More Systems of Equations #1

More systems of simultaneous equations

Most of the following are systems of equations you are likely to see in physics. Solve each system for the indicated unknowns. Assume any other variables in the equations are known quantities.

1.	(1) $\mathbf{x} = \mathbf{v} \mathbf{t}$	(2) $x = \frac{1}{2} a t^2$	Solve for x and t.
2.	(1) Mg - T = Ma	(2) $T - mg = ma$	Solve for a and T.
3.	(1) $x = x_{10} + v_1 t$	(2) $x = x_{20} + v_2 t$	Solve for v_1 and v_2 .
4.	(1) $F \cos\theta - \mu N = ma$	(2) $F \sin\theta + N - mg = 0$	Solve for N and a. Treat F $\cos\theta$ and F $\sin\theta$ as constants.
5.	(1) $\mathbf{x} = \mathbf{v}_{0\mathbf{x}}\mathbf{t}$	(2) $y = v_{0y}t + \frac{1}{2}gt^2$	Solve for t and y.

6. In Exercise 1(b) of the previous worksheet (Systems of Equations) you showed that any two of the equations

(1) $V_1 - I_1R_1 - I_2R_2 = 0$ (2) $V_1 - I_1R_1 - I_3R_3 = 0$ (3) $I_3R_3 - I_2R_2 = 0$

are independent. Assume all other quantities are known and solve for I₁ and I₂.

7. Any two of the above equations along with the equation

(4) $I_1 = I_2 + I_3$ are independent. Use this to find I_1 , I_2 , and I_3 .

8. In Exercise 1(a) of the previous worksheet (Systems of Equations) you showed that the equations

(1)
$$A + B = C$$
 (2) $A - B = D$ (3) $C + 3D = 7$

are independent. Solve this system for the unknowns A, C, and D.

9. Challenge Problem. Solve the following system of five independent equations for the five unknowns I₁, I₂, I₃, I₄, and I₅.

(1)
$$I_1 = I_4 + I_5$$
 (2) $I_2 + I_3 = I_5$ (3) $V - I_1 R - I_4(4R) = 0$
(4) $2V + I_1(2R) - I_3(3R) = 0$ (5) $I_4(4R) - I_3(3R) = 0$