1. (10%) (a) What is the definition of the *Definite Integral* of a function $f(x)$ over $[a,b]$?　　(b) What is the definition of *The Fundamental Theorem of Calculus?*

2. (10%) Find the limits: (a) $\lim\limits_{x\to 1}\dfrac{x^{50}-1}{x-1}$.　(b) $\lim\limits_{x\to\infty}\dfrac{x+\sin x+2\sqrt{x}}{x+\sin x}$.

3. (15%) Let $f(x)=|x|$. (a) Show that $f(x)$ is continuous at $x=0$.　(b) Show that $f(x)$ is not differentiable at $x=0$.

4. (10%) Let $f(x)=\dfrac{x-1}{x+1}$. Use the definition of the derivative of a function to find the instantaneous rate of change of $f(x)$ at $x=-1/2$.

5. (10%) Find dy/dx where $y=\displaystyle\int_{2}^{x^{2}}\sin(t^{3})\,dt$.

6. (15%) Sketch the graph of the function $f(x)=\dfrac{x^{2}-9}{x^{2}+1}$.　$(1/\sqrt{3}\approx 0.58)$ (identify relative extrema, inflection points, concavity, and asymptotes if any)

7. (10%) Find the values of p for which the integral $\displaystyle\int_{2}^{\infty}\dfrac{dx}{x(\ln x)^{p}}$ converges.

8. (10%) Investigate the convergence of the series.
   (a) $\displaystyle\sum_{n=1}^{\infty}\dfrac{4^{n}n!n!}{(2n)!}$.　(b) $\displaystyle\sum_{n=0}^{\infty}ar^{n}$, where a is a nonzero real number.

9. (10%) Find the volume of the solid that lies under the surface $z=xy^{2}$ and above the triangle with vertices $(0,0),(1,0)$ and $(1,1)$.

試題隨卷繳交