30 points   1. Find the solution of the initial-value problem

$$x' = -3x - z$$
$$y' = 3x + 2y + 3z$$
$$z' = 2x$$

with $x(0) = 1$, $y(0) = -1$ and $z(0) = 2$.

30 points   2. Find the solution of the initial-value problem

$$x' = -3x$$
$$y' = -5x + 6y - 4z$$
$$z' = -5x + 2y$$

with $x(0) = -2$, $y(0) = 0$ and $z(0) = 2$.

30 points   3. Find the solution of the initial-value problem

$$x' = -4x + 8y + 8z$$
$$y' = -4x + 4y + 2z$$
$$z' = 2z$$

with $x(0) = 1$, $y(0) = 0$ and $z(0) = 0$.

30 points   4. Find the solution of the initial-value problem

$$x' = 6x - 4z$$
$$y' = 8x - 2y$$
$$z' = 8x - 2z$$

with $x(0) = -2$, $y(0) = -1$ and $z(0) = 0$.

30 points   5. Find the general solution of the system

$$x' = 6x - 5y + 10z$$
$$y' = -x + 2y - 2z$$
$$z' = -x + y - z$$

30 points   6. Find the general solution of the system

$$x' = -2x + y - z$$
$$y' = x - 3y$$
$$z' = 3x - 5$$

30 points   7. Classify the equilibrium point of the system $y' = Ay$. Sketch the phase portrait by hand.

(1) $A = \begin{pmatrix} -16 & 9 \\ -18 & 11 \end{pmatrix}$ (2) $A = \begin{pmatrix} 8 & 3 \\ -6 & -1 \end{pmatrix}$ (3) $A = \begin{pmatrix} -11 & -5 \\ 10 & 4 \end{pmatrix}$

(4) $A = \begin{pmatrix} 2 & -4 \\ 8 & 6 \end{pmatrix}$ (5) $A = \begin{pmatrix} 6 & -5 \\ 10 & -4 \end{pmatrix}$ (6) $A = \begin{pmatrix} -4 & 10 \\ -2 & 4 \end{pmatrix}$

(7) $A = \begin{pmatrix} 6 & 4 \\ -1 & 2 \end{pmatrix}$ (8) $A = \begin{pmatrix} -4 & -4 \\ 1 & 0 \end{pmatrix}$ (9) $A = \begin{pmatrix} 2 & 1 \\ -10 & -5 \end{pmatrix}$