1)

№3

$\ddot{y} - 2\dot{y} - 4y = u$; $u = -\psi \cdot y$

$\psi = \begin{cases} 2, & y \cdot s > 0 \\ -2, & y \cdot s \le 0 \end{cases}$; $s = \dot{y} + 3y$

Замена:

$x_1 = y$

$x_2 = \dot{x}_1 = \dot{y}$

$$\begin{cases} \dot{x}_1 = x_2 \\ \dot{x}_2 = \ddot{x}_1 = \ddot{y} = u + 2\dot{y} + 4y = -\psi \cdot x_1 + 2x_2 + 4x_1 = \end{cases}$$

$$= \begin{cases} 2x_1 + 2x_2, & x_1(x_2 + 3x_1) > 0 \\ 6 \cdot x_1 + 2x_2, & x_1(x_2 + 3x_1) \le 0 \end{cases}$$

1) $x_1(x_2 + 3x_1) > 0$

$$\begin{cases} \dot{x}_1 = x_2 \\ 2x_1 + 2x_2 = \dot{x}_2 \end{cases}$$

$A = \begin{pmatrix} 0 & 1 \\ 2 & 2 \end{pmatrix}$ $\det(A - \lambda I) = \begin{vmatrix} -\lambda & 1 \\ 2 & 2-\lambda \end{vmatrix} = -\lambda(2-\lambda) - 2 =$

$= \lambda^2 - 2\lambda - 2$

$\lambda_{1,2} = 1 \pm \sqrt{3}$ – седло

2)

2) $x_1(x_2 + 3x_1) \leq 0$

$$\begin{cases} \dot{x}_1 = x_2 \\ \dot{x}_2 = 6x_1 + 2x_2 \end{cases}$$

$A = \begin{pmatrix} 0 & 1 \\ 6 & 2 \end{pmatrix}$; $\det(A - \lambda I) = \begin{vmatrix} -\lambda & 1 \\ 6 & 2-\lambda \end{vmatrix} =$

$= -\lambda(2-\lambda) - 6 = \lambda^2 - 2\lambda - 6$

$\lambda_{1,2} = 1 \pm \sqrt{7}$ – седло