Critical Points & Inflection Points

ex) Find all CP & IP for $y = e^x - x - 1$.

*CP: 1st deriv = 0 or DNE (max/min) (corner, cusp, v. tang)

* IP: 2nd deriv = 0 (concavity changes)

$y = e^x - x - 1$

$y' = e^x \ln e - 1$

$0 = e^x - 1$

$1 = e^x$

$0 = x$ (min)

$y' = e^x - 1$

$y'' = e^x$

$0 = e^x$

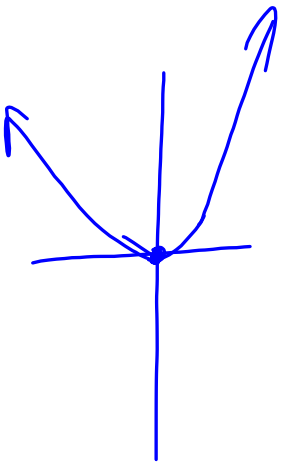
$\ln(0) = \ln e^x$

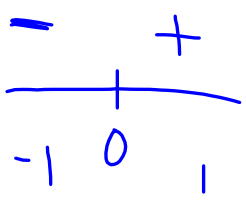
$\ln 0 = x \ln e$

$\frac{\ln 0}{\ln e} = x$

$\frac{\ln 0}{1} = x$ DNE

No I.P.

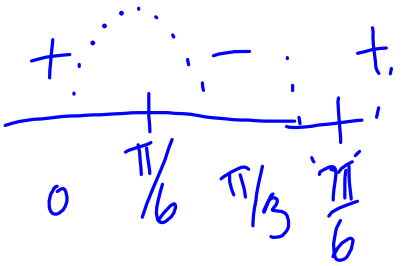




$e^{-1} - 1$ $e^1 - 1$

(0, 0)

ex) Find all CP & IP for $y = \sin(x) + \sqrt{3}\cos(x)$ $(+2\pi k)$



$y' = \cos(x) - \sqrt{3}\sin(x)$

$0 = \cos(x) - \sqrt{3}\sin(x)$

$\frac{\sqrt{3}\sin x}{\sin x} = \frac{\cos x}{\sin x}$

$\sqrt{3} = \cot x$

$x = \pi/6 + 2\pi k$, $7\pi/6 + 2\pi k$ $\Big\}$ $\pi/6 + \pi k, k \in Z$

$y'' = -\sin(x) - \sqrt{3}\cos(x)$

$0 = -\sin(x) - \sqrt{3}\cos(x)$

$\frac{\sin x}{\cos x} = \frac{-\sqrt{3}\cos(x)}{\cos(x)}$

$\tan x = -\sqrt{3}$

$x = 2\pi/3 + 2\pi k, k \in Z$

$5\pi/3 + 2\pi k, k \in Z$

$\left(\frac{\pi}{6} + 2\pi k, 2\right)$, MAX ($k \in Z$)

$\left(\frac{7\pi}{6} + 2\pi k, -2\right)$, MIN ($k \in Z$)

$\left(\frac{2\pi}{3} + \pi k, 0\right)$ ($k \in Z$) are the I.P.'s

If needed concavity...