1. Given the information $g(1)=2$, $g'(1)=4$, $g(4)=2$ and $g'(4)=-1$, find $f'(1)$ where (a) $f(x)=\frac{g(x)}{x^2+1}$ and (b) $f(x)=g(g^2(x))$ (10%)

2. Find values of a and b so that the function $f(x)=\begin{cases} x^2\cos(1/x)+2x, & x<0 \\ a\sqrt{x+1}+b, & x\ge 0 \end{cases}$ is differentiable at 0. (10 %)

3. Let $f(x)=3x^{2/3}+\frac{3}{5}x^{5/3}$.
   (a) Find x- and y- intercepts of $f(x)$. (4 %)
   (b) Find relative extrema and points of inflection for the graph of $f(x)$. (8%)
   (c) Sketch the graph (3%)

4. Let $f(x)=\frac{x^3+2x-3}{(8-9x)^{1/3}}(x^2+x+2)^x$. Find $f'(0)$ and $f'(1)$. (10%)

5. Evaluate $F'(2)$ for $F(x)=\int_0^{x^3}\frac{e^t}{\sqrt{1+t}}\,dt$. (5%)

6. Evaluate $f_x(0,0)$ and $f_y(0,0)$ and determine whether $f(x,y)$ is continuous at $(0,0)$, where $f(x,y)=\begin{cases} \frac{x^3-3y^3}{x^2+y^2} & (x,y)\ne(0,0) \\ 0 & (x,y)=(0,0) \end{cases}$ (10%)

7. Find the Maclaurin series for $\frac{1}{x^2+4}$ and find the interval of convergence of that series. (10%)

8. Locate all relative extrema and saddle points if any for $f(x,y)=xy-\frac{4}{x}+\frac{2}{y}$ (10%)

9. Sketch the region of the integration $\int_0^{\sqrt{\pi}}\int_y^{\sqrt{\pi}}\sin(x^2)\,dx\,dy$, then reverse the order of integration and finally evaluate the resulting integral. (10%)

10. Evaluate the integral $\oint_C \tan^{-1}y\,dx-\frac{y^2x}{1+y^2}\,dy$ where the curve C is oriented counterclockwise and is a triangle with vertices $(-1,-1)$, $(2,0)$, $(-1,3)$. (10%)