ANGLES IN POLYGONS

Task 1

1) Find the size of each interior angle of a regular pentagon.
   Sum of interior angles = (5 − 2) × 180 = 540°
   Each angle = 540 ÷ 5 = **108°**

2) Find the size of each interior angle of a regular octagon.
   Sum of interior angles = (8 − 2) × 180 =1080°
   Each angle = 1080 ÷ 8 = **135°**

3) Find the sum of interior angles of a decagon.
   Sum of interior angles = (10 − 2) × 180 = **1440°**

4) Work out the size of each interior angle of a regular 15-sided polygon.
   Sum of interior angles = (15 − 2) × 180 = 2340°
   Each angle = 2340 ÷ 15 = **156°**

5) Find the size of each exterior angle of a regular hexagon.
   Exterior angle = 360 ÷ 6 = **60°**

6) A regular polygon has exterior angles of 45°. How many sides does it have?
   Number of sides = 360 ÷ 45 = **8 sides**

7) A regular polygon has 20 sides. Work out the size of each exterior angle.
   360 ÷ 20 = **18°**

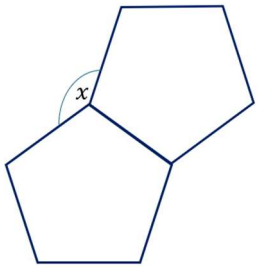
8) A regular polygon has an exterior angle of 12°. Work out the size of the interior angle.
   Interior angle = 180 − 12 = **168°**

9) A regular polygon has interior angles of 150°. How many sides does it have?
   Exterior angle = 180 − 150 = 30°
   Sides = 360 ÷ 30 = **12 sides**

10) A regular polygon has interior angles of 165°. Work out the number of sides it has.
    Exterior angle = 180 − 165 = 15°
    Sides = 360 ÷ 15 = **24 sides**

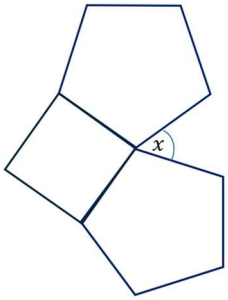
Task 2 – Regular polygons are pictured in the diagrams below. For each of the following, work out the size of the missing angle x.

11)



Exterior angle of a pentagon = 360 ÷ 5 = 72°
x = 72 × 2 = **144°**

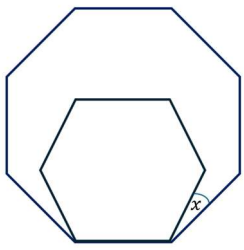
12)



Sum of interior angles of a pentagon = (5 − 2) × 180 = 540°
Each angle = 540 ÷ 5 = 108°

x = 360 – 108 – 108 – 90 = **54°**

13)

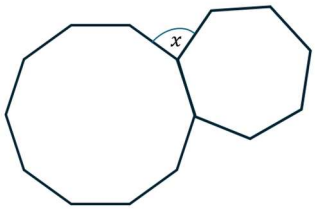


Sum of interior angles of an octagon = (8 − 2) × 180 = 1080°
Each angle = 1080 ÷ 8 = 135°

Sum of interior angles of a hexagon = (6 − 2) × 180 = 720°
Each angle = 720 ÷ 6 = 120°

x = 135 – 120 = **15°**

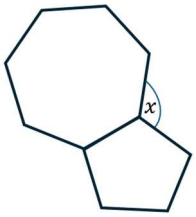
14)



Exterior angle of a decagon = 360 ÷ 10 = 36°
Exterior angle of a heptagon = 360 ÷ 7 = 51.428…°

x = 36 + 51.428… = **87.4° (3 sf)**

15)

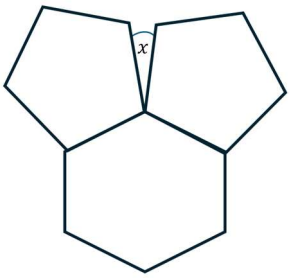


Exterior angle of a heptagon = 360 ÷ 7 = 51.428…°

Exterior angle of a pentagon = 360 ÷ 5 = 72°

x = 51.428… + 72 = **123° (3 sf)**

16)



Sum of interior angles of a pentagon = (5 − 2) × 180 = 540°
Each angle = 540 ÷ 5 = 108°

Sum of interior angles of a hexagon = (6 − 2) × 180 = 720°
Each angle = 720 ÷ 6 = 120°

x = 360 – 108 – 108 – 120 = **24°**

Task 3

17) A pentagon is shown below. Work out the size of the missing angle x.

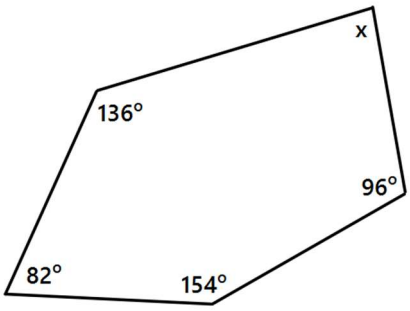


Diagram not drawn accurately

Sum of interior angles of a pentagon = (5 – 2) × 180 = 540°

x = 540 – 136 – 82 – 154 – 96 = **72°**

18) A quadrilateral ABCD is shown below. Work out the value of x.

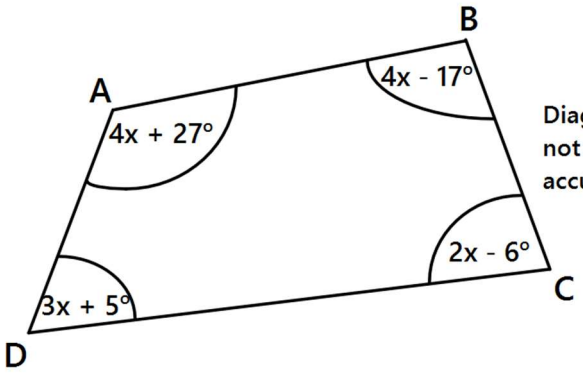


Diagram not drawn accurately

Angles in a quadrilateral add to 360°

4x + 27 + 3x + 5 + 4x – 17 + 2x – 6 = 360

13x + 9 = 360

13x = 351

x = **27°**

19) Hexagon ABCDEF is pictured below. Work out the size of the obtuse angle ABC.

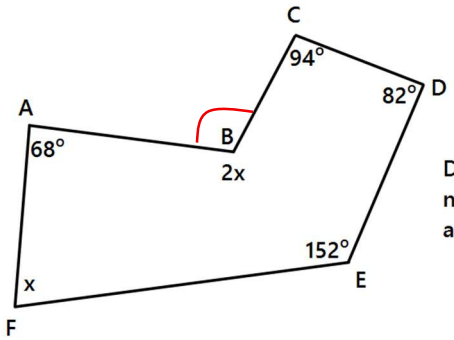


Diagram not drawn accurately

Sum of interior angles of a hexagon = (6 – 2) × 180 = 720°

x + 68 + 2x + 94 + 82 + 152 = 720

3x + 396 = 720

3x = 324

x = 108°

2x = 216°

216° is a reflex angle

The obtuse angle ABC = 360 – 216 = **144°**

20) A pentagon is pictured below. Work out the value of x.

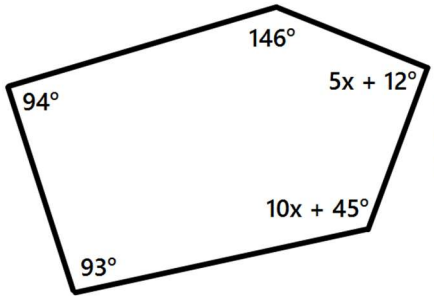
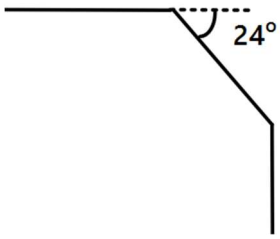


Diagram not drawn accurately

Sum of interior angles of a pentagon = (5 − 2) × 180 = 540°

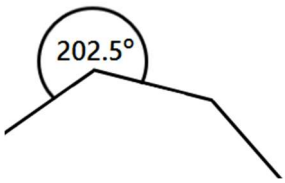
94 + 146 + 5x + 12 + 10x + 45 + 93 = 540
15x + 390 = 540
15x = 150
x = 10°

21) Part of a regular polygon is shown below. Work out the number of sides the polygon has.



Number of sides = 360 ÷ 24 = **15 sides**

22) Part of a regular polygon is shown below. Work out the number of sides the polygon has.



Interior angle 360 – 202.5 = 157.5°

Exterior angle = 180 – 157.5 = 22.5°
Number of sides = 360 ÷ 22.5 = **16 sides**

Task 4

23) A pentagon has angles in the ratio 2 : 3 : 4 : 4 : 5. Work out the size of the largest angle.

2 + 3 + 4 + 4 + 5 = 18
540 ÷ 18 = 30°
Largest = 5 × 30 = **150°**

24) A heptagon has six angles of 130° and one unknown angle x. Find x.

Sum of interior angles = (7 − 2) × 180 = 900°
x = 900 − (6 × 130) = 900 − 780 = **120°**

25) A pentagon has four angles of 100° and one angle x. Find x.

Sum of interior angles = (5 − 2) × 180 = 540°

x = 540 − (4 × 100) = **140°**

26) A quadrilateral has three right angles. Find the size of the fourth angle.

Sum = 360°

Three right angles = 270°

Fourth = 360 − 270 = **90°**

27) The exterior angles of a polygon are in the ratio $1 : 2 : 3 : 4 : 5$. Find the number of sides and each exterior angle.

Sum of exterior angles = 360°

1 + 2 + 3 + 4 + 5 = 15

Each part = 360 ÷ 15 = 24°

Angles:

24°, 48°, 72°, 96°, 120°

Number of sides = **5**

Challenge

28) An irregular pentagon is pictured below.

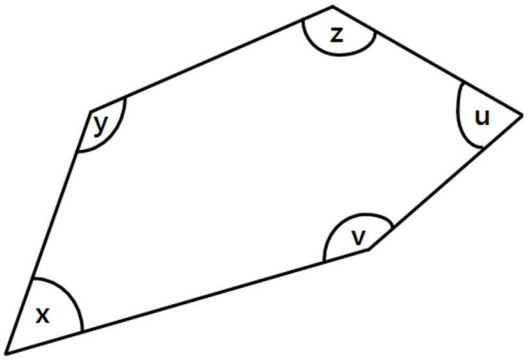


Diagram not drawn accurately

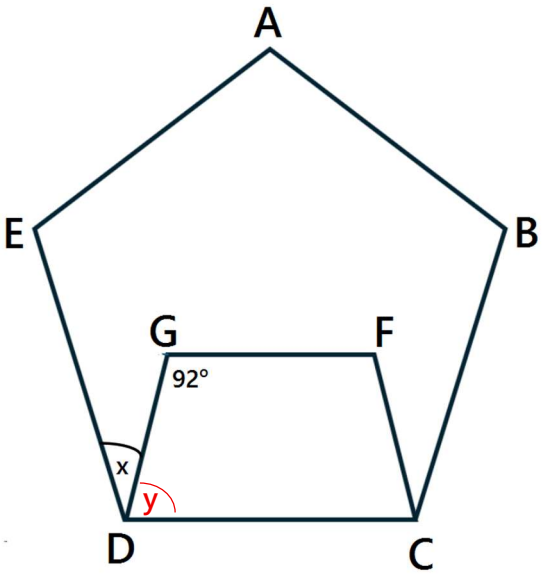
Angle x = angle u
Angle z = 125°
Angle v is three times the size of angle u
Angle y is 70° larger than the size of angle u

Work out the size of angle x.

Come up with an expression for each angle:
x: x
u: x
z: 125
v: 3x
y: x + 70

Angles in a pentagon add to 540:
x + x + 125 + 3x + x + 70 = 540
6x + 195 = 540
6x = 345
x = 57.5°

29) A regular pentagon ABCDE is shown below.
Given that GFCD is a trapezium, work out the size of the angle marked x.



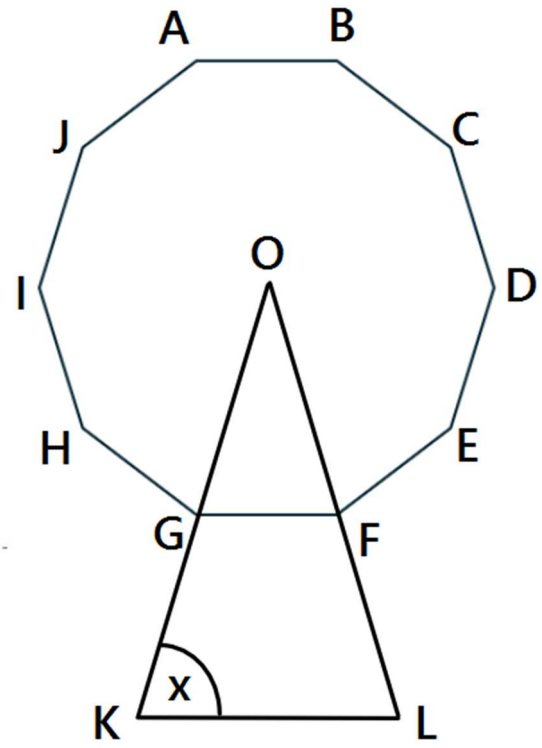
Sum of interior angles of a pentagon = (5 − 2) × 180 = 540°
Each angle = 540 ÷ 5 = 108°

The 92° angle and angle y are co-interior:

180 – 92 = 88°

x = 108 – 88 = **20°**

30) ABCDEFGHIJ is a 10-sided regular polygon, with centre O.
Given that KL is a straight line that is parallel to GF, work out the value of x.



Sum of interior angles of a decagon = (10 − 2) × 180 = 1440°
Each angle = 1440 ÷ 10 = 144°

Because O is the centre, it bisects the angles at G and F
G = 144 ÷ 2 = 72°
F = 144 ÷ 2 = 72°

O = 180 – 72 – 72 = 36°

Because KL is a straight line that is parallel of GF, triangle OKL is isosceles:
x = (180 – 36) ÷ 2 = 72°