**5** The curve $C$ has polar equation $r = \theta e^{\frac{1}{8}\theta}$, for $0 \leqslant \theta \leqslant 2\pi$.

**(b)** Find the area of the region bounded by $C$ and the initial line, giving your answer in the form $\left(p\pi^2 + q\pi + r\right)e^{\frac{1}{2}\pi} + s$, where $p$, $q$, $r$ and $s$ are integers to be determined. [6]

**(c)** Show that, at the point of $C$ furthest from the initial line,

$$\theta\cos\theta + \left(\tfrac{1}{8}\theta + 1\right)\sin\theta = 0$$

and verify that this equation has a root between 5 and 5.05. [5]