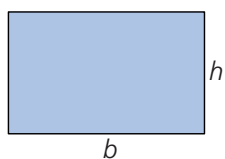


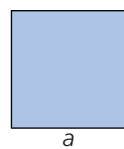
## 4 Perimeters and areas of polygons



**Rectangle**

$$P = 2b + 2h$$

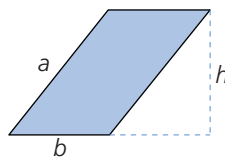
$$A = b \cdot h$$



**Square**

$$P = 4a$$

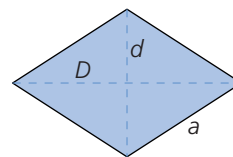
$$A = a^2$$



**Parallelogram**

$$P = 2a + 2b$$

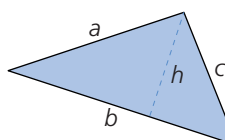
$$A = b \cdot h$$



**Rhombus**

$$P = 4a$$

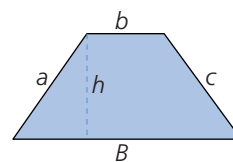
$$A = \frac{D \cdot d}{2}$$



**Triangle**

$$P = a + b + c$$

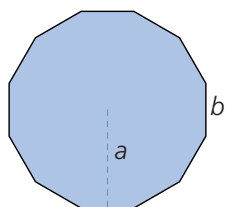
$$A = \frac{b \cdot h}{2}$$



**Trapezium**

$$P = a + b + c + B$$

$$A = \frac{(B + b) \cdot h}{2}$$



**Regular polygon**

$$P = b \cdot \text{number of sides}$$

$$A = \frac{P \cdot a}{2}$$

### Take note

- We can divide a regular polygon with  $n$  sides into  $n$  equal isosceles triangles.
- The apothem of a polygon,  $a$ , is the segment that joins the middle point of a side with the centre of the polygon.

### Mathematical language

The number  $\pi$  is defined as the ratio between a circle's circumference and its diameter.



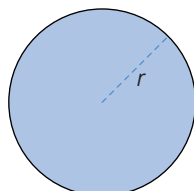
### Remember

The side of a regular hexagon has the same length as the radius of the circle that circumscribes the hexagon.

## 5 Perimeters and areas of circular figures

**Circumference**

$$L = 2\pi r$$

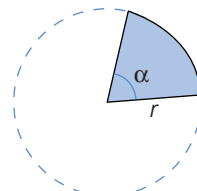


**Circle**

$$A = \pi r^2$$

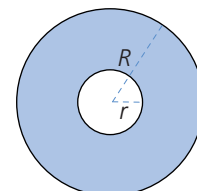
**Arc of a circle**

$$L = 2\pi r \cdot \frac{\alpha}{360^\circ}$$



**Circular sector**

$$A = \pi r^2 \cdot \frac{\alpha}{360^\circ}$$



**Circular ring**

$$A = \pi(R^2 - r^2)$$

### Worked example

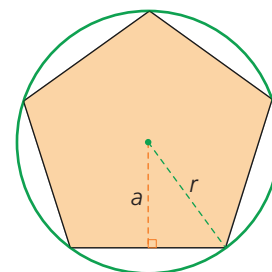
- 35** A circle is circumscribed in a regular pentagon. Each side of the pentagon is 6 cm, and the radius of the circle is 5,1 cm. Calculate the area of the polygon and the circumference of the circle.

#### Solution

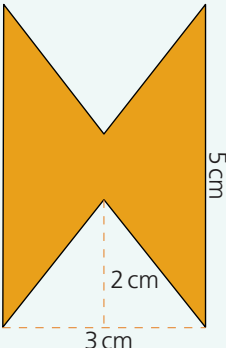
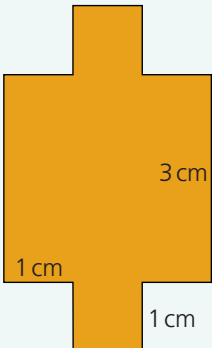
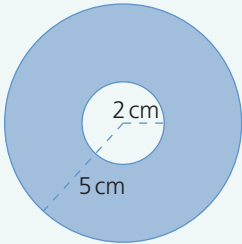
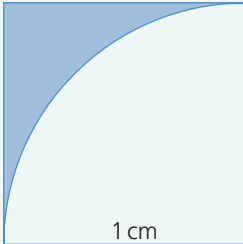
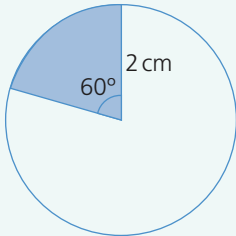
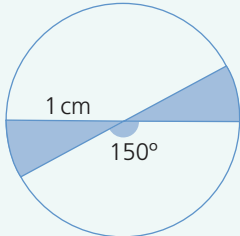
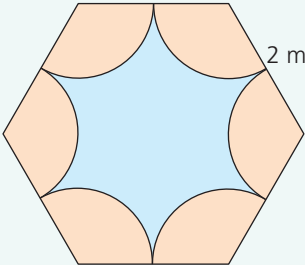
The apothem forms a right-angled triangle with the radius and half of the side. This means we can apply Pythagoras' theorem to calculate the length, so:

$$a = \sqrt{5,1^2 - 3^2} = \sqrt{17,01} = 4,5 \text{ cm, and the area is: } A = \frac{(6 \cdot 5) \cdot 4,5}{2} = 61,9 \text{ cm}^2$$


The length of the circumference is:  $L = 2\pi \cdot 5,1 = 32,1 \text{ cm}$



## Activities

- 36** Calculate the perimeter and the area of the following parallelograms whose sides are 2 cm and 4 cm. Write the answers in your notebook.
- a rectangle
  - a parallelogram which is 1,3 cm high
- 37** Find the perimeter and area of these quadrilaterals.
- A rhombus whose diagonals are 6 cm and 8 cm.
  - An isosceles trapezium with 2 cm and 4 cm bases and a height of 2 cm.
- 38** Calculate the perimeter and the area of a right trapezium with bases of 3 cm and 7 cm and with an oblique side of 5 cm.
- 39** Find the perimeter and the area of these triangles.
- an isosceles triangle with two equal sides of 10 cm and a third side of 8 cm
  - an acute-angled triangle which is 12 m high and which divides the base into a 5 m segment and a 10 m segment
- 40** Divide these figures to form simpler ones and determine the area of each figure.
- 
  - 
- 41** Find the area of an equilateral triangle with a 9 dm perimeter.
- 42** The sides of a regular pentagon are 4 cm each, and its apothem is 2,75 cm. Calculate its area.
- 43** Find the area of a regular hexagon if its apothem is 3 cm long.
- 44** Find the length of the circumference and the area of the circle with a diameter of 6,4 cm.
- 45** Determine the length of an arc of a circle whose diameter is 10 dm and with a  $45^\circ$  angle.
- 46** Calculate the area of a circular sector with a  $60^\circ$  angle and a radius of 7 cm.
- 47** Find the area of the shaded regions.
- 
  - 
- 48** Find the area of the shaded regions.
- 
  - 
- 49** What's the area of the central star if the sides of this regular hexagon are 2 m?
- 

### CLIL zone

- 50**  Work with a classmate. Use the phrases below to solve the problem.

The wheel of a bike has a diameter of 40 cm. How many metres will it have travelled after 35 rotations?

*We need to find the ... of the bike wheel.*

*This is...*

*Then we need to multiply/divide ... by...*