# Level 1 Data Practice #12

The graph below is of road deaths in NZ since 1950 taken from the Ministry of Transport at www.transport.govt.nz .

The solid blue line is the number of deaths for every 10,000 vehicles on the roads, including trucks, vans, motorcycles etc.

The red dotted line is the number of road deaths for every 100,000 people in the population involving a vehicle (including pedestrians, cyclists etc hit by one).

Deaths per Vehicle and per Capita
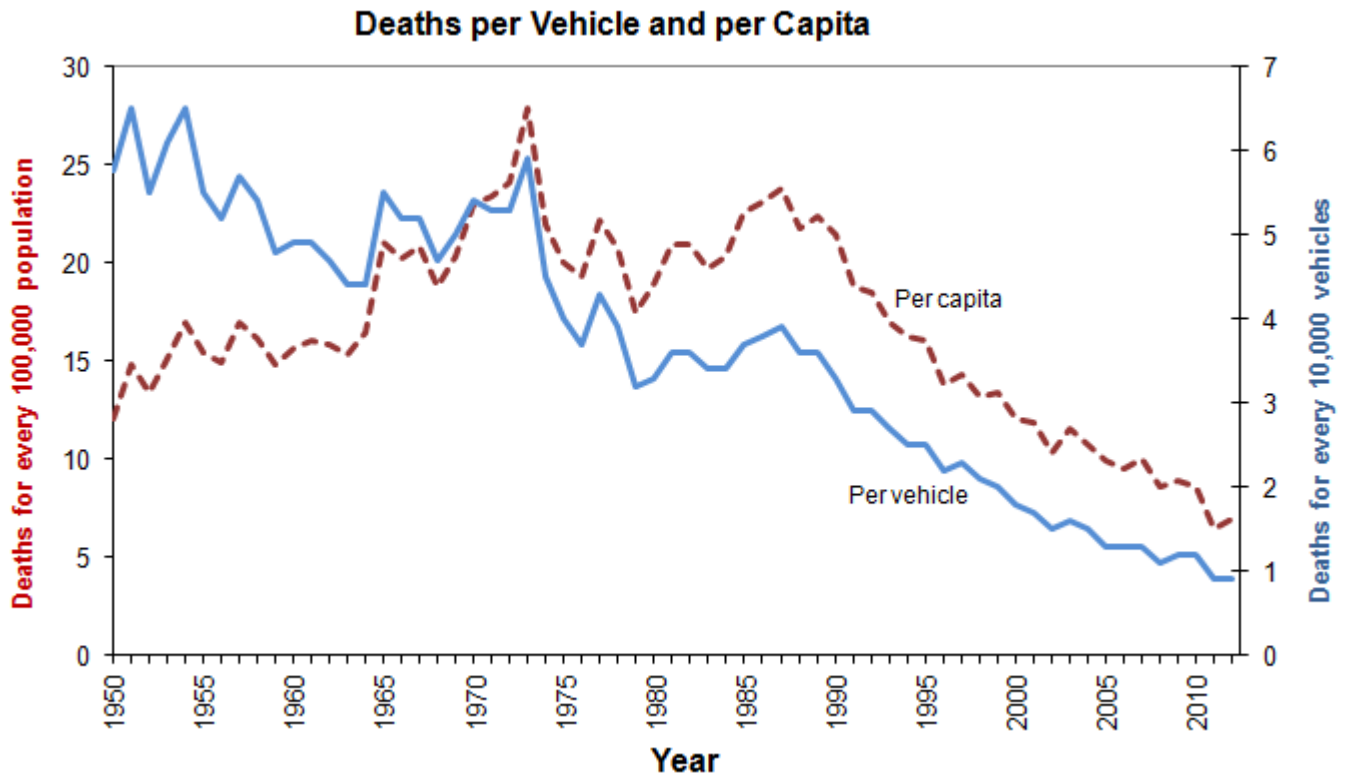
1. How many deaths were there in 2000 for every 10,000 vehicles?

2. Why have they plotted the line of deaths for every 100,000 people rather than just the total number of road deaths?

3. What patterns or trends do you see in the two lines.

   Explain your answer fully, using correct statistical language.

4. Predict the likely death rate per 100,000 people in 2020.

   What problems do you see with your prediction?

5. Explain why the overall shape of the lines start out differently, but end up following very similar paths?

6. Explain why both lines start out "noisy" but get much smoother over time?

Answers: Level 1 Data Practice #12

Deaths per Vehicle and per Capita
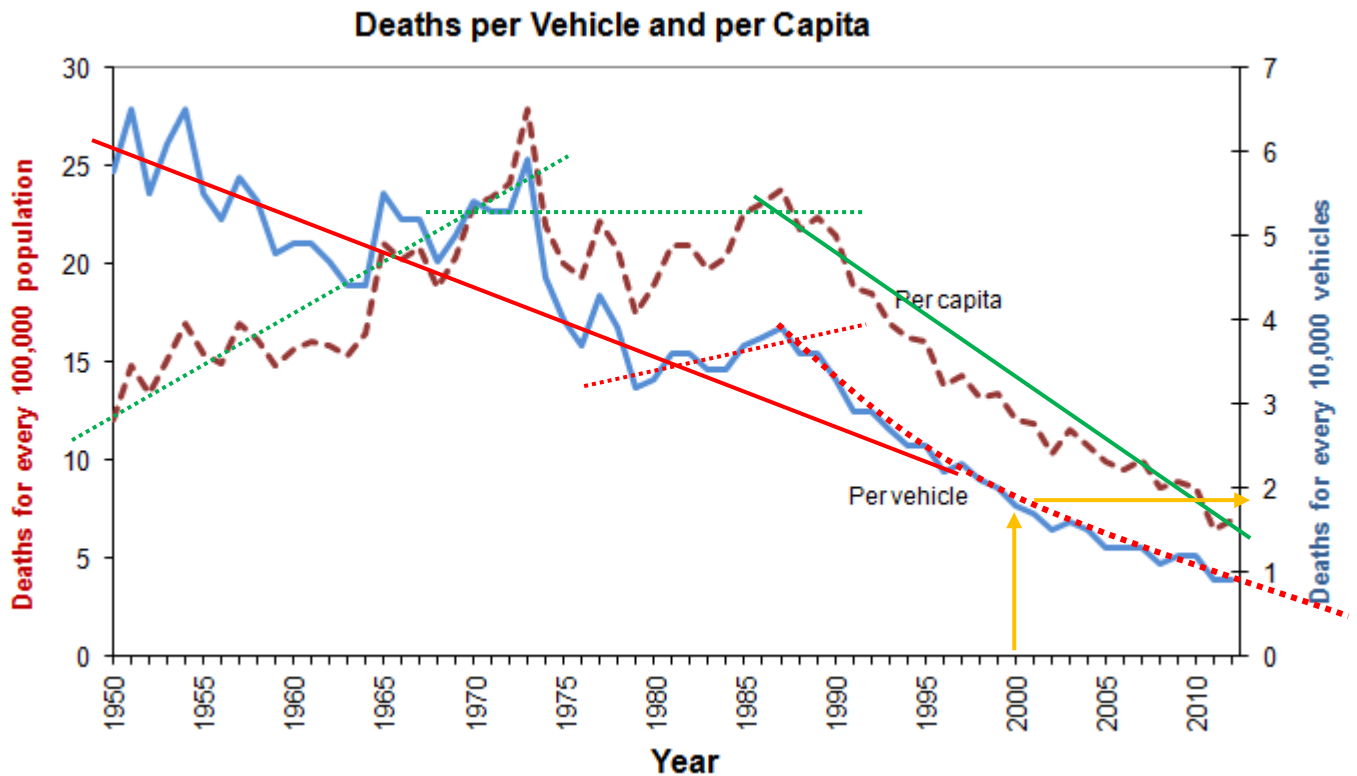
1. There were about 1.9 (see yellow arrows for how to get this figure)

2. The graphs are plotted "per capita" to remove the effect of the increase in population over that time. Without that, the effect of increasing population is to increase road deaths even if safety is improving. By removing the effect of population growth, we can study just the effects of safety improvements.

3. The per capita rate grew for 25 years, then there was a plateau, and from about 1990 it is falling very quickly. The fall from 1990 does not seem to be linear – the straight green solid line is not a great fit, with all the middle values too low and the ends too high – a curve would be much better.

   The per vehicle rate has dropped steadily, apart from a spike around 1973, for the whole time since 1950 by about 4.5 deaths every decade. For most of the period a linear fit is good (solid red line) but recently it fits a curve better (shown with the dotted red line).

4. Following the red trend line gives a rate of about 1 death per 100,000 people. The curve gives a similar, slightly higher value.

   This is most unlikely to be correct. If you follow that trend for five more years it gives a negative death rate, which is impossible. The trend must curve a bit up sometime soon.

5. In 1950 not many people owned cars so the deaths per capita was low, even though per person was high. As more people got cars, so the death rate rose to match. After about 1970 car ownership was common, so the improvements in car and road safety could start to have effect. Since 1990 the rate of cars per person has been stable, so changes now are shown in both lines as the safety improvements affect both lines exactly the same.

6. The noise is a feature of much smaller population, and the per 10,000 cars one is particularly noisy in the 1950s because there so many fewer cars. We are seeing a general effect – as a population increases, the amount of "noise" or variation decreases.