(%i1) a(u) := (2*a*rho*(v-u)^2)/m;

$$(\%o1) \qquad a\left(u\right) := \frac{2\,a\,\rho\,\left(v-u\right)^2}{m}$$

(%i2) u(t) := v + c/(t - t0)^2;

$$(\%o2) \qquad u\left(t\right) := v + \frac{c}{\left(t-t0\right)^2}$$

(%i3) diff(u(t),t);

$$(\%o3) \qquad -\frac{2\,c}{\left(t-t0\right)^3}$$

(%i4) u(t) := v + c/(t - t0);

$$(\%o4) \qquad u\left(t\right) := v + \frac{c}{t-t0}$$

(%i5) diff(u(t),t) = a(u(t));

$$(\%o5) \qquad -\frac{c}{\left(t-t0\right)^2} = \frac{2\,a\,c^2\,\rho}{m\,\left(t-t0\right)^2}$$

(%i6) solve([%], [c]);

$$(\%o6) \qquad [c = -\frac{m}{2\,a\,\rho}, c = 0]$$

(%i7) c : -m/(2*a*rho);

$$(\%o7) \qquad -\frac{m}{2\,a\,\rho}$$

(%i8) u(t);

$$(\%o8) \qquad v - \frac{m}{2\,a\,\rho\,\left(t-t0\right)}$$

(%i9) u(0);

$$(\%o9) \qquad v + \frac{m}{2\,a\,\rho\,t0}$$

(%i10) solve([u(0) = 0], [t0]);

$$(\%o10) \qquad [t0 = -\frac{m}{2\,a\,\rho\,v}]$$

(%i11) t0 : -m/(2*a*rho*v);

$$(\%o11) \qquad -\frac{m}{2\,a\,\rho\,v}$$

(%i12) s(t);

$$(\%o12) \qquad s\left(t\right)$$

(%i13) s(t) := v*(t + m/(2*rho*a)*log(t - m/(2*rho*a)))+s0;

(%o13)
$$s\left(t\right) := v\left(t + \frac{m}{2\,\rho\,a}\,log\left(t - \frac{m}{2\,\rho\,a}\right)\right) + s0$$

(%i14) diff(s(t),t);

(%o14)
$$\left(\frac{m}{2\,a\,\rho\left(t - \frac{m}{2\,a\,\rho}\right)} + 1\right)v$$

(%i15) expand(%);

(%o15)
$$\frac{m\,v}{2\,a\,\rho\,t - m} + v$$

(%i16) diff(s(t),t) = u(t);

(%o16)
$$\left(\frac{m}{2\,a\,\rho\left(t - \frac{m}{2\,a\,\rho}\right)} + 1\right)v = v - \frac{m}{2\,a\,\rho\left(\frac{m}{2\,a\,\rho\,v} + t\right)}$$

(%i17) expand(%);

(%o17)
$$\frac{m\,v}{2\,a\,\rho\,t - m} + v = v - \frac{m}{\frac{m}{v} + 2\,a\,\rho\,t}$$

(%i18) factor(%);

(%o18)
$$\frac{2\,a\,\rho\,t\,v}{2\,a\,\rho\,t - m} = \frac{2\,a\,\rho\,t\,v^2}{2\,a\,\rho\,t\,v + m}$$

(%i19) %/(2*a*rho*t);

(%o19)
$$\frac{v}{2\,a\,\rho\,t - m} = \frac{v^2}{2\,a\,\rho\,t\,v + m}$$

(%i20) %*(2*a*rho*t-m);

(%o20)
$$v = \frac{\left(2\,a\,\rho\,t - m\right)v^2}{2\,a\,\rho\,t\,v + m}$$

(%i21) factor(%);

(%o21)
$$v = \frac{\left(2\,a\,\rho\,t - m\right)v^2}{2\,a\,\rho\,t\,v + m}$$

(%i22) solve([%], [v]);

(%o22)
$$[v = -1, v = 0]$$

(%i23) solve([%], [a]);

(%o23)
$$[]$$

(%i24) %o21 / v^2;

(%o24)
$$\frac{1}{v} = \frac{2\,a\,\rho\,t - m}{2\,a\,\rho\,t\,v + m}$$