

## STEP II, 2006, Q2

- 2 Using the series

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots,$$

show that  $e > \frac{8}{3}$ .

Show that  $n! > 2^n$  for  $n \geq 4$  and hence show that  $e < \frac{67}{24}$ .

Show that the curve with equation

$$y = 3e^{2x} + 14 \ln\left(\frac{4}{3} - x\right), \quad x < \frac{4}{3}$$

has a minimum turning point between  $x = \frac{1}{2}$  and  $x = 1$  and give a sketch to show the shape of the curve.



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