Name and ID: _____

1. Find the solution of the initial-value problem

   (a) $x' = 2x + 4y + 4z, \quad y' = x + 2y + 3z, \quad z' = -3x - 4y - 5z$
   with $x(0) = 1$, $y(0) = -1$ and $z(0) = 0$.

   (b) $x' = 6x - 4z, \quad y' = 8x - 2y, \quad z' = 8x - 2z$
   with $x(0) = -2$, $y(0) = -1$ and $z(0) = 0$.

   (c) $x' = -4x + 8y + 8z, \quad y' = -4x + 4y + 2z, \quad z' = 2z$
   with $x(0) = 1$, $y(0) = 0$ and $z(0) = 0$.

2. Find the general solution of the system

$$\begin{aligned} x' &= 6x - 5y + 10z \\ y' &= -x + 2y - 2z \\ z' &= -x + y - z \end{aligned}$$

3. Find the general solution of the system

$$\begin{aligned} x' &= -2x + y - z \\ y' &= x - 3y \\ z' &= 3x - 5 \end{aligned}$$

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

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

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