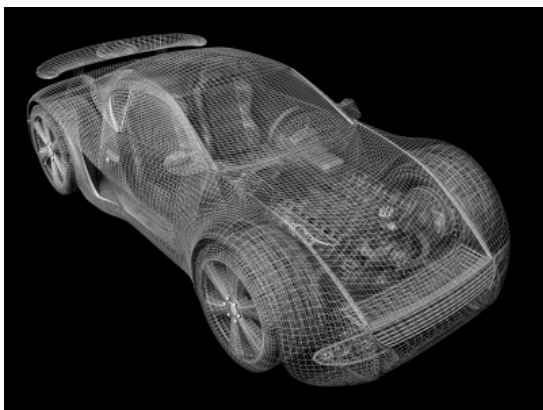# Scale Factors

Where do people use scale factors?

People tend to use scale factors when they want to make a **scale model** of something. Usually this is when they're trying to understand something which is either very big or very small.

When an architect or engineer is working on the design and construction of a large building they often make a scale model of the building. They might use computer software to make a virtual model or they might make a physical model that can be placed on a desk. In either case the dimensions of the building – its height, width and length – have to be **scaled** to the proportions of the model.

Similarly, a medical engineer might make a model of a part of the body like the heart which is bigger than an actual heart, so that trainee doctors can see how each of the bits of it work.

Car designers also use computer scale models of cars so that they can see how all the different bits fit together. To make a model car, someone has to work out how to scale down all of the sizes so that the small model car looks just like the real car – only smaller!

Suppose that you work for a firm that makes model cars. You've been told that each model car has to look exactly like the real car but with a scale factor of 1 : 24.

This means that if the real car is 2.4 metres long, the length of the model car can be calculated by dividing 2.4 metres by the scale factor 24. This is 0.1 metres.

Therefore the model car is 10 centimetres long.

1. Suppose that the wheels of the real car are 45 centimetres in diameter.
   What is the diameter of a wheel of the model car? _____

2. Suppose that the steering wheel of the real car is 30 centimetres in diameter.
   What is the diameter of the steering wheel of the model car? _____

3. The driver's seat in the real car needs 2 square metres of fabric to cover it.
   How many square centimetres of fabric is this? _____

4. Your colleague Philip tells you that the model car needs about 35 square centimetres of fabric to cover the driver's seat. Why does he say this? Do you agree with him?

   Explain your answer here.

Core worksheet

Creating a scale map of the United Kingdom for use in a weather forecast

If you buy a map it's important to get the right scale so that you can see the level of detail you need.

A street map of your local area might have a scale factor of 1:20000. That means that 1 centimetre on the street map represents 20000 centimetres, which is the same as 200 metres.

A national road map might have a scale factor of 1:250000. In such a road map, 1 centimetre represents 2.5 kilometres.

Weather forecasters on television or weather sites on the internet use a scale map of the UK to show us what the weather will be like in different parts of the country.

Suppose that you're looking at a weather map of the UK on a computer screen, where the UK looks just like the map in the picture shown.

The UK mainland is just under 500 kilometres from east to west and just under 1000 kilometres from north to south. On the screen the mainland appears to be 16 centimetres from north to south. The whole map is 20 centimetres in height by 14 centimetres in width.

1. Approximately, what is the scale of the map on the computer screen?

    _____

2. The length of the UK coastline is about 12500 kilometres.
    If you measured the length of the coastline on the screen, approximately how long would it be?

    _____

3. Whenever you scale a drawing on a computer it has to use this mathematics to make sure that the pixels on the screen display the correct colours. Many computer screens have a resolution of 96 dpi (dots per inch), which is about 37.8 pixels per centimetre, or 37.8 x 37.8 = 1429 pixels per square centimetre.

    Approximately how many pixels are needed to display the 20cm x 14cm map on the screen?

    _____

    Estimate the area that each pixel represents, giving your answer in square kilometres to the nearest whole number.

    _____