請務必附上計算過程，否則不予計分。

1. (18 pts) Find the limit if it exists, or show that the limit does not exist.

(a) $\lim\limits_{x\to\infty}(\sqrt{4x^2+3x+1}-2x)$　　　　(b) $\lim\limits_{(x,y)\to(0,0)}\frac{2xy^3}{x^2+y^6}$

(c) $\lim\limits_{n\to\infty}\sum\limits_{i=1}^{n}\frac{n}{n^2+i^2}$

2. (12 pts) Evaluate the following integrals.

(a) $\int\frac{2x}{x^2-x-6}\,dx$　　　　(b) $\int_0^1\int_y^1\frac{\sin x}{x}\,dx\,dy$

3. (10 pts) Calculate the indicated derivatives.

(a) Let $f(x,y)=x^3+y^3-2xy$. Find $\frac{\partial f}{\partial x}$.

(b) Let $g(x)=\int_{2x}^{3x}e^{t^2}\,dt$. Find $g'(x)$.

4. (10 pts) Determine if the given series is convergent or divergent. Please provide a reason.

(a) $\sum\limits_{n=1}^{\infty}(-1)^n\frac{n}{\sqrt{n^2+1}}$　　　　(b) $\sum\limits_{n=1}^{\infty}\frac{n5^n}{3^{2n}}$

5. (10 pts) Find an equation of the tangent plane to the surface $xy+yz+xz=3$ at the point $(1,1,1)$.

6. (10 pts) Find the absolute maximum and absolute minimum values of $f(x,y)=2x^3+y^4$ on the disk $x^2+y^2\le1$.

7. (10 pts) Suppose $f(x)$ is a differentiable function. If $f(0)=1$ and $3\le f'(x)\le5$ for all values of x, show that $4\le f(1)\le6$.

8. (10 pts) Find the Maclaurin series for the function $f(x)=x^2\sin 2x$.

9. (10 pts) Sketch the polar curve $r=1+\cos\theta$ and find the area of the region enclosed by the curve.