

STEP II, 2007, Q13 MS

Q13 The first couple of terms of the series expansion for e gives the opening result, which you are obviously intended to exploit later on in the question. Next, p (at least 1 matching pair) is best considered in the form $1 - p$ (no matching pairs), and you get (with a little imagination) a whole load of fractions of the form $\frac{n-r}{n}$ which can be approximated by the exponential result given at the outset. The laws of indices and a bit of summation of an AP then sort out the rest of the first problem.

The next two parts each involve working with an inequality, and the second requires another use of the initial exponential result. Each employs the remarkably accurate rational approximation to $\ln 2$ given in the question.

Answers: 23 ; 253.



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