Ex Sketch $y = x \ln x$

① x-int $0 = x \ln x$ Either $\begin{cases} x=0 \\ \ln x = 0 \end{cases}$

If $x=0$, $y = (0)\ln(0) =$ undef'd.

$\ln x = 0 \to x = 1$ $y(1) = (1)\ln(1) = 0$

$(1,0)$

y-int $\to x=0 \to$ $y =$ undef'd.

② VA $x=0$ $\lim_{x\to 0^+} x \ln x = \lim_{x\to 0^+} \frac{\ln x}{1/x}$

(L'H) $= \lim_{x\to 0^+} \frac{1/x}{-1/x^2} = \lim_{x\to 0^+} \frac{-x^2}{x} = 0^-$

* Outcome: y tends towards 0 and $x \to 0^+$, but $y(0)$ is undef'd.

$x=0, y=0$ is an open circle

③ HA $\lim_{x\to\infty} x \ln x = 0$

$\lim_{x\to -\infty} x \ln x =$ undef'd.

④ CP $y = x \ln x$ $\quad y' = \ln x + 1$

$0 = y' = \ln x + 1$

$-1 = \ln x$

$x = \frac{1}{e}$

$y(\frac{1}{e}) = -\frac{1}{e}$ $\quad$ CP $(\frac{1}{e}, -\frac{1}{e})$

⑤ PI $\quad y'' = \frac{1}{x}$ $\quad 0 = y'' \rightarrow$ no sol'n

$\rightarrow$ NO PI

⑥ OK

⑦ ~~MAX~~/MIN $\quad x = \frac{1}{e} \leftarrow$ MIN

$y''(\frac{1}{e}) = \frac{1}{\frac{1}{e}} = e > 0$

⑧ OK

⑨

	x	$\ln x$	y
$(0,1)$	+	−	−
$(1,\infty)$	+	+	+

	$\ln x$	$+1$	y'
$(0,\frac{1}{e})$	−		−
$(\frac{1}{e},\infty)$	+		+

	x	y''
$(0,\infty)$	+	+