PHYSICS 270 | University of Maryland | O.W. Greenberg
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Math Minimum

1. If $px^2 + qx + r = 0$, write the formula for x in terms of p, q and r.
2. Write the first three terms of the Taylor (power) series for $f(t)$ expanded around $t = 0$.
3. Write the binomial expansion for $(a + b)^3$, assuming $a > b$.
4. Write the absolute value, $|z|$, of the complex number $z = x + iy$.
5. Write the Euler formula for $e^{i\theta}$.
6. If the complex number $z = x + iy$ is written in polar form as $z = \rho e^{i\theta}$, express x and y in terms of ρ and θ.
7. Express ρ and θ in terms of x and y.
8. Write the formula for $sin(A + B)$.
9. Write the formula for $cos(A + B)$.
10. Write the first two terms of the Taylor (power) series for $cos\theta$.
11. Write the first two terms of the Taylor (power) series for $sin\theta$.
12. Write two equivalent general solutions of $\ddot{f} + \omega^2 f = 0$, where $f = f(t)$ and $\dot{f} = df(t)/dt$, etc.
13. The ith component of the cross product $\mathbf{a} \times \mathbf{b}$ can be written as $(\mathbf{a} \times \mathbf{b})_\mathbf{i} = \epsilon_\mathbf{ijk} \mathbf{a_j} \mathbf{b_k}$ where i, j, $k = 1, 2, 3$ stand for x, y, z and repeated indices are summed from 1 to 3. The symbol ϵ_{ijk} is totally antisymmetric in its indices and $\epsilon_{123} = 1$. This implies that $\epsilon_{123} = \epsilon_{312} = \epsilon_{231} = 1$, $\epsilon_{321} = \epsilon_{213} = \epsilon_{132} = -1$, and $\epsilon_{ijk} = 0$ if any two indices are the same. Show that the triple scalar product $(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{c} = \epsilon_\mathbf{ijk} \mathbf{a_j} \mathbf{b_k} \mathbf{c_i}$. This shows that the triple scalar product can be written in several equivalent ways, $(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{c} = \mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) = (\mathbf{b} \times \mathbf{c}) \cdot \mathbf{a} = -(\mathbf{c} \times \mathbf{b}) \cdot \mathbf{a}$, etc.