Formulari:

Cinemàtica:

$\vec{r}(t)=x(t)\vec{i}+y(t)\vec{j}+z(t)\vec{k}$, $\vec{v}=\frac{d\vec{r}}{dt}$, $\vec{a}=\frac{d\vec{v}}{dt}$, $\vec{a}=\frac{d\vec{v}}{dt}=const \Rightarrow \vec{v}-\vec{v}_0=\int_0^t \vec{a}dt=\vec{a}t$, $\frac{d\vec{r}}{dt}=\vec{v}=\vec{v}_0+\vec{a}t \Rightarrow \vec{r}=\vec{r}_0+\vec{v}_0t+\frac{1}{2}\vec{a}t^2$, $v=\frac{ds}{dt}=R\frac{d\theta}{dt}=R\omega$,

$\frac{dv}{dt}=R\frac{d\omega}{dt}=R\alpha$, $\theta=\theta_0+\omega_0t+\frac{1}{2}\alpha t^2$, $a_t=\frac{dv}{dt}$, $a_n=-\frac{v^2}{r}$, $\vec{r}=\vec{r}'+\overrightarrow{o'o}$, $\vec{v}=\vec{v}'+\overrightarrow{V_{o'o}}$

Dinàmica:

$\sum_i \vec{F}_i=m\vec{a}$, $F_f\le\mu_eN$, $F_f=\mu_dN$, $\vec{p}=m\vec{v}$, $\sum_i\vec{F}_i=\frac{d\vec{p}}{dt}$, $I=\int_{t_i}^{t_f}F(t)dt=F\Delta t=mv_f-mv_i$, $W=\int_i^f\vec{F}\cdot d\vec{r}=\frac{1}{2}mv_f^2-\frac{1}{2}mv_i^2$, $E_c=\frac{1}{2}mv^2$, $P=\frac{dW}{dt}$,

$W_{r_i\to r_f}=-\Delta U=-(U_f-U_i)$, $U(\vec{r})=-\int_{\vec{r}_0}^{\vec{r}}\vec{F}\cdot d\vec{r}$, $E_m=E_c+U$, $\Delta E_m=W_{F\ NoConserv}$, $v=\omega R$, $\vec{L}=\sum_i\vec{r}_i\times\vec{p}_i$, $\vec{L}=I\vec{\omega}$, $I=\sum_i m_ir_i^2$, $\vec{\tau}=\sum_i\vec{r}_i\times\vec{F}_i$, $\vec{\tau}=\frac{d\vec{L}}{dt}=I\vec{\alpha}$,

$E_c=\frac{1}{2}Mv_{CM}^2+\frac{1}{2}I_{CM}\omega^2$, $\vec{r}_{CM}=\frac{\sum_{i=1}^N m_i\vec{r}_i}{\sum_{i=1}^N m_i}$, $\vec{p}=\sum_{i=1}^N\vec{p}_i=M\vec{v}_{CM}$, $\vec{F}_{ext}=M\vec{a}_{CM}$, $\vec{r}'_i=\vec{r}_i-\vec{r}_{CM}$, $\vec{u}_i=\vec{v}_i-\vec{v}_{CM}$, $\vec{p}'=\sum_{i=1}^N m_i\vec{u}_i=0$, $E_c=\frac{1}{2}Mv_{CM}^2+\frac{1}{2}\sum_{i=1}^N m_iu_i^2$,

$v_{1f}-v_{2f}=-(v_{1i}-v_{2i})$, $u_{1f}=-u_{1i}, u_{2f}=-u_{2i}$, $v_{1f}-v_{2f}=-e(v_{1i}-v_{2i})$, $u_{1f}=-eu_{1i}, u_{2f}=-eu_{2i}$,

Oscil·lacions:

$\frac{d^2x}{dt^2}+\omega^2x=0$, $\omega^2=\frac{k}{m}$, $x(t)=A\cos(\omega t+\delta)$, $x_0=A\cos\delta$, $v_0=-A\omega\sin\delta$, $\omega=2\pi f=\frac{2\pi}{T}$, $E_m=\frac{1}{2}kA^2=E_c+U=\frac{1}{2}kx^2+\frac{1}{2}mv^2$, $\omega_{pend}=\sqrt{\frac{g}{L}}$, $\omega_{pendfis}=\sqrt{\frac{MgD}{L}}$,

$\frac{d^2x}{dt^2}+2\beta\frac{dx}{dt}+\omega_0^2x=0$, $\beta=\frac{b}{2m}, \omega_0=\sqrt{\frac{k}{m}}$, $x(t)=A_0e^{-\beta t}\cos(\omega' t), \omega'=\omega_0\sqrt{1-\frac{\beta^2}{\omega_0^2}}$, $E_m=\frac{1}{2}kA^2=\frac{1}{2}kA_0^2e^{-2\beta t}=E_0e^{-\frac{t}{\tau}}, \tau=\frac{1}{2\beta}=\frac{m}{b}$, $Q=\omega_0\tau$, $\beta_c=\omega_0$

Termodinàmica:

$T_F=\frac{9}{5}T_C+32^{o}$, $T=T_C+273.15$, $PV=nRT$, $\left(P+\frac{n^2a}{V^2}\right)(V-nb)=nRT$, $V=F(P,T), dV=\left(\frac{\partial V}{\partial T}\right)_P dT+\left(\frac{\partial V}{\partial P}\right)_T dP$, $\beta=\frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P, k=\frac{1}{V}\left(\frac{\partial V}{\partial p}\right)_T$,

$L=g(F,T), dL=\left(\frac{\partial L}{\partial T}\right)_F dT+\left(\frac{\partial L}{\partial F}\right)_T dF$, $\alpha=\frac{1}{L_0}\left(\frac{\partial L}{\partial T}\right)_F$, $\mathrm{Y}=\frac{L_0}{A}\left(\frac{\partial F}{\partial L}\right)_T$, $\frac{dF}{A}=-\mathrm{Y}\alpha dT$, $Q=C\Delta T=mc\Delta T$, 1 cal = 4.184 J, $Q_{latent}=mL$, $L=L_0(1+\alpha\,\Delta T)$,

$j_E=\frac{dQ}{dA\cdot dt}=-K\frac{dT}{dx}$, $\frac{dQ}{dt}=hA\Delta T$, $\Delta T=T_c-T_f$, $\mathbf{R_B=a\cdot}\boldsymbol{H}$, $\lambda_{max}T=2.898\times10^{-3}\,\mathrm{m\,K}$, $M=\sigma T^4, \sigma=5.67\times10^{-8}\,\mathrm{W\,m^{-2}\,K^{-4}}$, $\Delta U=Q-W$

Camps electromagnètics:

$F_{12}=k\frac{q_1q_2}{r_{12}^2}\vec{u}_{12}=k\frac{q_1q_2}{r_{12}^3}\vec{r}_{12}$, $k=\frac{1}{4\pi\varepsilon_0}=9{\cdot}10^9\frac{Nm^2}{C}$, $\varepsilon_0=8.85{\cdot}10^{-12}\frac{C}{Nm^2}$, $\vec{F}=q\vec{E}$, $\vec{E}=k\frac{q}{r^2}\vec{u}_r$, $\lambda=\frac{dq}{dl}$, $\sigma=\frac{dq}{dS}$, $\rho=\frac{dq}{dV}$, $\vec{E}=\int k\frac{dq}{r^2}\vec{u}_r$

$E_x=k\frac{P2x}{(x^2-a^2)^2}$, $E_x=k\frac{Qx}{(a^2+x^2)^{3/2}}$, $E_y=\frac{2k\lambda}{y}\frac{L/2}{\sqrt{(L/2)^2+y^2}}$, $E_x=2\pi k\sigma\left(1-\frac{x}{\sqrt{R^2+x^2}}\right)$, $E=2\pi k\sigma=\frac{\sigma}{2\varepsilon_0}$, $\Phi_S=\int_S\vec{E}\cdot d\vec{s}$, $\Phi_{SGauss}=\frac{Q_{int}}{\varepsilon_0}$,

$E_{r>R}=\frac{Q}{4\pi\varepsilon_0r^2}, E_{r<R}=0$, $E_{r>R}=\frac{\rho R^3}{3\varepsilon_0r^2}, E_{r<R}=\frac{\rho r}{3\varepsilon_0}$, $E=\frac{\sigma}{\varepsilon_0}$, $E_{r>R}=\frac{\sigma R}{\varepsilon_0 r}, E_{r<R}=0$, $E_{r<R}=\frac{\rho r}{2\varepsilon_0}, E_{r>R}=\frac{\rho R^2}{2\varepsilon_0 r}$, $E=\frac{2k\lambda}{r}$, $E_{Sup.Cond.}=\frac{\sigma}{\varepsilon_0}$

$W=\int_C\vec{F}\cdot d\vec{r}$, $\Delta U=U(b)-U(a)=-W_{a\to b}$, $V=\frac{U}{q}$, $\Delta V=V(b)-V(a)=-\int_a^b\vec{E}\cdot d\vec{r}$, $\vec{E}=-\vec{\nabla}V$, $\vec{\nabla}=\left(\frac{\partial}{\partial x},\frac{\partial}{\partial y},\frac{\partial}{\partial z}\right)$

$V=\int k\frac{dq}{r}$, $V=k\frac{q}{r}$, $V_{r>R}=k\frac{Q}{r}, V_{r<R}=k\frac{Q}{R}$, $V=k\frac{P}{x^2-a^2}$, $V=k\frac{Q}{\sqrt{R^2+x^2}}, V=2\pi k\sigma\left(\sqrt{R^2+x^2}-x\right)$, $V=V_0-2\pi k\sigma|x|$,

$V=V_0-2k\lambda\ln r$, $V_{r>R}=\frac{\sigma R}{\varepsilon_0}\ln r+C$, $U=\frac{1}{2}\sum_{i=1}^N q_iV_i$, $U=\frac{1}{2}QV$, $C=\frac{Q}{V}$, $C=\frac{\varepsilon A}{d}$, $\varepsilon=\varepsilon_0\varepsilon_r$, $E=\frac{E_0}{\varepsilon_r}=E_0-E_{ll}$, $\eta=\frac{1}{2}\varepsilon_0E^2$, $C=\sum_i C_i$,

$\frac{1}{C}=\sum_i\frac{1}{C_i}$, $\mu_0=4\pi10^{-7}\frac{Tm}{A}$, $e=-1.6{\cdot}10^{-19}C$, $\vec{F}=q\vec{v}\times\vec{B}$, $\vec{F}=I\,\vec{l}\times\vec{B}$, $d\vec{F}=I\,d\vec{l}\times\vec{B}$, $r=\frac{mv}{qB}$, $T=\frac{2\pi m}{qB}$, $v_0=\frac{E}{B}$,

$\vec{\tau}=\vec{r}\times\vec{F}$, $\tau=NIAB\sin\theta$, $\vec{m}=NIA\vec{n}$, $\vec{\tau}=\vec{m}\times\vec{B}$, $V_H=v_dB\omega$, $E=v_dB$, $n=\frac{IB}{qtV_H}$, $\vec{B}=\frac{\mu_0}{4\pi}\frac{q\vec{v}\times\vec{u}_r}{r^2}$, $d\vec{B}=\frac{\mu_0}{4\pi}\frac{I\,d\vec{l}\times\vec{u}_r}{r^2}$, $B=\frac{\mu_0I}{2R}$, $B=\frac{\mu_0IR^2}{2(R^2+x^2)^{3/2}}$,

$B=\frac{1}{2}\mu_0nI\left[\frac{b}{\sqrt{R^2+b^2}}+\frac{a}{\sqrt{R^2+a^2}}\right]$, $B=\mu_0nI$, $B=\frac{\mu_0I}{4\pi y}(\sin\theta_1+\sin\theta_2)$, $\oint_C\vec{B}\cdot d\vec{l}=\mu_0I_C$, $B=\frac{\mu_0I}{2\pi r}$, $dF_{12}=\frac{\mu_0I_1I_2}{2\pi r}dl$, $\Phi_m=\int_S\vec{B}\cdot d\vec{S}$, $\varepsilon=\oint_C\vec{E}\cdot d\vec{l}=-\frac{d\Phi_m}{dt}$,

$\varepsilon=-Blv$, $\varepsilon=BS\omega\sin(\omega t)$, $L=\frac{\Phi_m}{I}$, $L=\frac{\mu_0\pi N^2r^2}{l}$, $\Phi_1=L_1I_1+M_{12}I_2$, $M_{12}=\frac{\Phi_{m2}}{I_1}$, $U_m=\frac{1}{2}LI^2$, $\eta_m=\frac{B^2}{2\mu_0}$

Ones electromagnètiques:

$y=y(z-vt)$, $\frac{d^2y}{dz^2}=\frac{1}{v^2}\frac{d^2y}{dt^2}$, $v=\sqrt{\frac{F}{\mu}}$, $v=\lambda f$, $k=\frac{2\pi}{\lambda}$, $y=A\sin(kx-\omega t+\delta)$, $P=\frac{1}{2}\mu v\omega^2A^2$, $I=\frac{P}{4\pi r^2}$, $I=\frac{1}{2}\rho v\omega^2A^2, L=n\frac{\lambda_n}{2}$, $f_n=n\frac{v}{2L}$, $f_n=n\frac{v}{4L}$

$v=\frac{c}{n}$, $v=\frac{1}{\sqrt{\varepsilon_0\mu_0}}=c\approx3\cdot10^8m/s$, $E(x,t)=E_0\cos(\omega t-kx+\delta)$, $B(x,t)=B_0\cos(\omega t-kx+\delta)$, $E_0=c\,B_0$, $S=\eta c=\frac{1}{\mu_0}EB$, $\vec{S}=\frac{1}{\mu_0}\vec{E}\times\vec{B}=\frac{\vec{E}_0\times\vec{B}_0}{\mu_0}\cos^2(\vec{k}\vec{r}-\omega t)$,

$I=\langle S\rangle=\frac{1}{2}\frac{E_0B_0}{\mu_0}$, $p=\frac{U}{c}$, $P_r=\frac{I}{c}$, $n=\sqrt{\varepsilon_r}$, $n^2(\omega)=\varepsilon_r=1+\frac{Nq_e^2}{\varepsilon_0m_e(\omega_0^2-\omega^2)}$, $\theta_i=\theta_r$, $n_i\sin\theta_i=n_t\sin\theta_t$, $\sin\theta_c=\frac{n_t}{n_i}$, $\tan\theta_B=\frac{n_t}{n_i}$, $R=\left(\frac{n_t-n_i}{n_t+n_i}\right)^2$, $T=\frac{4n_tn_i}{(n_t+n_i)^2}$,

$\frac{dn}{dy}=\frac{n}{\rho}$, $A(z,t)=2A_0\cos\left[\frac{\delta}{2}\right]\sin\left[kz-\omega t+\frac{\delta}{2}\right]$, $A(z,t)=2A_0\sin[kz]\cos[\omega t]$, $I=I_1+I_2+2\sqrt{I_1I_2}\cos\delta$, $I=4I_0\cos^2\frac{\delta}{2}$, $y_m=m\frac{\lambda s}{a}$, $\left(m+\frac{1}{2}\right)\lambda=2n_fd_m$,

$I=I_0\,\mathrm{sinc}^2\beta, \mathrm{sinc}\,\beta=\frac{\sin\beta}{\beta}, \beta=\frac{kb}{2}\sin\theta$, $I=I_0\,\mathrm{sinc}^2\beta\,\mathrm{sinc}^2\alpha$, $I=I_0\left(\frac{J_1(\gamma)}{\gamma}\right)^2, \gamma=\frac{kD}{2}\sin\theta$, $\sin\theta=\frac{1.22\lambda}{D}\cong\Delta\theta$,

$I=I_0\mathrm{sinc}^2\beta\left(\frac{\sin N\alpha}{\sin\alpha}\right)^2, \beta=\frac{kb}{2}\sin\theta, \alpha=\frac{ka}{2}\sin\theta$, $m\lambda=a\sin\theta$, $2d\sin\theta=m\lambda$, $\vec{E}(z,t)=\vec{E}_0\cos(kz-\omega t)$, $\vec{E}_0=E_0\cos\alpha\,\vec{i}+E_0\sin\alpha\,\vec{j}$,

$\vec{E}(z,t)=E_{0x}\cos(kz-\omega t)\,\vec{i}+E_{0y}\sin(kz-\omega t)\,\vec{j}$, $E_x=E_{0x}\cos(kz-\omega t), E_y=E_{0y}\cos(kz-\omega t+\varepsilon)$, $I(\theta)=\frac{1}{2}c\varepsilon_0E^2=\frac{1}{2}c\varepsilon_0E_0^2\cos^2\theta=I_0\cos^2\theta$