Question 12 **(9 marks)**

The inner diameter of a cylinder in a motor car engine is critical to its performance. Let μ mm denote the population mean cylinder diameter produced by a manufacturing process. A random sample, R_1, of 100 cylinder diameters is taken and the standard deviation for this sample was found to be 1 mm.

Let $\bar{X}$ = the sample mean cylinder diameter for sample R_1.

(a) State the distribution for $\bar{X}$ and its parameters. (3 marks)

(b) What is the probability that $\bar{X}$ differs from μ by more than 0.2 mm. Give your answer correct to 0.001. (2 marks)

From random sample R_1, a 95% confidence interval for μ is formed.

(c) Calculate the width of this confidence interval, correct to 0.001. (2 marks)

Lilian, the production manager, wishes to decrease the width of the confidence interval. She suggests:

"We can form sample R_2 by using the data from sample R_1 and then combining this data with itself to form a sample with 200 observations. Using $n = 200$ will decrease the width of the confidence interval."

(d) State **two** major problems with using this idea. (2 marks)