Fizikalni obrazci, konstante in matematične zveze

Gibanje

$s = s_0 + vt$

$s = s_0 + \bar{v}t$

$s = s_0 + v_0 t + \frac{at^2}{2}; \quad a = \frac{\Delta v}{\Delta t}$

$v = v_0 + at; \quad v^2 = v_0^2 + 2as$

$x = v_{0x}t = v_0 \cos\alpha\, t$

$y = v_{0y}t - \frac{gt^2}{2} = v_0 \sin\alpha\, t - \frac{gt^2}{2}$

$y(x) = x \tan\alpha - x^2 \frac{g}{2v_0^2 \cos^2\alpha}$

$\nu = \frac{1}{t_0}; \quad \omega = 2\pi\nu; \quad v = \omega r$

$a_r = \omega v = \frac{v^2}{r} = \omega^2 r$

$a_t = r\alpha; \quad \alpha = \frac{\Delta\omega}{\Delta t}; \quad a = \sqrt{a_r^2 + a_t^2}$

$\varphi = \omega t; \quad \varphi = \frac{l}{r}$

$\varphi = \bar{\omega} t$

$\varphi = \omega_0 t + \frac{\alpha t^2}{2}$

$\omega = \omega_0 + \alpha t; \quad \omega^2 = \omega_0^2 + 2\alpha\varphi$

$\Phi_V = \frac{\Delta V}{\Delta t} = Sv; \quad \Phi_m = \frac{\Delta m}{\Delta t} = \rho\Phi_V$

$\rho = \frac{m}{V}$

Sile v mehaniki

$F_g = mg = \frac{GmM}{r^2}$

$F_{\mathrm{tr}} = k_{\mathrm{tr}} F_\perp; \quad F_{l,\max} = k_l F_\perp$

$F = ks; \quad \frac{s}{l} = \frac{1}{E}\frac{F}{S}; \quad p = \frac{F}{S}$

$\vec{M} = \vec{r} \times \vec{F}; \quad M = r'F = rF\sin\varphi; \quad M = D\varphi$

$x_0 = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3 + \cdots}{m_1 + m_2 + m_3 + \cdots}$

$\vec{a} = \frac{\vec{F}}{m}; \quad F_r = ma_r = m\omega^2 r = m\,\frac{v^2}{r}$

$\vec{F}\,\Delta t = \Delta\vec{G}; \quad \vec{G} = m\vec{v}; \quad \vec{F} = -\Phi_m \Delta\vec{v}$

Delo, moč, energija

$A = \vec{F}\cdot\vec{s} = Fs\cos\varphi; \quad A = -p\Delta V$

$W_k = \frac{mv^2}{2}; \quad W_p = mgh; \quad \left(W_p = -G\,\frac{mM}{r}\right)$

$W_{pr} = \frac{ks^2}{2}; \quad A = \Delta W_k + \Delta W_p + \Delta W_{pr}$

$P = \frac{A}{\Delta t} = \vec{F}\cdot\vec{v} = Fv\cos\varphi$

Tekočine

$p = p_0 + \rho g h; \quad F_{\mathrm{vzgon}} = \rho_{\mathrm{tek}} g V; \quad \frac{\Delta V}{V} = -\chi\,\Delta p$

$F_{\mathrm{kroglice}} = 6\pi r\eta v; \quad F_u = \frac{1}{2} c_u \rho S v^2$

$p + \frac{\rho v^2}{2} + \rho g h = p' + \frac{\rho v'^2}{2} + \rho g h'$

$F = \gamma l; \quad \Delta p_{\mathrm{kapljice}} = \frac{2\gamma}{r}; \quad \Delta p_{\mathrm{mehurčka}} = \frac{4\gamma}{r}$

Vrtenje

$\alpha = \frac{M}{J}; \quad J = J_0 + md^2$

$W_k = \frac{J\omega^2}{2}; \quad A = M\varphi; \quad P = M\omega$

$M\Delta t = \Delta\Gamma; \quad \Gamma = J\omega; \quad \Gamma = r'G = r\,mv\,\sin\varphi$

$W_k = \frac{mv_0^2}{2} + \frac{J_0\omega^2}{2}$

Toplota

$\Delta l = \alpha l \Delta T; \quad \Delta V = \beta V \Delta T; \quad \beta = 3\alpha$

$\frac{pV}{T} = \frac{p'V'}{T'} = \frac{m}{M}R$

$p = p_{\mathrm{delni\_1}} + p_{\mathrm{delni\_2}} + \cdots + p_{\mathrm{delni\_}n}$

$\Delta W_n = A + Q; \quad A = -p\Delta V\,(p = \mathrm{konst.})$

$Q = mc_p\Delta T; \quad Q = mc_v\Delta T; \quad \Delta W_n = mc_v\Delta T$

$Q = q\Delta m; \quad \frac{c_p}{c_v} = \kappa; \quad c_p - c_v = \frac{R}{M}$

$pV^\kappa = p'V'^\kappa; \quad TV^{\kappa-1} = T'V'^{\kappa-1}$

$\eta = \frac{A}{Q_{\mathrm{do}}} = 1 - \frac{Q_{\mathrm{od}}}{Q_{\mathrm{do}}}$

$\mathrm{Carnot:}\ \frac{Q_{\mathrm{do}}}{T_{\mathrm{višja}}} = \frac{Q_{\mathrm{od}}}{T_{\mathrm{nižja}}}; \quad \eta_C = 1 - \frac{T_{\mathrm{nižja}}}{T_{\mathrm{višja}}}$

$P = \frac{Q}{\Delta t}; \quad P = \lambda S\,\frac{\Delta T}{\Delta x}$

$p = nkT; \quad n = \frac{N}{V}; \quad k = \frac{R}{N_A}$

$p = \frac{1}{3} n m_1 \overline{v^2} = \frac{1}{3}\rho\overline{v^2}; \quad \overline{W}_{\mathrm{kin}} = \frac{3}{2}kT$

Elektrika

$I = \frac{\Delta e}{\Delta t}; \quad I = \frac{U}{R}; \quad R = \frac{\zeta l}{S}; \quad \Delta R = \alpha R \Delta T$

$R_{\mathrm{zap}} = R_1 + R_2 + \cdots; \quad \frac{1}{R_{\mathrm{vzp}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$

$P = UI = RI^2 = \frac{U^2}{R}; \quad A_e = Pt = Ue$

$\bar{P} = U_{\mathrm{ef}} I_{\mathrm{ef}}; \quad U_{\mathrm{ef}} = \frac{1}{\sqrt{2}} U_0; \quad I_{\mathrm{ef}} = \frac{1}{\sqrt{2}} I_0$

$\vec{F} = e\vec{E};\ E = \frac{1}{4\pi\varepsilon_0}\frac{e}{r^2};\ F = \frac{1}{4\pi\varepsilon_0}\frac{e_1 e_2}{r^2}$

$\Phi_e = e = \varepsilon_0 \vec{E}\cdot\vec{S} = \varepsilon_0 ES\cos\varphi$

$U = -\vec{E}\cdot\vec{s} = \frac{A_e}{e};\ E_{\text{plošča}} = \frac{\sigma}{2\varepsilon_0};\ \sigma = \frac{e}{S}$

$e = CU;\ E = \frac{U}{d};\ C = \frac{\varepsilon_0 S}{d}$

$C_{\text{vzp}} = C_1 + C_2 + \cdots;\ \frac{1}{C_{\text{zap}}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots$

$A_e = e(U(\vec{r}) - U(\vec{r}\,')) = \Delta W_{el};\ W_{el} = eU(\vec{r})$

$U(\vec{r}) = \frac{e}{4\pi\varepsilon_0 r};\ A = \Delta W_k + \Delta W_p + \Delta W_{el}$

$W_C = \frac{CU^2}{2} = \frac{e^2}{2C};\ w_e = \frac{\varepsilon_0 E^2}{2}$

Magnetizem in indukcija

$\vec{F_m} = I\vec{l}\times\vec{B};\ F_m = IlB\sin\varphi$

$\vec{F_m} = e\vec{v}\times\vec{B};\ F_m = evB\sin\varphi$

$B = \frac{\mu_0 I}{2\pi r}\,(\text{vodnik});\ B = \frac{\mu_0 I}{2r}\,(\text{zanka})$

$B = \frac{\mu_0 NI}{l}\,(\text{tuljava});\ F_m = \frac{\mu_0 I_1}{2\pi r}\,I_2 l$

$\vec{M} = NI\vec{S}\times\vec{B} = \vec{p}_m\times\vec{B};\ M = NISB\sin\varphi$

$U_i = \vec{l}\cdot(\vec{v}\times\vec{B}) = \vec{B}\cdot(\vec{l}\times\vec{v}) = \vec{v}\cdot(\vec{B}\times\vec{l})$

$U_i = lBv\sin\varphi$

$\Phi_m = N\vec{B}\cdot\vec{S} = NBS\cos\varphi;\ U_i = -\frac{\Delta\Phi_m}{\Delta t}$

$\Phi_m = LI;\ U_i = -L\,\frac{\Delta I}{\Delta t};\ L = \frac{\mu_0 N^2 S}{l}$

$U_i = N\omega SB\sin\omega t;\ W_L = \frac{LI^2}{2};\ w_m = \frac{B^2}{2\mu_0}$

$\omega_{\text{ciklotron}} = \frac{eB}{m};\ G = erB$

$\vec{F}_{\text{Lorentz}} = e\vec{E} + e\vec{v}\times\vec{B}$

Nihanje in valovanje

$s(t) = s_0\sin\omega t;\ \omega = 2\pi\nu = \frac{2\pi}{t_0}$

$v(t) = \frac{ds(t)}{dt} = v_0\cos\omega t$

$a(t) = \frac{dv(t)}{dt} = -\omega^2 s_0\sin\omega t = -\omega^2 s(t)$

$ma = -m\omega^2 s = F = -ks$

$t_0 = 2\pi\sqrt{\frac{m}{k}};\ t_0 = 2\pi\sqrt{\frac{l}{g}}$

$W = W_k + W_{pr} =$

$\frac{ks_0^2}{2}(\cos^2\omega t + \sin^2\omega t) = \frac{ks_0^2}{2} = \frac{mv_0^2}{2}$

$\varphi(t) = \varphi_0\sin\omega t$

$\Omega(t) = \frac{d\varphi(t)}{dt} = \omega\varphi_0\cos\omega t = \Omega_0\cos\omega t$

$\alpha(t) = \frac{d\Omega(t)}{dt} = -\omega^2\varphi_0\sin\omega t = -\omega^2\varphi(t)$

$M = J\alpha = -J\omega^2\varphi$

$t_0 = 2\pi\sqrt{\frac{J}{D}};\ t_0 = 2\pi\sqrt{\frac{J}{mgd}}$

$t_0 = 2\pi\sqrt{LC};\ W = W_C + W_L =$

$\frac{CU_0^2}{2}(\cos^2\omega t + \sin^2\omega t) = \frac{CU_0^2}{2} = \frac{LI_0^2}{2}$

$c = \nu\lambda = \frac{\omega}{k};\ \omega = 2\pi\nu = \frac{2\pi}{t_0};\ k = \frac{2\pi}{\lambda}$

$\delta = 2\pi\frac{\Delta x}{\lambda} = k\Delta x;\ \Delta t = \frac{\delta}{2\pi}\,t_0$

$s(x,t) = s_0\sin(\omega t - \delta) = s_0\sin(\omega t - kx)$

$c = \sqrt{\frac{F}{\rho S}} = \sqrt{\frac{Fl}{m}};\ c = \sqrt{\frac{E}{\rho}};\ c = \frac{1}{\sqrt{\chi\rho}}$

$c = \sqrt{\frac{\kappa p}{\rho}} = \sqrt{\frac{\kappa RT}{M}}$

$\nu_N = (N+1)\,\frac{c}{2l} = (N+1)\nu_0,\ \ N = 0,1,2,\ldots$

$\nu_{N(\text{1 prosto krajišče})} = (2N+1)\,\frac{c}{4l} = (2N+1)\nu_0$

$a\sin\beta = N\lambda,\ \ N = 0,\pm1,\pm2,\ldots,\ \ N_{\max} \leq \frac{a}{\lambda}$

$\nu = \nu_0\left(1 \pm \frac{v}{c}\right);\ \nu = \frac{\nu_0}{1 \mp \frac{v}{c}}$

$n = \frac{c_0}{c};\ c_0 = \frac{1}{\sqrt{\varepsilon_0\mu_0}};\ \frac{\sin\alpha}{\sin\beta} = \frac{c_1}{c_2} = \frac{n_2}{n_1}$

$\sin\alpha_{\text{totalni}} = \frac{c_1}{c_2} = \frac{n_2}{n_1} : c_2 > c_1$ oz. $n_2 < n_1$

$\tan\alpha_{\text{Brewstrov}} = n$

$\frac{1}{f} = \left(\frac{n_{\text{leče}}}{n_{\text{okolice}}} - 1\right)\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$

$\frac{1}{f} = \frac{1}{a} + \frac{1}{b};\ m_{\text{povečava}} = \frac{s}{p} = \frac{b}{a}$

$P = \frac{W}{t};\ j = \frac{P}{S};\ j(r) = \frac{P}{4\pi r^2};\ j' = j\cos\alpha$

$\lambda_{\max} = \frac{k_W}{T};\ j^*_{\text{črno}} = \frac{P^*}{S} = \sigma T^4$

$j^*_{\text{sivo}} = (1-a)\sigma T^4;\ a = \frac{j_{\text{odbito}}}{j_{\text{vpadno}}}$

Delci in valovanja

$W_f = h\nu = h\,\frac{c}{\lambda};\ G_f = \frac{W}{c} = \frac{h\nu}{c} = \frac{h}{\lambda}$

$W_f = A_i + W_k;\ A_i = \frac{hc}{\lambda_{\max}};\ W_k = U_{\text{mejna}}e_0$

$\lambda_{\text{De Broglie}} = \frac{h}{G};\ U_A e_0 = \frac{hc}{\lambda_{\min(\text{zavorna})}}$

$W_H = -W_0\,\frac{1}{n^2};\ W_0 = \frac{e_0^2}{8\pi\varepsilon_0 r_B} = 13{,}6\ \text{eV}$

$r_B = \frac{h^2\varepsilon_0}{\pi m_e e_0^2};\ W_f = -W_0\left(\frac{1}{n'^2} - \frac{1}{n^2}\right) : n' > n$

$N(t) = N_0\,\mathrm{e}^{-\lambda t} = N_0\,2^{-\frac{t}{t_{1/2}}};\ t_{1/2} = \frac{\ln 2}{\lambda}$

$A(t) = -\frac{dN(t)}{dt} = \lambda\,N(t)$

$j(x) = j_0\mathrm{e}^{-\mu x} = j_0\,2^{-\frac{x}{d_{1/2}}};\ d_{1/2} = \frac{\ln 2}{\mu}$

$W_{\text{vezavna}} = Zm_p c^2 + Nm_n c^2 - m_j c^2$

$W_{\text{reakcijska}} = m_j c^2 - m_A c^2 - m_B c^2$

Fizikalne konstante in količine

Težni pospešek	$g = 9{,}8\,\frac{\mathrm{m}}{\mathrm{s}^2}$
Gravitacijska konstanta	$G = 6{,}7 \cdot 10^{-11}\,\frac{\mathrm{Nm}^2}{\mathrm{kg}^2}$
Polmer Zemlje	$r_Z = 6400\,\mathrm{km}$
Masa Zemlje	$m_Z = 6 \cdot 10^{24}\,\mathrm{kg}$
Masa Sonca	$m_S = 2 \cdot 10^{30}\,\mathrm{kg}$
Razdalja Zemlja – Sonce	$d = 1{,}5 \cdot 10^{8}\,\mathrm{km}$
Razdalja Zemlja – Luna	$d = 384\,000\,\mathrm{km}$
Gostota vode	$\rho_{\mathrm{voda}} = 1\,000\,\frac{\mathrm{kg}}{\mathrm{m}^3}$
Zračni tlak na gladini morja	$p_0 = 100\,\mathrm{kPa}$
Specifična toplota vode	$c = 4\,200\,\frac{\mathrm{J}}{\mathrm{kgK}}$
Lomni kvocient vode	$n = 1{,}33$
Splošna plinska konstanta	$R = 8\,300\,\frac{\mathrm{J}}{\mathrm{kmolK}}$
Avogadrovo število	$N_A = 6{,}0 \cdot 10^{26}\,\frac{1}{\mathrm{kmol}}$
Boltzmannova konstanta	$k = 1{,}38 \cdot 10^{-23}\,\frac{\mathrm{J}}{\mathrm{K}}$
Kilomolska masa zraka	$M_{\mathrm{zrak}} = 29\,\frac{\mathrm{kg}}{\mathrm{kmol}}$
Razmerja spec. toplot plinov	$\kappa = \frac{5}{3}$ (enoatomni); $\kappa = \frac{7}{5}$ (dvoatomni)
Osnovni naboj	$e_0 = 1{,}6 \cdot 10^{-19}\,\mathrm{As}$
Influenčna konstanta	$\varepsilon_0 = 8{,}9 \cdot 10^{-12}\,\frac{\mathrm{As}}{\mathrm{Vm}}$
Indukcijska konstanta	$\mu_0 = 4\pi \cdot 10^{-7}\,\frac{\mathrm{Vs}}{\mathrm{Am}}$
Hitrost svetlobe v vakuumu	$c_0 = 3{,}0 \cdot 10^{8}\,\frac{\mathrm{m}}{\mathrm{s}}$
Planckova konstanta	$h = 6{,}6 \cdot 10^{-34}\,\mathrm{Js} = 4{,}1 \cdot 10^{-15}\,\mathrm{eVs}$
Stefanova konstanta	$\sigma = 5{,}67 \cdot 10^{-8}\,\frac{\mathrm{W}}{\mathrm{m}^2\mathrm{K}^4}$
Wienova konstanta	$k_W = 2{,}90 \cdot 10^{-3}\,\mathrm{m{\cdot}K}$
Atomska masna enota	$u = 1{,}66 \cdot 10^{-27}\,\mathrm{kg} = 931{,}5\,\frac{\mathrm{MeV}}{\mathrm{c}^2}$
Masa elektrona	$m_e = 9{,}1 \cdot 10^{-31}\,\mathrm{kg} = 0{,}511\,\frac{\mathrm{MeV}}{\mathrm{c}^2}$
Masa protona	$m_p = 1{,}673 \cdot 10^{-27}\,\mathrm{kg} = 1{,}00728\,\mathrm{u} = 938{,}3\,\frac{\mathrm{MeV}}{\mathrm{c}^2}$
Masa nevtrona	$m_n = 1{,}675 \cdot 10^{-27}\,\mathrm{kg} = 1{,}00866\,\mathrm{u} = 939{,}6\,\frac{\mathrm{MeV}}{\mathrm{c}^2}$

Vztrajnostni momenti

telo	os	J_0
palica	skozi težišče	$\frac{1}{12}ml^2$
valj	geometrijska os	$\frac{1}{2}mr^2$
	pravokotna na geometrijsko os	$\frac{1}{4}mr^2+\frac{1}{12}mh^2$
krogla	skozi težišče	$\frac{2}{5}mr^2$
obroč	geometrijska os	mr^2
	pravokotna na geometrijsko os	$\frac{1}{2}mr^2$

Matematične zveze

Trigonometrične zveze in izreki

$\sin^2\alpha+\cos^2\alpha=1;\ \ \tan\alpha=\dfrac{\sin\alpha}{\cos\alpha}=\dfrac{1}{\cot\alpha}$

$\sin(\alpha\pm\beta)=\sin\alpha\cos\beta\pm\cos\alpha\sin\beta$

$\cos(\alpha\pm\beta)=\cos\alpha\cos\beta\mp\sin\alpha\sin\beta$

$\tan(\alpha\pm\beta)=\dfrac{\tan\alpha\pm\tan\beta}{1\mp\tan\alpha\tan\beta}$

$\sin 2\alpha=2\sin\alpha\cos\alpha;\ \ \cos 2\alpha=\cos^2\alpha-\sin^2\alpha$

$\sin\alpha+\sin\beta=2\sin\dfrac{\alpha+\beta}{2}\cos\dfrac{\alpha-\beta}{2}$

$\sin\alpha-\sin\beta=2\cos\dfrac{\alpha+\beta}{2}\sin\dfrac{\alpha-\beta}{2}$

$\cos\alpha+\cos\beta=2\cos\dfrac{\alpha+\beta}{2}\cos\dfrac{\alpha-\beta}{2}$

$\cos\alpha-\cos\beta=-2\sin\dfrac{\alpha+\beta}{2}\sin\dfrac{\alpha-\beta}{2}$

$\tan\alpha\pm\tan\beta=\dfrac{\sin(\alpha\pm\beta)}{\cos\alpha\cos\beta}$

$\sin\alpha\sin\beta=\dfrac{1}{2}\left[\cos(\alpha-\beta)-\cos(\alpha+\beta)\right]$

$\cos\alpha\cos\beta=\dfrac{1}{2}\left[\cos(\alpha-\beta)+\cos(\alpha+\beta)\right]$

$\sin\alpha\cos\beta=\dfrac{1}{2}\left[\sin(\alpha-\beta)+\sin(\alpha+\beta)\right]$

$\sin\dfrac{\alpha}{2}=\sqrt{\dfrac{1-\cos\alpha}{2}};\ \ \cos\dfrac{\alpha}{2}=\sqrt{\dfrac{1+\cos\alpha}{2}}$

$\tan\dfrac{\alpha}{2}=\sqrt{\dfrac{1-\cos\alpha}{1+\cos\alpha}}=\dfrac{1-\cos\alpha}{\sin\alpha}=\dfrac{\sin\alpha}{1+\cos\alpha}$

$\sin^2\alpha=\dfrac{1}{2}(1-\cos 2\alpha);\ \ \cos^2\alpha=\dfrac{1}{2}(1+\cos 2\alpha)$

Kosinusni izrek: $a^2=b^2+c^2-2bc\cos\alpha$

Sinusni izrek: $\dfrac{a}{\sin\alpha}=\dfrac{b}{\sin\beta}=\dfrac{c}{\sin\gamma}=2R$

Vektorji

$\vec a\cdot\vec b=\vec b\cdot\vec a;\ \ \vec a\cdot(\vec b+\vec c)=\vec a\cdot\vec b+\vec a\cdot\vec c$

$\vec a=(a_x,a_y,a_z);\ \ \vec b=(b_x,b_y,b_z)$

$\vec a\cdot\vec b=a_xb_x+a_yb_y+a_zb_z=ab\cos\varphi$

$\vec a\times\vec b=-\vec b\times\vec a\perp\vec a,\,\vec b$

$\vec a\times(\vec b+\vec c)=\vec a\times\vec b+\vec a\times\vec c$

$(m\vec a)\times\vec b=\vec a\times(m\vec b)=m(\vec a\times\vec b)$

$\vec a\times\vec b=\begin{vmatrix}\vec i & \vec j & \vec k\\ a_x & a_y & a_z\\ b_x & b_y & b_z\end{vmatrix}=$

$(a_yb_z-a_zb_y)\vec i+(a_zb_x-a_xb_z)\vec j+(a_xb_y-a_yb_x)\vec k$

$|\vec a\times\vec b|=ab\sin\varphi$

$(\vec a,\,\vec b,\,\vec c)=\vec a\cdot(\vec b\times\vec c)=\vec b\cdot(\vec c\times\vec a)=\vec c\cdot(\vec a\times\vec b)$

Računanje z relativno majhnimi količinami

$(1+x)^n=1+nx+\dfrac{n(n-1)}{1\cdot 2}x^2+\cdots+nx^{n-1}+x^n$

$(1\pm x)^n\approx 1\pm nx$ za $x\ll 1$. Primeri :

$\dfrac{1}{1+x}=(1+x)^{-1}\approx 1-x,$

$\dfrac{1}{(1-x)^2}=(1-x)^{-2}\approx 1+2x,$

$\sqrt{1-x^2}=(1-x^2)^{\frac{1}{2}}\approx 1-\dfrac{x^2}{2}.$

$\sin\varphi\approx\varphi,\ \cos\varphi\approx 1-\dfrac{\varphi^2}{2},\ \tan\varphi\approx\varphi$ za $\varphi\ll 1$

Zaporedja

$S=1+2+3+\cdots+N;\ \ S_N=\dfrac{N(N+1)}{2}$

$a_n=a_1\,k^{n-1};\ \ S=\dfrac{a_1}{1-k}$ za $|k|<1$

Geometrijska telesa

$S_{\text{krogle}}=4\pi r^2;\ \ V_{\text{krogle}}=\dfrac{4\pi r^3}{3}$

Kvadratna enačba

$ax^2+bx+c=0\,,\quad x_{1,2}=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$