Equations

1. $P = \frac{dW}{dt} = IV$
2. $I = \frac{dq}{dt}$
3. $V = \frac{W}{q}$
4. $R = \frac{\rho L}{A}$
5. Ohm's Law: $V = IR$
6. Coulomb's Law: $\vec{F} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$
7. Kirchhoff's Voltage Law: $\sum V_i = 0$ (around a closed loop)
8. Kirchhoff's Current Law: $\sum I_i = 0$ (going into a node)
9. Conductance: $G = \frac{1}{R}$
10. Equivalent resistance: $R_{eq} = \frac{V_{test}}{I_{test}}$
11. Series capacitance: $\frac{1}{C_{total}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots$
12. Parallel capacitance: $C_{total} = C_1 + C_2 + \ldots$
13. Series inductor: $L_{total} = L_1 + L_2 + \ldots$
14. Parallel inductor: $\frac{1}{L_{total}} = \frac{1}{L_1} + \frac{1}{L_1} + \ldots$
15. $I_{cap} = C\frac{dV}{dt}$
16. $V_{ind} = L\frac{dI}{dt}$
17. Energy stored in capacitor: $\frac{1}{2}CV^2$
18. Energy stored in inductor: $\frac{1}{2}LI^2$
19. Voltage in RC circuit: $v_c(\infty) + (v_c(t_0) - v_c(\infty))\, e^{(\frac{-1}{RC})(t-t_0)}$
20. Current in RL circuit: $I_L(\infty) + (I_L(t_0) - I_L(\infty))\, e^{(\frac{-R}{L})(t-t_0)}$
21. Impedance of a capacitor: $\frac{-j}{\omega C}$
22. Impedance of an inductor: $j\omega L$
23. Equivalent impedance for impedances in series: $Z_{eq} = \sum_i^n Z_i$
24. Equivalent impedance for impedances in parallel: $\frac{1}{Z_{eq}} = \sum_i^n \frac{1}{Z_i}$
25. RMS value of signal: $S_{rms} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} s^2(t)dt}$
26. Maximum power extracted by a load in DC circuits: $\frac{Vth^2}{4R_{th}}$
27. Maximum power extracted by a load in AC circuits: $\frac{|\tilde{V}_{th}|^2}{8R_{th}}$
28. $Z_L = Z_{th}^*$ maximizes the transferred power.
29. Average power: $P_{avg} = \frac{V_m I_m}{2}\cos(\theta_v - \theta_i)$
30. Reactive power: $V_{ar} = Im(\frac{1}{2}\tilde{V}\tilde{I}^*)$
31. Apparent power: $P_{app} = \frac{|V_{rms}|^2}{|z|}$

(R_{eq}) Turn off all independent sources (dependent sources remain unchanged) and calculate the resulting resistance at the desired port. Notice that you may have to apply the i-v test if resistors cannot be combined through series and parallel connections, or if the circuit includes dependent sources.

(V_{th}) Leave the desired port open-circuited (i.e. no load connected) and find the voltage across it.

(I_N) Short-circuit the desired port (i.e. connect a short circuit across the port) and find the current through it.