



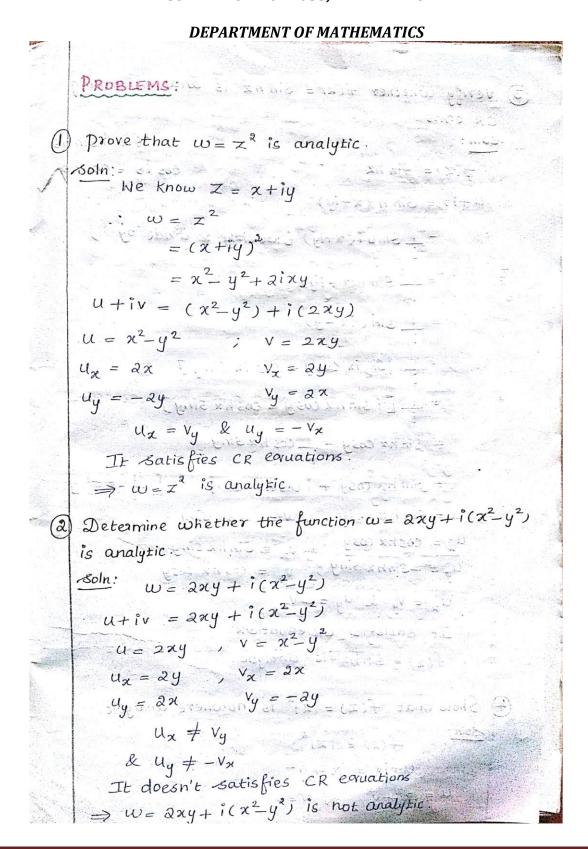
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DEPARTMENT OF MATHEMATICS Necessary Condition (Cartesian Coordinates): (or) Cauchy-Riemann Equations: If the function f(z) = u(x,y) + iv(x,y)is analytic in a Diegion R of the Z plane, then (i) $\frac{\partial u}{\partial n}$, $\frac{\partial u}{\partial y}$, $\frac{\partial v}{\partial x}$ and $\frac{\partial v}{\partial y}$ exists --- $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y} \text{ and } \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$ at every point in that region. Sufficient Conditions: If the function f(z) = u(x,y) + iv(x,y) is analytic in a region R of the Z-plane of (i) Ux, uy, vx & vy are exists and all are continuous (ii) $u_{\chi} = V_{y}$ and $u_{y} = -V_{\chi}$. Necessary Condition (polar Coordinates): If the function w = f(z) = u(r,0) + iv(r,0)is analytic in a Diegion R of the z-plane then (i) if $\frac{\partial u}{\partial r}$, $\frac{\partial u}{\partial \theta}$, $\frac{\partial v}{\partial r}$ and $\frac{\partial v}{\partial \theta}$ exists. (ii) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial o}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial o}$ Sufficient Conditions: 42 ONLY 100 CONTROL ST. CE 34 CH If the function $\omega = f(z) = u(r,0) + iv(r,0)$ is analytic in a Dregion R of the Z-plane, then (i) $\frac{\partial u}{\partial r}$, $\frac{\partial u}{\partial \theta}$, $\frac{\partial v}{\partial r}$ and $\frac{\partial v}{\partial \theta}$ exists & all are Continuous (ii) $\frac{\partial u}{\partial x} = \frac{1}{x} \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial x} = -\frac{1}{x} \frac{\partial u}{\partial \theta}$









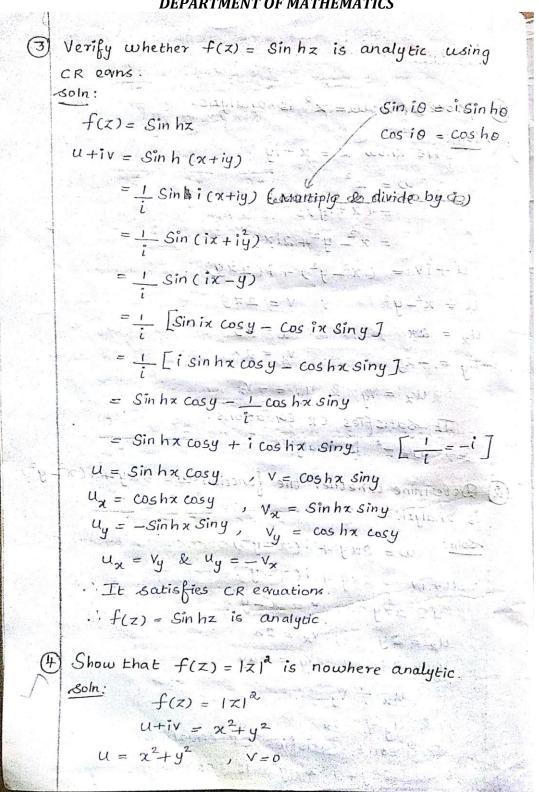




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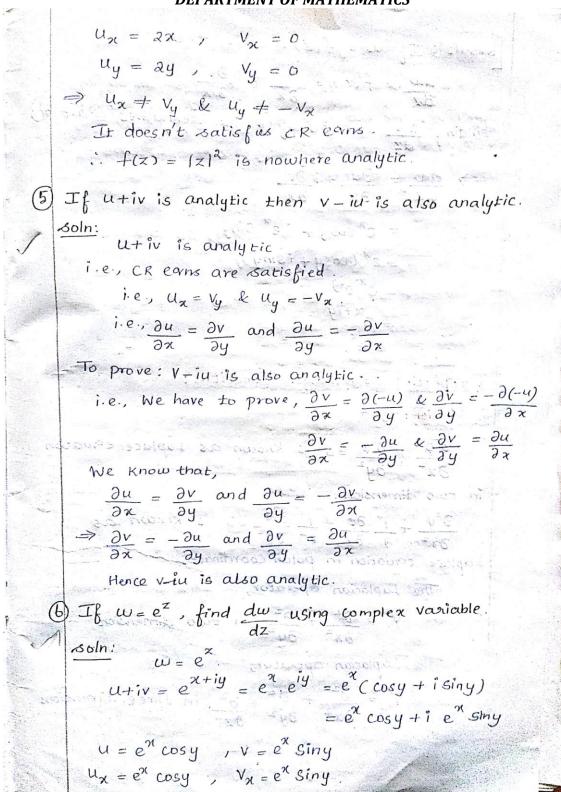






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Result: If
$$w = f(z) = u + iv$$
 then

$$\frac{dw}{dz} = f'(z) = \frac{\partial u}{\partial x} + i \frac{\partial v}{\partial x}$$

Finding $\frac{dw}{dz}$ in terms of postial destivatives $w.r. \in \pi$)

$$\Rightarrow \frac{dw}{dz} = \frac{\partial u}{\partial x} + i \frac{\partial v}{\partial x}$$

$$= e^{\pi} \cos y + i e^{\pi} \sin y$$

$$= e^{\pi} (\cos y + i \sin y)$$

$$= e^{\pi} e^{iy}$$

$$= e^{\pi} e^{iy}$$

$$= e^{\pi} e^{iy}$$

$$= e^{\pi} e^{\pi} e^{\pi}$$