1. (20 pts). Let $\vec{a}=(1,1,0)$, $\vec{b}=(1,0,1)$ be 3×1 vectors in the Euclidean space. In addition, let $\vec{c}$ be a 3×1 vector in the Euclidean space. Assume that $\vec{a}$, $\vec{b}$ and $\vec{c}$ has the following relationship: $\vec{c}\cdot(\vec{a}\times\vec{b})=0$. Give the solution set of $\vec{c}$. (**Note:** The solution set may contain one or more than one solutions of $\vec{c}$.)

2. (20 pts) The Euler formula: $e^{i\theta}=\cos\theta+i\sin\theta$.

   (a) (10 pts) Apply the Euler formula to derive the following equality:

   $$\sin(\alpha+\beta)=\sin(\alpha)\cos(\beta)+\cos(\alpha)\sin(\beta)$$

   (b) (10 pts) Apply the Euler formula to derive $d\cos\theta/d\theta$ and $d\sin\theta/d\theta$. **Note:** no credit will be given unless the Euler formula is applied in the derivation.

3. (20 pts) Find the following areas.

   (b) (10 pts) Let A be the area of the region bounded above by $y=x+2$ and below by $y=x^2$. Find A.

   (a) (10 pts) Let $B=\int_{-1}^{1}\frac{1}{x^2}dx$. Give B.

4. (20 pts) Solve the following problems.
   (a) (10 pts) Let $y=1/\ln x$. Give dy/dx.

   (b) (10 pts) Let $y=\int_{3}^{x^2+x}\frac{1}{t^3+1}dt$. Derive dy/dx

5. (20 pts) Evaluate the following limits:

   (a) (5 pts) $\lim_{n\to\infty}(1+\frac{1}{c})^n=?$, where $c>0$.

   (b) (5 pts) $\lim_{n\to\infty}(1+\frac{1}{n})^c=?$, where $c>0$.

   (c) (10 pts) Is it true that $\lim_{n\to\infty}(1+\frac{1}{n})^n=1$? Explain your answer.