STUDENT NAME:

Calculus 1550, section 20. Thursday, October 23, 2003. Nineteenth quiz

1. [3 points] Some functions on the interval $[0, 2]$:

$A.\ \dfrac{x+1}{x-1}$	on $[0,2]$	$D.\ \lvert x-1\rvert$	on $[0,2]$
$B.\ \dfrac{x-1}{x+1}$	on $[0,2]$	$E.\ \lvert x^2-x+1\rvert$	on $[0,2]$
$C.\ x^3+x-1$	on $[0,2]$	$F.\ \lvert x^3+x-1\rvert$	on $[0,2]$

Which of the above functions satisfy the hypothesis of the mean value theorem on $[0, 2]$?

B, C, E

2. [7 points] For one of the above functions of your choice, which satisfys the hypothesis of the mean value theorem on $[0, 2]$, find all values c in $[0, 2]$ such that the conclusion of the mean value theorem hold.

B: $\left(\dfrac{x-1}{x+1}\right)' = \dfrac{(x+1)-(x-1)}{(x+1)^2} = \dfrac{2}{(x+1)^2}$

$f(0) = -1$
$f(2) = 1/3$ so average rate of change is $\dfrac{1/3 - -1}{2-0} = \dfrac{4/3}{2} = 2/3$

now solve for $f'(x) = 2/3$: $\dfrac{2}{(x+1)^2} = 2/3 \Rightarrow 3 = (x+1)^2$
$\Rightarrow x+1 = \pm\sqrt{3} \Rightarrow x = \pm\sqrt{3}-1 = -2.73$ or 0.73

only $0.73 \in [0,2]$.

so solution is $\boxed{c \approx 0.73}$

C: $(x^3+x-1)' = 3x^2+1$

$f(0) = -1$
$f(2) = 9$ average rate of change $= \dfrac{9 - -1}{2-0} = \dfrac{10}{2} = 5$

if $3x^2+1 = 5$ then $3x^2 = 4$ $x^2 = 4/3 \Rightarrow x = \pm 2/\sqrt{3} = \pm 1.1547..$

in $[0,2]$, a value of c with $f'(c) = 5$ is $\boxed{\approx 1.154}$

E: on 0,2, $|x^2-x+1| = x^2-x+1$ (since x^2-x+1 is always +ve, as no real roots)

$(x^2-x+1)' = 2x-1$

$f(0) = 1$
$f(2) = 4-2+1 = 3$ average change $= \dfrac{3-1}{2-0} = \dfrac{2}{2} = 1$

$2x-1 = 1 \Rightarrow 2x = +2 \Rightarrow \boxed{x = 1}$