

# 6 Dimensions of circles

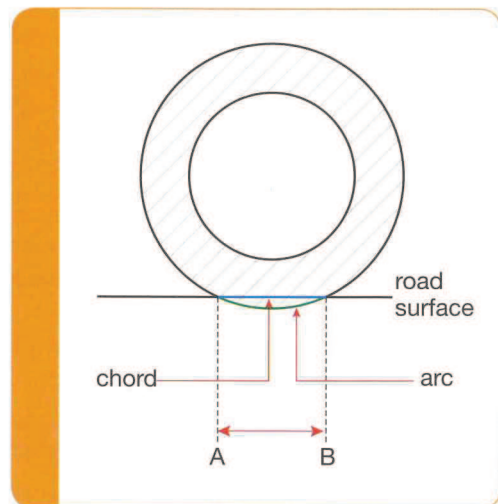
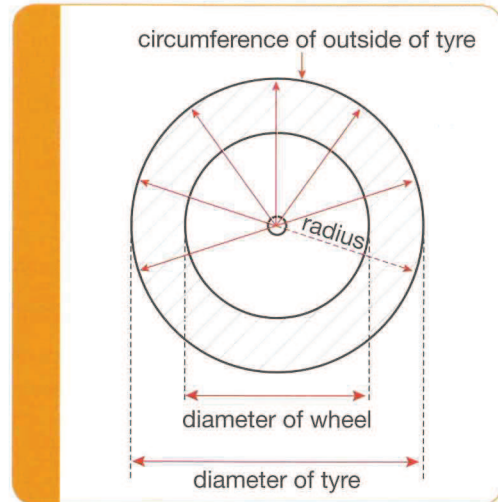
## A Key dimensions of circles

An engineer is giving a training course to a group of technical sales staff who work for a tyre manufacturer. During the talk, she mentions a number of dimensions relating to circles.

‘Obviously, the outside edge of a tyre forms a **circle**, as you can see in this simple diagram. The **outer circle** in the diagram is the outside of the tyre, and the **inner circle** – the circle with the smaller **diameter** – represents both the inside of the tyre and the outside of the wheel. And, clearly, the inner circle is right in the middle of the outer circle – it’s exactly in the **centre**. So because it’s **central**, that means the inside and outside of the tyre form **concentric circles**. And as the tyre is **circular**, simple geometry tells us that measurements of the **radius**, taken from the centre of the circle to different points on its edge – points on the **circumference** – are equal. All the **radii** are the same. In other words, the tyre has a **constant radius**.’

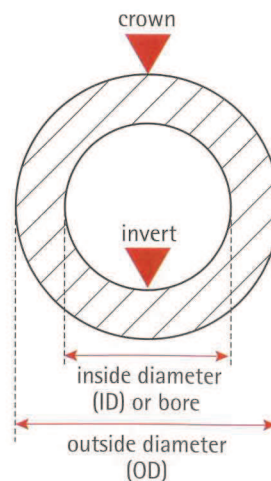
‘But when a tyre is fitted to a vehicle, it’s compressed against the road surface. That means its geometry changes. So while the wheel – the inner circle – obviously remains **round**, the circumference of the tyre – the outer circle – changes shape. It **deforms**. Before **deformation**, this part of the tyre forms an **arc** of the circle, between points A and B. So, as you can see in this diagram, it’s not a straight line – it’s a **curved line**. But after deformation, it’s no longer a **curve**. The tyre becomes **deformed** between points A and B. It becomes a **chord** of the same circle, forming a **straight line** between A and B. However, the length of a chord and the length of an arc, between the same two points on a circle, are different. So the design of the tyre has to allow for this change in shape – from a **rounded edge** to a straight edge.’

**Note:** See Appendix II on page 99 for more on shapes.



## B Pipe dimensions

Specific terms are used to describe the circular dimensions of pipes. The width of the inside of a pipe is called the **inside diameter (ID)**. It can also be called the **bore**. The outside width is called the **outside diameter (OD)**. When pipes are laid horizontally, the top of the outside of the pipe is called the **crown**, and the bottom of the inside of the pipe is called the **invert**.



**6.1** Complete the notes, made by a salesperson attending the engineer's talk, using the words in the box. Look at A opposite to help you.

arc	circular	constant	deformed	radius
chord	circumference	curved	diameter	

Before tyres are fitted to vehicles:

- shape is round - outside edge is perfectly (1) .....
- distance from centre of wheel to edge of tyre = (2) .....
- total distance across tyre =  $2 \times \text{radius} =$  (3) ..... of tyre
- all measurements from centre to points around tyre's (4) ..... are equal - tyre has (5) ..... radius
- bottom of tyre is (6) ..... of a circle

When fitted to vehicle, bottom of tyre is compressed and (7) ..... - changes from (8) ..... line to straight line. Straight line is (9) ..... of a circle.

**6.2** Find words and expressions in B opposite with the following meanings. One question has two possible answers.

- 1 the highest point of a horizontal pipe
- 2 the lowest point of the inside of a horizontal pipe
- 3 the maximum overall external width of a pipe
- 4 the maximum internal width between the pipe walls

**6.3** Change one word in each of the sentences below to correct them. Look at A and B opposite to help you.



- 1 The distance travelled by the vehicle each time its wheels turn completely is equal to the radius of one of its tyres.
- 2 The diameter of the tyre is measured from the centre of the wheel to the outside edge of the tyre.

- 3 The radius of the curve in the motorway is constant, so the edges of the road follow chords of a circle.
- 4 The curve in the motorway has a constant radius, so the inside and outside edges of the road are arcs of two deformed circles that have the same centre.



- 5 The invert is on the circumference of the external face of the pipe, and therefore cannot be in contact with the liquid flowing inside the pipe.
- 6 The thickness of the wall at the bottom of the pipe, plus the distance between the invert and the crown of the pipe, is equal to the inside diameter of the pipe.

### Over to you



- Choose an object which has circular and/or curved shapes. Describe it using language from A opposite. (You could also give approximate measurements.)
- Imagine you are designing the object. What measurements and lines will be needed to define its circular/curved features?