Appendix A

Some Useful Formulae for Complex Analysis

1. Complex Power: $z^c = e^{c \ln z}$

2. Euler's Formula: $e^{ix} = \cos x + i \sin x$

3. De Moivre's Formula: $(\cos x + i \sin x)^n = \cos nx + i \sin nx$

4. Cauchy-Riemann equations:

$$u_x = v_y, \quad v_x = -u_y, \quad \text{or} \quad u_r = \frac{1}{r} v_\theta, \quad v_r = \frac{-1}{r} u_\theta$$

5. Derivative, if exists: $f'(z) = u_x + i v_x = e^{-i\theta}(u_r + i v_r)$

6. Cauchy Integral Formula:

$$\int_C \frac{f(z)}{(z - z_o)^m} dz = \frac{2\pi i}{(m-1)!} \frac{d^{(m-1)}}{dz^{(m-1)}} f(z)|_{z=z_o}$$

Some Useful Formulae for Vector Calculus

Let $\mathbf{F} = F_1\,\mathbf{i} + F_2\,\mathbf{j} + F_3\,\mathbf{k}$.

1. Scalar Triple Product: $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) = \mathbf{c} \cdot (\mathbf{a} \times \mathbf{b}) = \mathbf{b} \cdot (\mathbf{c} \times \mathbf{a})$

2. Gradient: $\nabla f = \frac{\partial f}{\partial x}\,\mathbf{i} + \frac{\partial f}{\partial y}\,\mathbf{j} + \frac{\partial f}{\partial z}\,\mathbf{k}$

3. Divergence: $\nabla \cdot \mathbf{F} = \frac{\partial F_1}{\partial x} + \frac{\partial F_2}{\partial y} + \frac{\partial F_3}{\partial z}$

4. Curl: $\nabla \times \mathbf{F} = \begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ F_1 & F_2 & F_3 \end{vmatrix}$

5. Gauss Theorem: $\iiint_T \nabla \cdot \mathbf{F}\, dv = \iint_S \mathbf{F} \cdot \mathbf{n}\, dA$

6. Stokes Theorem: $\iint_S (\nabla \times \mathbf{F}) \cdot \mathbf{n}\, dA = \int_C \mathbf{F} \cdot \mathbf{dr}$