Tank Depletion @model

(1) $\sqrt{z(t)} = \sqrt{H} - b \cdot t$		(2) $b = \frac{\phi}{2} \cdot \frac{A}{S} \cdot \sqrt{g}$
(3) $\sqrt{p(t)} = \sqrt{p_0} - b \cdot g \cdot t$	(4) $p_0 = \rho\, g\, H$	
(5) $\mathrm{v}(t) = \mathrm{v}_0 - c \cdot g \cdot t$	(6) $\mathrm{v}_0 = \phi \cdot \sqrt{2\, g\, H}$	(7) $c = \frac{\phi^2}{\sqrt{2}} \cdot \frac{A}{S}$
(8) $q(t) = q_0 - d \cdot g \cdot t$	(9) $q_0 = S \cdot \phi \cdot \sqrt{2\, g\, H}$	(10) $d = \frac{\phi^2}{\sqrt{2}} \cdot A$

where

$z(t)$	fluid level in the tank above the tank bottom at time t	$H = z(0)$	initial fluid level in the tank above the tank bottom
$p(t)$	pressure at the bottom of the tank at time t	$p_0 = p(0)$	initial pressure at the bottom of the tank
$\mathrm{v}(t)$	outflow velocity at time t	$\mathrm{v}_0 = \mathrm{v}(0)$	initial outflow velocity
$q(t)$	outflow rate at time t	$q_0 = q(0)$	initial outflow rate
A	cross-sectional area of the tank	S	cross-sectional area of the drainage orifice
ϕ	correction factor for the drainage orifice	g	gravity constant

See also

Physics / Mechanics / Continuum mechanics / Fluid Mechanics / Fluid Dynamics / Fluid Flow / Pipe Flow / Pipe Flow Dynamics