6. (i) (a) Sketch a graph of the curve with equation

$$y = \frac{1}{5^x} + 3 \qquad x \in \mathbb{R}$$

Show on your sketch

- the coordinates of any points at which the curve crosses the axes
- the equation of any asymptotes

(3)

(b) Using logarithms and making your method clear, solve the equation

$$\frac{1}{5^x} + 3 = 23$$

giving the answer to 3 significant figures.

(2)

(ii) Given that $\log_4 x = a$, find in simplest form in terms of a

(a) $\log_4(64x)$

(2)

(b) $\log_4\left(\frac{2}{x^2}\right)$

(3)

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Question 6 continued

(Total for Question 6 is 10 marks)

7. (a) Find, in ascending powers of x, up to and including the term in x^2, the binomial expansion of

$$\left(1+\frac{5}{16}x\right)^{10}$$

fully simplifying each coefficient.

(4)

(b) Use $x=\frac{1}{10}$ and the answer to part (a) to show that an estimate for $\left(\frac{33}{32}\right)^{10}$ is

$$\frac{1389}{k}$$

where k is an integer to be found.

(3)

(c) Hence find a rational estimate for $\sqrt[10]{1389}$

(2)

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