Units: SI system: kg (kilogram), m (meter), s (second), C (coulomb); $\mathcal{A}$ (ampere)=C/s, V (volt)=J/C, F (farad)=C/V, Ω (ohm)=V/$\mathcal{A}$. $1\,\text{mm} = 10^{-3}\,\text{m}$, $1\,\text{cm} = 10^{-2}\,\text{m}$, $1\,\text{km} = 10^3\,\text{m}$; $1\,\text{N}$ (newton)=kg·m/s^2, $1\,\text{J}$ (joule)=N $\cdot$ m $=$ kg $\cdot$ m^2/s^2, $1\,\text{W}$ (watt)=J/s; prefixes: m (milli) 10^{-3}, μ (micro) 10^{-6}, n (nano) 10^{-9}, p(pico) 10^{-12}, k (kilo) 10^3, M (mega) 10^6.
Constants: $g = 9.8\,\text{m/s}^2$, $k_e = 9*10^9\,\text{N m}^2/\text{C}^2 = 1/(4\pi\epsilon_0)$, $\epsilon_0 = 8.85*10^{-12}\,\text{C}^2/(\text{N m}^2)$, $\mu_0 = 4\pi*10^{-7}\,T-m/A$. $e = -1.6*10^{-19}\,\text{C}$, $m_e = 9.11*10^{-31}\,\text{kg}$, $m_p \simeq m_n = 1.67*10^{-27}\,kg$
Volumes. Cylinder: $\pi R^2 h$, sphere: $\frac{4}{3}\pi R^3$, cone: $\frac{1}{3}\pi R^2 h$. **Areas:** Sphere: $4\pi R^2$

Quadratic equation. $ax^2 + bx + c = 0$, $x = \left(-b \pm \sqrt{b^2 - 4ac}\right)/(2a)$

Derivatives/integrals. $\frac{d}{dt}x^n = nx^{n-1}$, $\int x^n\,dx = \frac{1}{n+1}x^{n+1}$, $\int dx/x = \ln x$; $\int dx \left/ \sqrt{a^2 + x^2}\right. = \ln\left(x + \sqrt{a^2 + x^2}\right)$; $\int dx\,(a^2 + x^2)^{-\frac{3}{2}} = x/\left(a^2\sqrt{a^2 + x^2}\right)$

Vectors. If $\vec{c} = \vec{a}+\vec{b}$, then $c_x = a_x+b_x$, $c_y = a_y+b_y$, $c_z = a_z+b_z$ and $c = \sqrt{c_x^2 + c_y^2 + c_z^2}$. Dot product: $\vec{a}\cdot\vec{b} = a_xb_x+a_yb_y+a_zb_z = a*b*\cos\theta$. Cross product: $\hat{i}\times\hat{j} = \hat{k}$, $\hat{j}\times\hat{k} = \hat{i}$, $\hat{k}\times\hat{i} = \hat{j}$; $\vec{A}\times\vec{B} = (A_yB_z - A_zB_y)\hat{i} + (A_zB_x - A_xB_z)\hat{j} + (A_xB_y - A_yB_x)\hat{k}$; $\left|\vec{A}\times\vec{B}\right| = A*B*\sin\alpha$.

Coulombs Law: $F = k_e\frac{q_1q_2}{r^2}$, r-distance between charges; in vector form $\vec{F} = k_e\frac{q_1q_2}{r^2}\hat{r}$, $\hat{r} = \vec{r}/r$ - unit vector from charge q_1 to q_2, $k_e = 9*10^9$... Superposition: if charge q_1 acts on q_0 with $\vec{F}_{01}$, charge q_2 acts on q_0 with $\vec{F}_{02}$, etc., then $\vec{F}_{\text{net on }q_0} = \vec{F}_{01} + \vec{F}_{02} + \ldots$

Electric field. Definition: $\vec{E} = \vec{F}_0/q_0$ (charge q_0 is a "probe"). Field from a charge q: $E = k_e\frac{q}{r^2}$, r-distance between charge and observation point; in vector form $\vec{E} = k_e\frac{q}{r^2}\hat{r}$, $\hat{r} = \vec{r}/r$ - unit vector from charge q to the observation point, $k_e = 9*10^9$... Superposition: consider charges q_1, q_2, etc. and the observation point. If q_1 creates field $\vec{E}_1$ at the observation point, q_2 creates field $\vec{E}_2$, etc., then $\vec{E} = \vec{E}_1 + \vec{E}_2 + \ldots$.
Force on a charge placed in external field $\vec{E}$: $\vec{F} = q\vec{E}$.

Gauss Law. Flux through a small area A with $\vec{A}$ along the normal to the surface: $\Phi = \vec{E}\cdot\vec{A}$. Flux through a closed surface: $\oint \vec{E} \cdot d\vec{A} = q_{\text{enc}}/\epsilon_0$. Field $E(r)$ from a uniformly charged spherical shell with radius R and charge Q: $E(r < R) = 0$, $E(r > R) = k_eQ/r^2$. Field $E(r)$ from a uniformly charged infinite line with linear charge density λ: $E(r) = \lambda/(2\pi\epsilon_0 r)$. Field E from a uniformly charged infinite non-conducting plane with surface charge density σ: $E = \sigma/(2\epsilon_0)$.

From Phys 111:
Kinematics: $v = dx/dt$, $a = dv/dt = d^2x/dt^2$. Circular motion with constant speed: $\omega = v/R$, $a_c = v^2/R = \omega^2 R$, towards center.
The three Laws of motion: (1) If $\vec{F}_{net} = 0$ then $\vec{v} = const$; (2) $\vec{F}_{net} = m\vec{a}$; (3) $\vec{F}_{21} = -\vec{F}_{12}$
Work and power. $W_{AB} = \int_A^B \vec{F}\cdot d\vec{r}$. Power: $P = W/\Delta t = \vec{F}\cdot\vec{v}$.
Kinetic energy and work-energy theorem: $K = \frac{1}{2}mv^2$, $\Delta K = W$ where W is the *net* work (i.e. work by all forces).
Potential energy. For conservative forces (with path-independent work) introduce $U(\vec{r})$ so that $W_{AB} = U_A - U_B = -\Delta U$. If *only* conservative forces, then energy conservation: $K + U = const$.