MATH 101.10 (112)
Quiz 5 (Sects. 3.10-4.1) **Duration: 20mn**

Name: **ID number:**

1.)(3pts)Find the linearization of the function $f(x) = e^{-\sqrt{2x+1}}$ at $a = 0$.
2.)(3pts)If $\cosh x = \frac{5}{3}$, then find the value of $3\sinh x - 5\tanh x$.
3.)(4pts)Find local maximum and minimum of the function $g(x) = x^4(x-1)^3$.

1.) $f(x) = e^{-\sqrt{2x+1}}$

$L(x) = f(0) + f'(0)\,x$

$f'(x) = -\frac{2}{2\sqrt{2x+1}}\, e^{-\sqrt{2x+1}}$, $\Rightarrow f'(0) = -e^{-1}$

$f(0) = e^{-1}$

$\boxed{L(x) = e^{-1} - xe^{-1}}$

2) $\cosh x = \frac{5}{3} \iff \frac{e^x + e^{-x}}{2} = \frac{5}{3}$

$3e^x + 3e^{-x} = 10$

$3e^{2x} - 10e^x + 3 = 0$

$\Delta = 100 - 36 = 64 = 8^2$

$e^x = \frac{10-8}{6} = \frac{1}{3} \Rightarrow x = \ln(\frac{1}{3})$

$e^x = \frac{10+8}{6} = 3 \Rightarrow x = \ln 3$

Case1: if $x = -\ln 3$

$3\sinh x - 5\tanh x = 3\frac{e^{\ln\frac{1}{3}} - e^{-\ln\frac{1}{3}}}{2} - 5\frac{e^{\ln\frac{1}{3}} - e^{-\ln\frac{1}{3}}}{e^{\ln\frac{1}{3}} + e^{-\ln\frac{1}{3}}}$

$= 3\frac{\frac{1}{3} - 3}{2} - 5\frac{\frac{1}{3} - 3}{\frac{1}{3} + 3}$

$= -4 + 4$

$= 0$

Case2: if $x = \ln 3$

$3\sinh x - 5\tanh x = 3\frac{e^{\ln 3} - e^{-\ln 3}}{2} - 5\frac{e^{\ln 3} - e^{-\ln 3}}{e^{\ln 3} + e^{-\ln 3}}$

$= 3\frac{3 - \frac{1}{3}}{2} - 5\frac{3 - \frac{1}{3}}{3 + \frac{1}{3}}$

$= 4 - 4 = 0$

3.) $g(x) = x^4(x-1)^3$

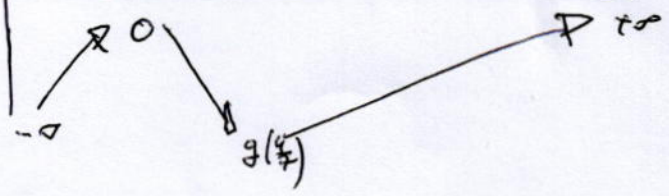
$g'(x) = 4x^3(x-1)^3 + 3(x-1)^2 x^4$

$= (x-1)^2\left[4x^3(x-1) + 3x^4\right]$

$= x^3(x-1)^2\left[4x - 4 + 3x\right]$

$= x^3(x-1)^2(7x-4)$

x	$-\infty$		0		$\frac{4}{7}$		1		$+\infty$
$g'(x)$		$+$	0	$-$	0	$+$	0	$+$	



g has a local maximum at 0 and a local minimum at $4/7$.