STEP II, 2006, Q2 EC

2 This question was the second most popular on the paper (in terms of the number of attempts) and really sorted out those who were comfortable with inequalities from those that weren't. Those who were generally scored very high marks on the question; even those who weren't generally managed several bits and pieces to get around half-marks on it.

Once again, there was an informal (possibly induction-type) proof required for the second bit of the question, although this was handled slightly more capably than the easier one in Q1, possibly because so many candidates seemed happier to effectively produce a formally inductive line of reasoning. Most candidates then picked up on the purpose of this bit in helping create a convergent GP to sum, which helped establish the next inequality for e.

The differentiation proved undemanding, and most candidates managed to realise that the minimum and maximum points referred to would be established by considering the sign of $\frac{\mathrm{d}y}{\mathrm{d}x}$ at $x = \frac{1}{2}$, 1 and $\frac{5}{4}$. Rather fewer were entirely happy to use the given bounds on e to help them do so, with many going off to lengthier (although often equally correct) workings-out. (In the final part, the use of $e < 3$ would have done the trick.) Those candidates who used approximations rather than inequalities were missing the point, as were those who tried to use $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ without actually knowing the exact values of x which they could use in it.