Question 17 **(12 marks)**

A researcher is interested in estimating the population mean μ (dollars) that Perth residents had spent via online shopping in December 2020. A random sample of size n gave a sample mean of \$400, a sample standard deviation s and a 95% confidence interval of width \$200.

(a) State the 95% confidence interval obtained. (1 mark)

(b) Calculate the standard deviation of the sample mean, correct to \$0.01. (2 marks)

(c) In terms of n, what sample size would yield a 95% confidence interval of width \$50? Show your reasoning. (2 marks)

(d) What is the probability that another sample of size $2n$ would produce a sample mean that differs from μ by more than \$50? (3 marks)

Four different confidence intervals (A, B, C and D) are obtained for the mean amount spent via online shopping by Perth residents in December 2020.

Confidence interval	Sample size	Sample standard deviation	Confidence level
A	n	s	95%
B	n	s	99%
C	$2n$	s	95%
D	n	$0.8s$	95%

(e) Which of the confidence intervals (A, B, C or D) contains μ, the population mean expenditure for online shopping in December 2020? Justify your answer. (2 marks)

(f) For each of the following, state the confidence interval that has the smaller width. Justify your answers.

(i) A and B. (1 mark)

(ii) C and D. (1 mark)