5 Fig. 5 shows part of the curve $y = \operatorname{cosec} x$ together with the x- and y-axes.
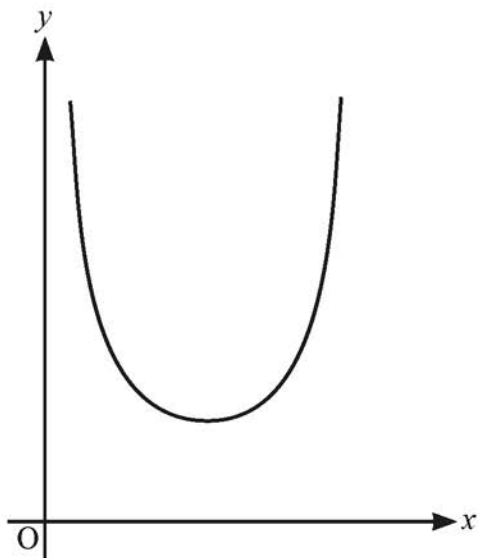

Fig. 5

(a) For the section of the curve which is shown in Fig. 5, write down

    (i) the equations of the two vertical asymptotes, **[2]**

    (ii) the coordinates of the minimum point. **[1]**

(b) Show that the equation $x = \operatorname{cosec} x$ has a root which lies between $x = 1$ and $x = 2$. **[2]**

(c) Use the iteration $x_{n+1} = \operatorname{cosec}(x_n)$, with $x_0 = 1$, to find

    (i) the values of x_1 and x_2, correct to 5 decimal places, **[1]**

    (ii) this root of the equation, correct to 3 decimal places. **[1]**

(d) There is another root of $x = \operatorname{cosec} x$ which lies between $x = 2$ and $x = 3$.

    Determine whether the iteration $x_{n+1} = \operatorname{cosec}(x_n)$ with $x_0 = 2.5$ converges to this root. **[1]**

(e) Sketch the staircase or cobweb diagram for the iteration, starting with $x_0 = 2.5$, on the diagram in the Printed Answer Booklet. **[3]**