Phase portraits of 2-D linear systems

Sketch the phase portrait and identify the type of the equilibrium:

[1] \( \frac{dx_1}{dt} = 2x_1 + x_2, \quad \frac{dx_2}{dt} = x_2 \)

[2] \( \frac{dx_1}{dt} = -2x_1, \quad \frac{dx_2}{dt} = -2x_2 \)

[3] \( \frac{dx_1}{dt} = -7x_1 + 10x_2, \quad \frac{dx_2}{dt} = -5x_1 + 8x_2 \)

[4] \( \frac{dx_1}{dt} = -2x_1 - 3x_2, \quad \frac{dx_2}{dt} = x_1 - 6x_2 \)

[5] \( \frac{dx_1}{dt} = -7x_1 + 9x_2, \quad \frac{dx_2}{dt} = -x_1 - x_2 \)

[6] \( \frac{dx_1}{dt} = 3x_1 + 5x_2, \quad \frac{dx_2}{dt} = -2x_1 + x_2 \)

[7] \( \frac{dx_1}{dt} = x_1 + 5x_2, \quad \frac{dx_2}{dt} = -2x_1 - x_2 \)

[8] \( \frac{dx_1}{dt} = 5x_2, \quad \frac{dx_2}{dt} = -2x_1 - 2x_2 \)
Answers:


In the pictures below, the blue directions are the directions of eigenvectors.


[5] Attractive Degenerate Node

[6] Repulsive focus

[7] Center

[8] Attractive focus