Question 13 **(10 marks)**

The proportion of caravans on the road being towed by vehicles that have the incorrect towing capacity is p.

(a) Show, using calculus, that to maximise the margin of error a value of $\hat{p} = 0.5$ should be used. Note: As z and n are constants, the standard error formula can be reduced to $E = \sqrt{\hat{p}(1-\hat{p})}$. (3 marks)

(b) A consulting firm wants to determine p within 8% with 99% confidence. How many towing vehicles should be tested at a random check? (3 marks)

(c) Six months later, the consulting firm carries out a random sampling of towing vehicles. A 99% confidence interval calculated for the proportion of vehicles with incorrect towing capacity is (0.342, 0.558). Determine the number of vehicles in the sample that have an incorrect towing capacity. (4 marks)