Note:

- **Organize your answers in the same order as the problems.**
- **Write legibly**

1- Find the formula of $\tan^{-1} z$ that uses the complex log. Then use it to find all values of $\tan^{-1}(1+i)$.

2- Write $\cosh(z)$ in the form $u(x,y)+iv(x,y)$ indicating your steps. Then use it to find the image of the line $y=\dfrac{\pi}{4}$.

3- Let $z_n = x_n + iy_n$, $n \geq 1$ .Show that (z_n) is a Cauchy sequence , if and only if, (x_n) and (y_n) are Cauchy.

4- Write the statement of the fundamental theorem of algebra, then prove it.

5- Evaluate $\displaystyle\int_\gamma \frac{\sinh(z)}{(z^2+\pi^2)^2}$, where γ is the circle $\left|z-2i\right| = 2$ in the positive direction.