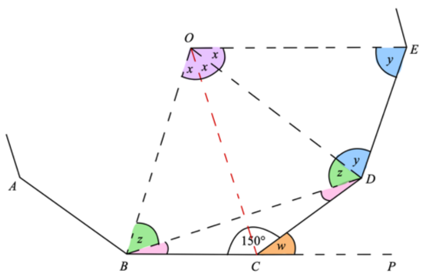
$180\ (5-2) = 540°$(sum of interior angles)

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

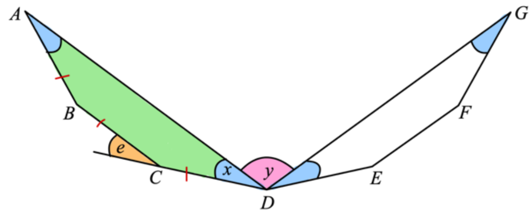
or

$z = 150 - 75 - 15 = 60°$ 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

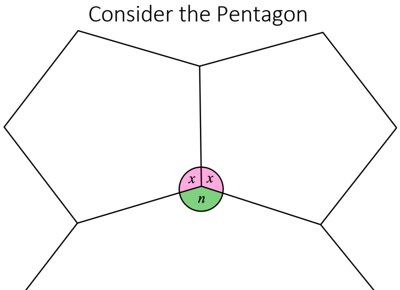
$x = \frac{360-156-156}{2} = 24°$

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= $180 - 72 = 108°$

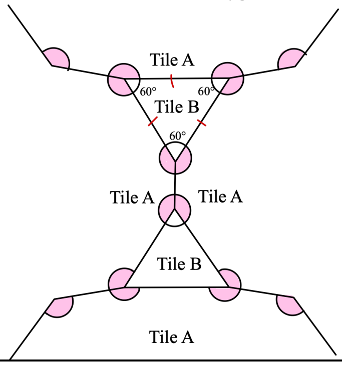
We have two pentagons connected to polygon A at point P.
We also know that angles at a point add to 360° and
Interior angle of A= $n = 360 - 108 - 108 = 144°$

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.

$360 - 60 = 300°$

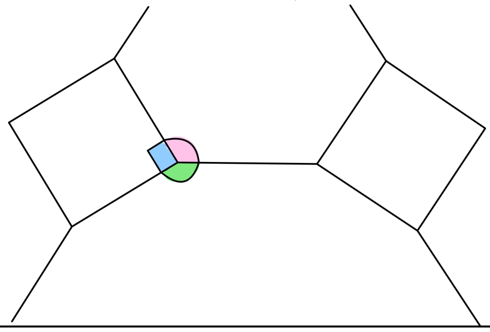
1 interior $= \frac{300}{2} = 150°$

1 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.

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

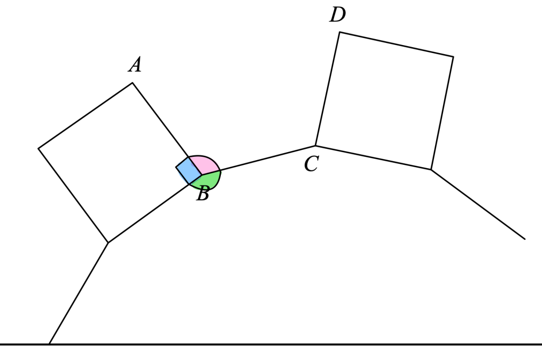
1 interior of n sided shape$= 360 - 120 - 90 = 150°$

1 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 interior $= 360 - 150 - 90 = 120°$

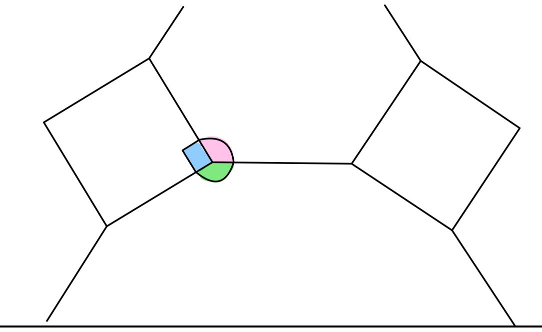
1 exterior of P $= 180 - 120 = 60°$

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

therefore, we have a hexagon.

32)

Consider the Square



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

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

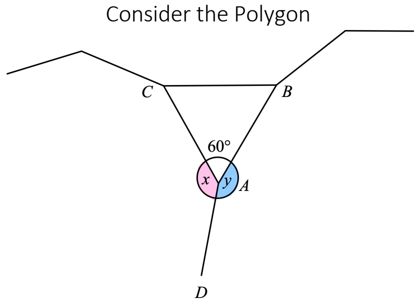
1 interior $= 360 - 120 - 90 = 150°$

1 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 $= 180 - 162 = 18°$

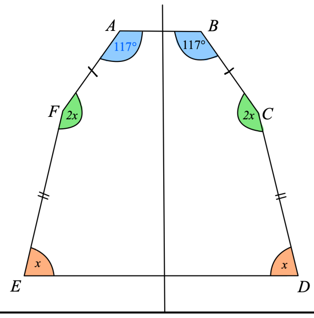
$$\text{number of sides} = \frac{360}{\text{exterior angle}} = \frac{360}{18} = 20 \text{ sides}$$

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

4 Diamond

35)

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

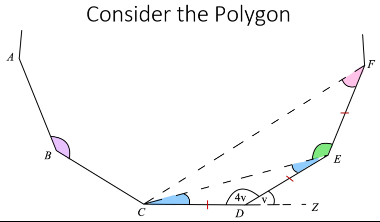
Use formula for sum of interior angles $180(n-2)$

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

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

36)

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)

$\frac{360-144-144}{2} = 36°$

37)

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

38)

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

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

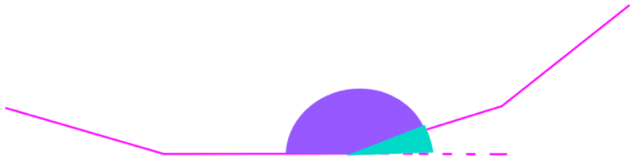
$720 - 319 = 401°$

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

39) .



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

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

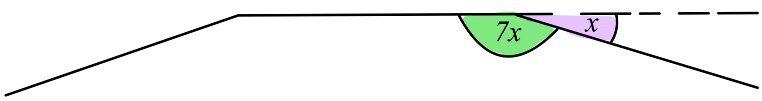
$$180n - 360 = 140n + 180n - 180n + 360$$

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

$$40n = 720$$

$$n = 18$$

40)



$$7x + x = 180°$$

$$8x = 180°$$
$$x = 22.5°$$

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

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

41)

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

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

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