1. $\lim_{h\to 0}\frac{\ln(4+h)-\ln(4)}{h}$ is

2. Find f'(4) if f(x) = ln x.

$f'(x)=\frac{1}{x}$

$f'(4)=\frac{1}{4}$

These are exactly the same problems.

Def'n of Derivative

$$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

4) Let p and q be real numbers and let f be the function defined by

$$f(x)=\begin{cases}1+2p(x-1)+(x-1)^2 & x\le 1\\ qx+p & x>1\end{cases}$$

$\xrightarrow{\frac{d}{dx}} 0+2p+2(x-1)'\cdot 1$

a) Find the values of q, in terms of p, for which f is continuous at $x=1$
b) Find the values of p and q for which f is differentiable at $x=1$
c) If p and q have the values determined in part b, is f'' a continuous function? Justify your answer.

a) $1+2p(1-1)+(1-1)^2=q\cdot 1+p$

$1=q+p$

$\star\ 1-p=q$

b) $2p+2(x-1)=q$

$2p+2(1-1)=q$

$\star\ 2p=q$

$1-p=q$

$2p=1-p$

$3p=1$

$p=\frac{1}{3}\rightarrow q=\frac{2}{3}$

c) $f(x)=\begin{cases}1+2\cdot\frac{1}{3}(x-1)+(x-1)^2, & x\le\\ \frac{2}{3}x+\frac{1}{3}, & x>1\end{cases}$

$f'(x)=\begin{cases}\frac{2}{3}+2(x-1), & x\le 1\\ \frac{2}{3}, & x>1\end{cases}$

$f''(x)=\begin{cases}2, & x\le 1\\ 0, & x>1\end{cases}$

The second derivative is not continuous @ $x=1$.

$\lim_{x\to 1^-}f''(x)=2$

$\lim_{x\to 1^+}f''(x)=0.$

5)

A function f is continuous on the closed interval $[-3, 3]$ such that $f(-3) = 4$ and $f(3) = 1$. The functions f' and f'' have the properties given in the table below.

x	$-3 < x < -1$	$x = -1$	$-1 < x < 1$	$x = 1$	$1 < x < 3$
$f'(x)$	Positive	Fails to exist	Negative	0	Negative
$f''(x)$	Positive	Fails to exist	Positive	0	Negative

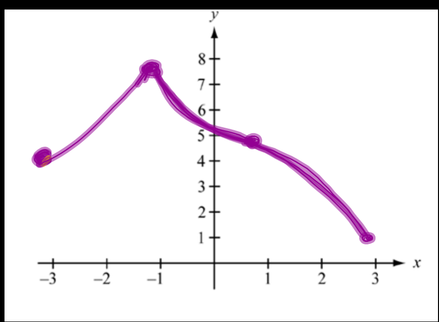
ccu ccu ccD

(a) What are the x-coordinates of all absolute maximum and absolute minimum points of f on the interval $[-3, 3]$? Justify your answer.

(b) What are the x-coordinates of all points of inflection of f on the interval $[-3, 3]$? Justify your answer.

(c) On the axes provided, sketch a graph that satisfies the given properties of f.

(b) A point of inflection occurs when $f''(x)$ goes from positive to negative or negative to positive. According to the chart, $f''(x)$ goes from positive to negative @ $x=1$. Therefore, $f(x)$ has a point of inflection at the x-value of 1.



At $x=-1$, $f(x)$ has an absolute maximum because $f'(x)$ goes from positive to negative @ $x=-1$ and $f(-3)=4$. Since $f'(x)$ is positive from $x=-3$ to $x=-1$, $f(x)$ is increasing on $(-3,-1)$ $\therefore f(-1)>f(-3)$ making $x=-1$ the x-value for the absolute maximum.

.Since $f'(x)$ is negative on $(-1,1)$ and $(1,3)$, $f(x)$ is decreasing on those intervals. Therefore, $f(x)$ has an absolute minimum at $x = 3$.