9(a) $f(z) = 2x^3 + 6xy^2 - 2x + i(2y^3 + 6x^2y - 2y)$

$\therefore u = 2x^3 + 6xy^2 - 2x, \quad v = 2y^3 + 6x^2y - 2y$ 1

C-R eqns: $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y} \Rightarrow$ ~~$6x^2 + 6y^2 - 2 = 6y^2 + 6x^2 - 2$~~

Identically satisfied 2

$\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$: $12xy = -(12xy) \Rightarrow \boxed{xy = 0}$ 1

$\therefore$ Either $x = 0 \Rightarrow$ all of the y-axis
or $y = 0 \Rightarrow$ all of the x-axis
} & Also derivatives are cont. there.

3

So differentiable only along x-axis or y-axis.

$f(z)$ is nowhere analytic since it is not differentiable in any neighbourhood. 2

9

(b) $u = x^2 - y^2 + \sin x \cosh y$

$\frac{\partial v}{\partial y} = \frac{\partial u}{\partial x} = 2x + \cos x \cosh y$. Integrate w.r.t. y 1

$\Rightarrow v = 2xy + \cos x \sinh y + k(x)$. Sub. into 2

the second C-R eqn $\frac{\partial v}{\partial x} = -\frac{\partial u}{\partial y} \Rightarrow$