

# 1 - Z uvedených vzorců vyjádři neznámé ve složených závorkách:

$$1.a - v = \frac{s}{t} \{s\}$$

$$v = \frac{s}{t} \quad / \cdot t$$

$$vt = s$$

$$s = vt$$

$$v = \frac{s}{t} \{t\}$$

$$v = \frac{s}{t} \quad / \cdot t$$

$$vt = s \quad \cdot / : v$$

$$v = \frac{s}{t}$$

$$1.b - s = s_0 + vt \{s_0\}$$

$$s = s_0 + vt \quad / - vt$$

$$s - vt = s_0$$

$$s_0 = s - vt$$

$$s = s_0 + vt \{v\}$$

$$s = s_0 + vt \quad / - s_0$$

$$s - s_0 = vt \quad / : t$$

$$\frac{s - s_0}{t} = v$$

$$v = \frac{s - s_0}{t}$$

$$1.c - p = h\rho g \{h\}$$

$$p = h\rho g \quad / : \rho g$$

$$\frac{p}{\rho g} = h$$

$$h = \frac{p}{\rho g}$$

$$p = h\rho g \{g\}$$

$$p = h\rho g \quad / : h\rho$$

$$\frac{p}{h\rho} = g$$

$$g = \frac{p}{h\rho}$$

$$1.d - F_1 r_1 = F_2 r_2 \{F_1\}$$

$$F_1 r_1 = F_2 r_2 \quad / : r_1$$

$$F_1 = \frac{F_2 r_2}{r_1}$$

$$F_1 r_1 = F_2 r_2 \{r_2\}$$

$$F_1 r_1 = F_2 r_2 / : F_2$$

$$\frac{F_1 r_1}{F_2} = r_2$$

$$r_2 = \frac{F_1 r_1}{F_2}$$

$$\mathbf{1.e -} \quad \frac{\Delta l}{\Delta l_1} = \frac{1}{E} \frac{F}{S} \{F\}$$

$$\frac{\Delta l}{\Delta l_1} = \frac{1}{E} \frac{F}{S} / \cdot ES$$

$$\frac{\Delta l ES}{\Delta l_1} = F$$

$$F = \frac{\Delta l}{\Delta l_1} ES$$

$$\frac{\Delta l}{\Delta l_1} = \frac{1}{E} \frac{F}{S} \{E\}$$

$$\frac{\Delta l}{\Delta l_1} = \frac{1}{E} \frac{F}{S} / \cdot E \Delta l_1$$

$$E \Delta l = \frac{F}{S} \Delta l_1 / : \Delta l$$

$$E = \frac{F}{S} \frac{\Delta l_1}{\Delta l}$$

$$\frac{\Delta l}{\Delta l_1} = \frac{1}{E} \frac{F}{S} \{\Delta l_1\}$$

$$\frac{\Delta l}{\Delta l_1} = \frac{1}{E} \frac{F}{S} / \cdot \Delta l_1 ES$$

$$ES \Delta l = F \Delta l_1 / : F$$

$$\frac{ES \Delta l}{F} = \Delta l_1$$

$$\Delta l_1 = \frac{ES \Delta l}{F}$$

$$\mathbf{1.f -} \quad \frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1} \{\sin \beta\}$$

$$\frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1} / \cdot \sin \beta \cdot n_1$$

$$\sin \alpha \cdot n_1 = \sin \beta \cdot n_2 / : n_2$$

$$\frac{\sin \alpha \cdot n_1}{n_2} = \sin \beta$$

$$\sin \beta = \frac{\sin \alpha \cdot n_1}{n_2}$$

$$\frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1} \{n_1\}$$

$$\frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1} \quad / \cdot \sin \beta \cdot n_1$$

$$\sin \alpha \cdot n_1 = \sin \beta \cdot n_2 \quad / : \sin \alpha$$

$$n_1 = \frac{\sin \beta}{\sin \alpha} n_2$$

$$\frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1} \quad \{n_2\}$$

$$\frac{\sin \alpha}{\sin \beta} = \frac{n_2}{n_1} \quad / \cdot n_1$$

$$n_1 \frac{\sin \alpha}{\sin \beta} = n_2$$

$$n_2 = n_1 \frac{\sin \alpha}{\sin \beta}$$

## 2 - Z uvedených vzorců vyjádři neznámé ve složených závorkách:

2.a -  $S = 6a^2 \{a\}$

$$S = 6a^2 \quad / : 6$$

$$\frac{S}{6} = a^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{S}{6}} = a$$

$$a = \sqrt{\frac{S}{6}}$$

2.b -  $E_k = \frac{1}{2}mv^2 \{m\}$

$$E_k = \frac{1}{2}mv^2 \quad / \cdot 2$$

$$2E_k = mv^2 \quad / : v^2$$

$$\frac{2E_k}{v^2} = m$$

$$m = \frac{2E_k}{v^2}$$

$$E_k = \frac{1}{2}mv^2 \quad \{v\}$$

$$E_k = \frac{1}{2}mv^2 \quad / \cdot 2$$

$$2E_k = mv^2 \quad / : m$$

$$\frac{2E_k}{m} = v^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{2E_k}{m}} = v$$

$$v = \sqrt{\frac{2E_k}{m}}$$

$$2.c - F = \frac{1}{2}CS\rho v^2 \{S\}$$

$$F = \frac{1}{2}CS\rho v^2 \cdot 2$$

$$2F = CS\rho v^2 \quad /: C\rho v^2$$

$$\frac{2F}{C\rho v^2} = S$$

$$S = \frac{2F}{C\rho v^2}$$

$$F = \frac{1}{2}CS\rho v^2 \{v\}$$

$$F = \frac{1}{2}CS\rho v^2 \cdot \frac{2}{CS\rho}$$

$$\frac{2F}{CS\rho} = v^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{2F}{CS\rho}} = v$$

$$v = \sqrt{\frac{2F}{CS\rho}}$$

$$2.d - F_d = \frac{mv^2}{r} \{m\}$$

$$F_d = \frac{mv^2}{r} \cdot \frac{r}{v^2}$$

$$\frac{F_d r}{v^2} = m$$

$$m = \frac{F_d r}{v^2}$$

$$F_d = \frac{mv^2}{r} \{r\}$$

$$F_d = \frac{mv^2}{r} \cdot r$$

$$rF_d = mv^2 \quad /: F_d$$

$$r = \frac{mv^2}{F_d}$$

$$F_d = \frac{mv^2}{r} \{v\}$$

$$F_d = \frac{mv^2}{r} \cdot \frac{r}{m}$$

$$F_d \frac{r}{m} = v^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{F_d r}{m}} = v$$

$$v = \sqrt{\frac{F_d r}{m}}$$

2.e -  $F = \kappa \frac{m_1 m_2}{r^2} \{m_1\}$

$$F = \kappa \frac{m_1 m_2}{r^2} \quad / \cdot \frac{r^2}{\kappa m_2}$$

$$\frac{F r^2}{\kappa m_2} = m_1$$

$$m_1 = \frac{F r^2}{\kappa m_2}$$

$$F = \kappa \frac{m_1 m_2}{r^2} \{r\}$$

$$F = \kappa \frac{m_1 m_2}{r^2} \quad / \cdot r^2$$

$$F r^2 = \kappa m_1 m_2 \quad / : F$$

$$r^2 = \frac{\kappa m_1 m_2}{F} \quad / \sqrt{\quad}$$

$$r = \sqrt{\frac{\kappa m_1 m_2}{F}}$$

2.f -  $p = \frac{1}{3} \frac{N}{V} m_0 v_k^2 \{V\}$

$$p = \frac{1}{3} \frac{N}{V} m_0 v_k^2 \quad / \cdot V$$

$$pV = \frac{Nm_0 v_k^2}{3} \quad / : p$$

$$V = \frac{Nm_0 v_k^2}{3p}$$

$$p = \frac{1}{3} \frac{N}{V} m_0 v_k^2 \{v_k\}$$

$$p = \frac{1}{3} \frac{N}{V} m_0 v_k^2 \quad / \cdot \frac{3V}{Nm_0}$$

$$\frac{3pV}{Nm_0} = v_k^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{3pV}{Nm_0}} = v_k$$

$$v_k = \sqrt{\frac{3pV}{Nm_0}}$$

$$2.g - V = \frac{1}{3} \pi r^2 v \{r\}$$

$$V = \frac{1}{3} \pi r^2 v \cdot \frac{3}{\pi v}$$

$$\frac{3V}{\pi v} = r^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{3V}{\pi v}} = r$$

$$r = \sqrt{\frac{3V}{\pi v}}$$

$$V = \frac{1}{3} \pi r^2 v \{v\}$$

$$V = \frac{1}{3} \pi r^2 v \cdot \frac{3}{\pi r^2}$$

$$\frac{3V}{\pi r^2} = v$$

$$v = \frac{3V}{\pi r^2}$$

$$2.h - E_n = \frac{h^2}{8mL^2} n^2 \{n\}$$

$$E_n = \frac{h^2}{8mL^2} n^2 \cdot \frac{8mL^2}{h^2}$$

$$\frac{8E_n mL^2}{h^2} = n^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{8E_n mL^2}{h^2}} = n$$

$$n = \sqrt{\frac{8E_n mL^2}{h^2}}$$

$$E_n = \frac{h^2}{8mL^2} n^2 \{m\}$$

$$E_n = \frac{h^2}{8mL^2} n^2 \cdot m$$

$$mE_n = \frac{h^2}{8mL^2} n^2 \quad / : E_n$$

$$m = \frac{h^2 n^2}{8mL^2 E_n}$$

$$E_n = \frac{h^2}{8mL^2} n^2 \{L\}$$

$$E_n = \frac{h^2}{8mL^2} n^2 \cdot L^2$$

$$E_n L^2 = \frac{h^2}{8m} n^2 \quad / : E_n$$

$$L^2 = \frac{h^2}{8mE_n} n^2 \quad / \sqrt{\quad}$$

$$L = \sqrt{\frac{h^2 n^2}{8mE_n}}$$

### 3 - Z uvedených vzorců vyjádři neznámé ve složených závorkách:

**3.a -**  $v = v_0 + at \quad \{v_0\}$

$$v = v_0 + at \quad / - at$$

$$v - at = v_0$$

$$v_0 = v - at$$

$$v = v_0 + at \quad \{t\}$$

$$v = v_0 + at \quad / - v_0$$

$$v - v_0 = at \quad / : a$$

$$\frac{v - v_0}{a} = t$$

$$t = \frac{v - v_0}{a}$$

**3.b -**  $v = v_0 - gt \quad \{v_0\}$

$$v = v_0 - gt \quad / + gt$$

$$v + gt = v_0$$

$$v_0 = v + gt$$

$$v = v_0 - gt \quad \{g\}$$

$$v = v_0 - gt \quad / + gt$$

$$v + gt = v_0 \quad / - v$$

$$gt = v_0 - v \quad / : t$$

$$g = \frac{v_0 - v}{t}$$

**3.c -**  $s = s_0 + v_0 t + \frac{1}{2} at^2 \quad \{a\}$

$$s = s_0 + v_0 t + \frac{1}{2} at^2 \quad / - s_0 - v_0 t$$

$$s - s_0 - v_0 t = \frac{1}{2} at^2 \quad / \cdot \frac{2}{t^2}$$

$$\frac{2(s - s_0 - v_0 t)}{t^2} = a$$

$$a = \frac{2(s - s_0 - v_0 t)}{t^2}$$

$$s = s_0 + v_0 t + \frac{1}{2} at^2 \quad \{v_0\}$$

$$s = s_0 + v_0 t + \frac{1}{2} at^2 \quad / - s_0 - \frac{1}{2} at^2$$

$$s - s_0 - \frac{1}{2} at^2 = v_0 t$$

$$\frac{2s - 2s_0 - at^2}{2} = v_0 t \quad / : t$$

$$\frac{2s - 2s_0 - at^2}{2t} = v_0$$

$$v_0 = \frac{2s - 2s_0 - at^2}{2t}$$

**3.d -**  $S = 2\pi r(r + v) \{v\}$

$$S = 2\pi r^2 + 2\pi rv \quad / - 2\pi r^2$$

$$S - 2\pi r^2 = 2\pi rv \quad / : 2\pi r$$

$$\frac{S - 2\pi r^2}{2\pi r} = v$$

$$v = \frac{S - 2\pi r^2}{2\pi r}$$

**3.e -**  $S = 2(ab + ac + bc) \{a\}$

$$S = 2ab + 2ac + 2bc \quad / - 2bc$$

$$S - 2bc = 2ab + 2ac$$

$$S - 2bc = a(2b + 2c) \quad / 2b + 2c$$

$$\frac{S - 2bc}{2b + 2c} = a$$

$$a = \frac{S - 2bc}{2b + 2c}$$

**3.f -**  $l = l_0(1 + \alpha\Delta t) \{l_0\}$

$$l = l_0(1 + \alpha\Delta t) \quad / : 1 + \alpha\Delta t$$

$$\frac{l}{1 + \alpha\Delta t} = l_0$$

$$l_0 = \frac{l}{1 + \alpha\Delta t}$$

$$l = l_0(1 + \alpha\Delta t) \{\Delta t\}$$

$$l = l_0 + l_0\alpha\Delta t \quad / - l_0$$

$$l - l_0 = l_0\alpha\Delta t \quad / : l_0\alpha$$

$$\frac{l - l_0}{l_0\alpha} = \Delta t$$

$$\Delta t = \frac{l - l_0}{l_0\alpha}$$

**3.g -**  $I = \frac{U_e}{R_i + R} \{U_e\}$

$$I = \frac{U_e}{R_i + R} \quad / \cdot (R_i + R)$$

$$(R_i + R)I = U_e$$

$$U_e = (R_i + R)I$$

$$I = \frac{U_e}{R_i + R} \{R\}$$

$$I = \frac{U_e}{R_i + R} \quad / \cdot (R_i + R)$$

$$I(R_i + R) = U_e$$

$$IR_i + IR = U_e \quad / - IR_i$$

$$IR = U_e - IR_i \quad / : I$$

$$R = \frac{U_e - IR_i}{I}$$

$$3.h - \quad Z = -\frac{f}{a-f} \{a\}$$

$$Z = -\frac{f}{a-f} \quad / \cdot (a-f)$$

$$Z(a-f) = -f$$

$$Za - Zf = -f \quad / + Zf$$

$$Za = Zf - f \quad / : Z$$

$$a = \frac{Zf - f}{Z}$$

$$Z = -\frac{f}{a-f} \{f\}$$

$$Z = -\frac{f}{a-f} \quad / \cdot (a-f)$$

$$Z(a-f) = -f$$

$$Za - Zf = -f \quad / + Zf$$

$$Za = Zf - f$$

$$Za = f(Z-1)$$

$$\frac{Za}{Z-1} = f$$

$$f = \frac{Za}{Z-1}$$

$$3.i - \quad hf = W_w + \frac{1}{2}mv^2 \{f\}$$

$$hf = W_w + \frac{1}{2}mv^2 \quad / : h$$

$$f = \frac{W_w + \frac{1}{2}mv^2}{h}$$

$$f = \frac{2W_w + mv^2}{2h}$$

$$f = \frac{2W_w + mv^2}{2h}$$

$$hf = W_w + \frac{1}{2}mv^2 \{m\}$$

$$hf = W_w + \frac{1}{2}mv^2 \quad / - W_w$$

$$hf - W_w = \frac{1}{2}mv^2 \quad / \cdot \frac{2}{v^2}$$

$$\frac{2(hf - W_w)}{v^2} = m$$

$$m = \frac{2(hf - W_w)}{v^2}$$

$$hf = W_w + \frac{1}{2}mv^2 \quad \{v\}$$

$$hf = W_w + \frac{1}{2}mv^2 \quad / - W_w$$

$$hf - W_w = \frac{1}{2}mv^2 \quad / \cdot \frac{2}{m}$$

$$\frac{2(hf - W_w)}{m} = v^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{2(hf - W_w)}{m}} = v$$

$$v = \sqrt{\frac{2(hf - W_w)}{m}}$$

**3.j -**  $mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2 \quad \{h_1\}$

$$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2 \quad / : m$$

$$gh_1 + \frac{1}{2}v_1^2 = gh_2 + \frac{1}{2}v_2^2 \quad / - \frac{1}{2}v_1^2$$

$$gh_1 = gh_2 + \frac{1}{2}v_2^2 - \frac{1}{2}v_1^2 \quad / : g$$

$$h_1 = \frac{gh_2 + \frac{1}{2}v_2^2 - \frac{1}{2}v_1^2}{g}$$

$$h_1 = h_2 + \frac{v_2^2 - v_1^2}{2g}$$

$$h_1 = h_2 + \frac{v_2^2 - v_1^2}{2g}$$

$$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2 \quad \{v_2\}$$

$$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2 \quad / : m$$

$$gh_1 + \frac{1}{2}v_1^2 = gh_2 + \frac{1}{2}v_2^2 \quad / - gh_2$$

$$gh_1 - gh_2 + \frac{1}{2}v_1^2 = \frac{1}{2}v_2^2 \quad / \cdot 2$$

$$2gh_1 - 2gh_2 + v_1^2 = v_2^2 \quad / \sqrt{\quad}$$

$$\sqrt{2gh_1 - 2gh_2 + v_1^2} = v_2,$$

$$v_2 = \sqrt{2gh_1 - 2gh_2 + v_1^2}$$

#### 4 - Z uvedených vzorců vyjádři neznámé ve složených závorkách:

$$4.a - v = \sqrt{\frac{\kappa M}{R+h}} \{R\}$$

$$v = \sqrt{\frac{\kappa M}{R+h}} \quad /^2$$

$$v^2 = \frac{\kappa M}{R+h} \quad / \cdot \frac{(R+h)}{v^2}$$

$$R+h = \frac{\kappa M}{v^2} \quad / - h$$

$$R = \frac{\kappa M}{v^2} - h$$

$$v = \sqrt{\frac{\kappa M}{R+h}} \{M\}$$

$$v = \sqrt{\frac{\kappa M}{R+h}} \quad /^2$$

$$v^2 = \frac{\kappa M}{R+h} \quad / \cdot \frac{(R+h)}{\kappa}$$

$$\frac{v^2 (R+h)}{\kappa} = M$$

$$M = \frac{v^2 (R+h)}{\kappa}$$

$$4.b - T = 2\pi \sqrt{\frac{l}{g}} \{l\}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \quad / : 2\pi$$

$$\frac{T}{2\pi} = \sqrt{\frac{l}{g}} \quad /^2$$

$$\left(\frac{T}{2\pi}\right)^2 = \frac{l}{g} \quad / \cdot g$$

$$\frac{gT^2}{4\pi^2} = l$$

$$l = \frac{gT^2}{4\pi^2}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \{g\}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \quad / : 2\pi$$

$$\frac{T}{2\pi} = \sqrt{\frac{l}{g}} \quad /^2$$

$$\left(\frac{T}{2\pi}\right)^2 = \frac{l}{g} \quad / \cdot g$$

$$\frac{gT^2}{4\pi^2} = l \quad / \cdot \frac{4\pi^2}{T^2}$$

$$g = l \frac{4\pi^2}{T^2}$$

$$4.c - \quad u = \sqrt{a^2 + b^2 + c^2}; \{a\}$$

$$u = \sqrt{a^2 + b^2 + c^2} \quad /^2$$

$$u^2 = a^2 + b^2 + c^2 \quad / - b^2 - c^2$$

$$u^2 - b^2 - c^2 = a^2 \quad / \sqrt{\quad}$$

$$\sqrt{u^2 - b^2 - c^2} = a$$

$$a = \sqrt{u^2 - b^2 - c^2}$$

$$4.d - \quad f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad \{k\}$$

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad / \cdot 2\pi$$

$$2\pi f = \sqrt{\frac{k}{m}} \quad /^2$$

$$4\pi^2 f^2 = \frac{k}{m} \quad / \cdot m$$

$$4\pi^2 f^2 m = k$$

$$k = 4\pi^2 f^2 m$$

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad \{m\}$$

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad / \cdot 2\pi$$

$$2\pi f = \sqrt{\frac{k}{m}} \quad /^2$$

$$4\pi^2 f^2 = \frac{k}{m} \quad / \cdot \frac{m}{4\pi^2 f^2}$$

$$m = \frac{k}{4\pi^2 f^2}$$

$$4.e - \quad l = l_0 \sqrt{1 - \frac{v^2}{c^2}} \quad \{v\}$$

$$l = l_0 \sqrt{1 - \frac{v^2}{c^2}} \quad / : l_0$$

$$\frac{l}{l_0} = \sqrt{1 - \frac{v^2}{c^2}} \quad /^2$$

$$\left(\frac{l}{l_0}\right)^2 = 1 - \frac{v^2}{c^2} \quad / + \frac{v^2}{c^2} - \left(\frac{l}{l_0}\right)^2$$

$$\frac{v^2}{c^2} = 1 - \frac{l^2}{l_0^2} \quad / \cdot c^2$$

$$v^2 = c^2 \left( \frac{l_0^2 - l^2}{l_0^2} \right) \quad / \sqrt{\quad}$$

$$v = c \sqrt{\frac{l_0^2 - l^2}{l_0^2}}$$

$$v = c \frac{\sqrt{l_0^2 - l^2}}{l_0}$$

$$l = l_0 \sqrt{1 - \frac{v^2}{c^2}} \quad \{c\}$$

$$l = l_0 \sqrt{1 - \frac{v^2}{c^2}} \quad / : l_0$$

$$\frac{l}{l_0} = \sqrt{1 - \frac{v^2}{c^2}} \quad / ^2$$

$$\left( \frac{l}{l_0} \right)^2 = 1 - \frac{v^2}{c^2} \quad / + \frac{v^2}{c^2} - \left( \frac{l}{l_0} \right)^2$$

$$\frac{v^2}{c^2} = 1 - \frac{l^2}{l_0^2} \quad / \cdot c^2$$

$$v^2 = c^2 \left( \frac{l_0^2 - l^2}{l_0^2} \right) \quad / \sqrt{\quad}$$

$$v = c \sqrt{\frac{l_0^2 - l^2}{l_0^2}} \quad / : \sqrt{\frac{l_0^2 - l^2}{l_0^2}}$$

$$\frac{v}{\sqrt{\frac{l_0^2 - l^2}{l_0^2}}} = c$$

$$\frac{v}{\sqrt{l_0^2 - l^2}} = c$$

$$c = \frac{l_0 v}{\sqrt{l_0^2 - l^2}}$$

**4.f -**  $V = \frac{\pi v}{6} (3\rho_1^2 + 3\rho_2^2 + v^2) \quad \{\rho_1\}$

$$V = \frac{\pi v}{6} (3\rho_1^2 + 3\rho_2^2 + v^2) \quad / \cdot \frac{6}{\pi v}$$

$$\frac{6V}{\pi v} = 3\rho_1^2 + 3\rho_2^2 + v^2 \quad / - 3\rho_2^2 - v^2$$

$$\frac{6V}{\pi v} - 3\rho_2^2 - v^2 = 3\rho_1^2 \quad / : 3$$

$$\frac{6V - 3\pi v \rho_2^2 - \pi v^3}{\pi v} = 3\rho_1^2 \quad / : 3$$

$$\frac{6V - 3\pi v \rho_2^2 - \pi v^3}{3\pi v} = \rho_1^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{6V - 3\pi v \rho_2^2 - \pi v^3}{3\pi v}} = \rho_1$$

$$\rho_1 = \sqrt{\frac{6V - 3\pi v \rho_2^2 - \pi v^3}{3\pi v}}$$

**5 - Z uvedených vzorců vyjádři neznámé ve složených závorkách:**

**5.a -**  $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \quad \{C\}$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \quad / \cdot C \cdot C_1 \cdot C_2$$

$$C_1 C_2 = C C_2 + C C_1$$

$$C_1 C_2 = C(C_2 + C_1) \quad / : (C_2 + C_1)$$

$$\frac{C_1 C_2}{(C_2 + C_1)} = C$$

$$C = \frac{C_1 C_2}{(C_2 + C_1)}$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \quad \{C_1\}$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \quad / \cdot C \cdot C_1 \cdot C_2$$

$$C_1 C_2 = C C_2 + C C_1 \quad / - C C_1$$

$$C_1 C_2 - C C_1 = C C_2$$

$$C_1(C_2 - C) = C C_2 \quad / : (C_2 - C)$$

$$C_1 = \frac{C C_2}{C_2 - C}$$

**5.b -**  $v = \frac{(d_1 + d_2)v_1 v_2}{d_1 v_2 + d_2 v_1} \quad \{d_2\}$

$$v = \frac{d_1 v_1 v_2 + d_2 v_1 v_2}{d_1 v_2 + d_2 v_1}$$

$$v = \frac{d_1 v_1 v_2 + d_2 v_1 v_2}{d_1 v_2 + d_2 v_1} \quad / \cdot (d_1 v_2 + d_2 v_1)$$

$$v(d_1 v_2 + d_2 v_1) = d_1 v_1 v_2 + d_2 v_1 v_2$$

$$d_1 v v_2 + d_2 v v_1 = d_1 v_1 v_2 + d_2 v_1 v_2 \quad / - d_2 v_1 v_2 - d_1 v v_2$$

$$d_2 v v_1 - d_2 v_1 v_2 = d_1 v_1 v_2 - d_1 v v_2$$

$$d_2(v v_1 - v_1 v_2) = d_1 v_2(v_1 - v) \quad / : (v v_1 - v_1 v_2)$$

$$d_2 = \frac{d_1 v_2(v_1 - v)}{v_1(v - v_2)}$$

$$v = \frac{(d_1 + d_2)v_1 v_2}{d_1 v_2 + d_2 v_1} \quad \{v_1\}$$

$$v = \frac{d_1 v_1 v_2 + d_2 v_1 v_2}{d_1 v_2 + d_2 v_1}$$

$$v = \frac{d_1 v_1 v_2 + d_2 v_1 v_2}{d_1 v_2 + d_2 v_1} \quad / \cdot (d_1 v_2 + d_2 v_1)$$

$$v(d_1 v_2 + d_2 v_1) = d_1 v_1 v_2 + d_2 v_1 v_2$$

$$d_1 v v_2 + d_2 v v_1 = d_1 v_1 v_2 + d_2 v_1 v_2 \quad / - d_2 v v_1$$

$$d_1 v v_2 = d_1 v_1 v_2 + d_2 v_1 v_2 - d_2 v v_1$$

$$d_1 v v_2 = v_1 (d_1 v_2 + d_2 v_2 - d_2 v) \quad / : (d_1 v_2 + d_2 v_2 - d_2 v)$$

$$\frac{d_1 v v_2}{d_1 v_2 + d_2 v_2 - d_2 v} = v_1$$

$$v_1 = \frac{d_1 v v_2}{d_1 v_2 + d_2 v_2 - d_2 v}$$

$$5.c - \quad u = \frac{u' + v}{1 + \frac{u'v}{c^2}} \quad \{v\}$$

$$u = \frac{u' + v}{\frac{c^2 + u'v}{c^2}}$$

$$u = \frac{c^2(u' + v)}{c^2 + u'v} \quad / \cdot (c^2 + u'v)$$

$$u(c^2 + u'v) = c^2(u' + v)$$

$$c^2 u + uu'v = c^2 u' + c^2 v \quad / - uu'v - c^2 u'$$

$$c^2 u - c^2 u' = c^2 v - uu'v$$

$$c^2(u - u') = v(c^2 - uu') \quad / : (c^2 - uu')$$

$$\frac{c^2(u - u')}{c^2 - uu'} = v$$

$$v = \frac{c^2(u - u')}{c^2 - uu'}$$

$$5.d - \quad \frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \left( \frac{1}{r_1} + \frac{1}{r_2} \right) \quad \{n_1\}$$

$$\frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \left( \frac{r_1 + r_2}{r_1 r_2} \right)$$

$$\frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \frac{r_1 + r_2}{r_1 r_2} \quad / \cdot \frac{r_1 r_2}{r_1 + r_2}$$

$$\frac{r_1 r_2}{f(r_1 + r_2)} = \frac{n_2}{n_1} - 1 \quad / + 1$$

$$\frac{r_1 r_2}{f(r_1 + r_2)} + 1 = \frac{n_2}{n_1}$$

$$\frac{r_1 r_2 + f(r_1 + r_2)}{f(r_1 + r_2)} = \frac{n_2}{n_1} \quad / \cdot n_1 \cdot \frac{f(r_1 + r_2)}{r_1 r_2 + f(r_1 + r_2)}$$

$$n_1 = \frac{n_2 f(r_1 + r_2)}{r_1 r_2 + f(r_1 + r_2)}$$

$$\frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \left( \frac{1}{r_1} + \frac{1}{r_2} \right) \quad \{n_2\}$$

$$\frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \left( \frac{r_1 + r_2}{r_1 r_2} \right)$$

$$\frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \frac{r_1 + r_2}{r_1 r_2} \quad / \cdot \frac{r_1 r_2}{r_1 + r_2}$$

$$\frac{r_1 r_2}{f(r_1 + r_2)} = \frac{n_2}{n_1} - 1 \quad / + 1$$

$$\frac{r_1 r_2}{f(r_1 + r_2)} + 1 = \frac{n_2}{n_1}$$

$$\frac{r_1 r_2 + f(r_1 + r_2)}{f(r_1 + r_2)} = \frac{n_2}{n_1} \quad / \cdot n_1$$

$$n_1 \frac{r_1 r_2 + f(r_1 + r_2)}{f(r_1 + r_2)} = n_2$$

$$n_2 = n_1 \frac{r_1 r_2 + f(r_1 + r_2)}{f(r_1 + r_2)}$$

$$\frac{1}{f} = \left( \frac{n_2}{n_1} - 1 \right) \left( \frac{1}{r_1} + \frac{1}{r_2} \right) \quad \{r_1\}$$

$$\frac{1}{f} = \frac{n_2 - n_1}{n_1} \left( \frac{1}{r_1} + \frac{1}{r_2} \right) \quad / \cdot \frac{n_1}{n_2 - n_1}$$

$$\frac{n_1}{f(n_2 - n_1)} = \frac{1}{r_1} + \frac{1}{r_2} \quad / - \frac{1}{r_2}$$

$$\frac{n_1}{f(n_2 - n_1)} - \frac{1}{r_2} = \frac{1}{r_1}$$

$$\frac{n_1 r_2 - f(n_2 - n_1)}{r_2 f(n_2 - n_1)} = \frac{1}{r_1} \quad / \cdot \frac{r_2 f(n_2 - n_1)}{n_1 r_2 - f(n_2 - n_1)} \cdot r_1$$

$$r_1 = \frac{r_2 f(n_2 - n_1)}{n_1 r_2 - f(n_2 - n_1)}$$

**6 - Ze soustavy rovnic pro rovnoměrně zrychlený pohyb s nulovou počáteční rychlostí  $v = at$ ,  $s = \frac{1}{2}at^2$  vyjádři:**

**6.a - čas  $t$  pomocí rychlosti  $v$  a zrychlení  $a$   
Stačí použít rovnici pro rychlost  $v = at$**

$$v = at \quad / : a$$

$$\frac{v}{a} = t$$

$$t = \frac{v}{a}$$

**6.b - b) čas t pomocí dráhy s a zrychlení a**

Všechny tři veličiny se vyskytují v rovnici pro dráhu, vyjádříme čas z ní

$$s = \frac{1}{2} at^2 \quad / \cdot \frac{2}{a}$$

$$\frac{2s}{a} = t^2 \quad / \sqrt{\quad}$$

$$\sqrt{\frac{2s}{a}} = t$$

$$t = \sqrt{\frac{2s}{a}}$$

**c) zrychlení a pomocí dráhy s a rychlosti v**

tyto tři veličiny se společně nevyskytují ani v jedné z rovnic. Vyjádříme si z první rovnice čas pomocí rychlosti a zrychlení a dosadíme za něj do rovnice pro dráhu

$$v = at \Rightarrow t = \frac{v}{a}$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} a \frac{v^2}{a^2}$$

$$s = \frac{v^2}{2a} \quad / \cdot \frac{a}{s}$$

$$a = \frac{v^2}{2s}$$

**d) čas t pomocí dráhy s a rychlosti v**

tyto tři veličiny se společně nevyskytují ani v jedné z rovnic. Vyjádříme si z první rovnice zrychlení pomocí rychlosti a času a dosadíme za něj do rovnice pro dráhu

$$v = at \Rightarrow a = \frac{v}{t}$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} \frac{v}{t} t^2$$

$$s = \frac{1}{2} vt \quad / \cdot \frac{2}{v}$$

$$\frac{2s}{v} = t$$

$$t = \frac{2s}{v}$$

**e) dráhu s pomocí zrychlení a a rychlosti v**

tyto tři veličiny se společně nevyskytují ani v jedné z rovnic. Vyjádříme si z první rovnice čas pomocí rychlosti a zrychlení a dosadíme za něj do rovnice pro dráhu

$$v = at \Rightarrow t = \frac{v}{a}$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} a \frac{v^2}{a^2}$$

$$s = \frac{v^2}{2a}$$

**f) rychlost v pomocí zrychlení a a dráhy s**

**tyto tři veličiny se společně nevyskytují ani v jedné z rovnic. Vyjádříme si z první rovnice čas pomocí rychlosti a zrychlení a dosadíme za něj do rovnice pro dráhu**

$$v = at \Rightarrow t = \frac{v}{a}$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} a \frac{v^2}{a^2}$$

$$s = \frac{1}{2} \frac{v^2}{a} \quad / \cdot 2a$$

$$2sa = v^2 \quad / \sqrt{\quad}$$

$$\sqrt{2sa} = v$$

$$v = \sqrt{2sa}$$

**g) zrychlení a pomocí dráhy s a rychlosti v**

**tyto tři veličiny se společně nevyskytují ani v jedné z rovnic. Vyjádříme si z první rovnice čas pomocí rychlosti a zrychlení a dosadíme za něj do rovnice pro dráhu**

$$v = at \Rightarrow t = \frac{v}{a}$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} at^2 = \frac{1}{2} a \left( \frac{v}{a} \right)^2$$

$$s = \frac{1}{2} a \frac{v^2}{a^2}$$

$$s = \frac{1}{2} \frac{v^2}{a} \quad / \cdot \frac{a}{s}$$

$$a = \frac{v^2}{2s}$$

**7 - Ze soustavy rovnic pro rovnoměrně zrychlený pohyb  $v = v_0 + at$ ,  $s = v_0 t + \frac{1}{2} at^2$**

**vyjádří:**

**7.a - a) čas t pomocí rychlostí v, v<sub>0</sub> a zrychlení a**

**Tyto čtyři veličiny se vyskytují v rovnici pro rychlost. Čas tedy vyjádříme z této rovnice.**

$$v = v_0 + at \quad / - v_0$$

$$v - v_0 = at \quad / : a$$

$$\frac{v - v_0}{a} = t$$

$$t = \frac{v - v_0}{a}$$

**7.b - b) rychlost  $v_0$ , pomocí času  $t$ , dráhy  $s$  a zrychlení  $a$**

**Tyto čtyři veličiny se vyskytují v rovnici pro dráhu. Čas tedy vyjádříme z této rovnice.**

$$s = v_0 t + \frac{1}{2} a t^2 \quad / - \frac{1}{2} a t^2$$

$$s - \frac{1}{2} a t^2 = v_0 t$$

$$\frac{2s - a t^2}{2} = v_0 t \quad / : t$$

$$\frac{2s - a t^2}{2t} = v_0$$

$$v_0 = \frac{2s - a t^2}{2t}$$

**7.c - c) zrychlení  $a$  pomocí dráhy  $s$  a rychlostí  $v$  a  $v_0$**

**Tyto čtyři veličiny se nevyskytují ani v jedné z rovnic. Musíme tedy z rovnice pro rychlost vyjádřit čas a dosadit za něj do rovnice pro dráhu**

$$v = v_0 + a t \quad / - v_0$$

$$v - v_0 = a t \quad / : a$$

$$\frac{v - v_0}{a} = t$$

$$t = \frac{v - v_0}{a}$$

$$s = v_0 t + \frac{1}{2} a t^2 = v_0 \left( \frac{v - v_0}{a} \right) + \frac{1}{2} a \left( \frac{v - v_0}{a} \right)^2$$

$$s = \frac{v_0 v - v_0^2}{a} + \frac{1}{2} a \frac{v^2 - 2v v_0 + v_0^2}{a^2}$$

$$s = \frac{2v_0 v - 2v_0^2}{2a} + \frac{v^2 - 2v v_0 + v_0^2}{2a}$$

$$s = \frac{2v_0 v - 2v_0^2 + v^2 - 2v v_0 + v_0^2}{2a}$$

$$s = \frac{v^2 - v_0^2}{2a} \quad / \cdot \frac{a}{s}$$

$$a = \frac{v^2 - v_0^2}{2s}$$

**7.d - d) dráhu  $s$  pomocí zrychlení  $a$  a rychlostí  $v$  a  $v_0$**

**Tyto čtyři veličiny se nevyskytují ani v jedné z rovnic. Musíme tedy z rovnice pro rychlost vyjádřit čas a dosadit za něj do rovnice pro dráhu**

$$v = v_0 + a t \quad / - v_0$$

$$v - v_0 = a t \quad / : a$$

$$\frac{v - v_0}{a} = t$$

$$t = \frac{v - v_0}{a}$$

$$s = v_0 t + \frac{1}{2} a t^2 = v_0 \left( \frac{v - v_0}{a} \right) + \frac{1}{2} a \left( \frac{v - v_0}{a} \right)^2$$

$$s = \frac{v_0 v - v_0^2}{a} + \frac{1}{2} a \frac{v^2 - 2v v_0 + v_0^2}{a^2}$$

$$s = \frac{2v_0 v - 2v_0^2}{2a} + \frac{v^2 - 2v v_0 + v_0^2}{2a}$$

$$s = \frac{2v_0 v - 2v_0^2 + v^2 - 2v v_0 + v_0^2}{2a}$$

$$s = \frac{v^2 - v_0^2}{2a}$$