

## **Underground Maps**

## **Introduction**

The London underground map has had many versions over the years since it was first built in 1863. There are two maps with this exercise, one from around 1909, and one from present day. Think about the following questions.

- (a) Could they both be used to plan a route across London?
- (b) Can they both be used to find underground stations?
- (c) Which one do you find easier to read?



Old version of tube map





Modern version of the tube map

You will have noticed that the new map is not geographically accurate (distances are distorted), but it is much easier to read and understand. What is important here is not the exact distance, but the connections between stations.

A tube map is an example of what mathematicians call "a graph", i.e. a collection of points joined by lines.

Now, solve the following exercise. You can use the map you find easier to read.

## **Exercise**

Find the route with the least number of stations between the following:

- (a) London Kings Cross and London Waterloo?
- (b) Liverpool Street and Green Park?
- (c) Paddington and London Kings Cross, if you can't go through Baker Street?
- (a) Can you find a route that always requires at least 1 change?
- (b) Can you find a route that always requires at least 2 changes

