2. (*a*) Show that the binomial expansion of $(4+5x)^{\frac{1}{2}}$ in ascending powers of x, up to and including the term in x^2 is

$$2 + \frac{5}{4}x + kx^2,$$

giving the value of the constant k as a simplified fraction.

(4)

(*b*) (i) Use the expansion from part (a), with $x = \frac{1}{10}$, to find an approximate value for $\sqrt{2}$.

Give your answer in the form $\frac{p}{q}$, where p and q are integers.

(ii) Explain why substituting $x = \frac{1}{10}$ into this binomial expansion leads to a valid approximation.

(4)

(Total for Question 2 is 8 marks)