Escuela Politécnica Nacional

Métodos Numéricos

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Grafique la trayectoria de los siguientes sistemas de ecuaciones

Ejercicio 1

1) $x_1 + x_2 = 7$

2) $-2x_1 + 5x_2 = 0$

3) $x_0 = (0, 0)$

4) $x_0 = (5, 2)$

Ejercicio 2

1) $x_1 + x_2 = 6$

2) $-2x_1 + x_2 = 0$

Ejercicio 1

```
from iterative_methods import gauss_jacobi, gauss_seidel
import numpy as np
import matplotlib.pyplot as plt
```

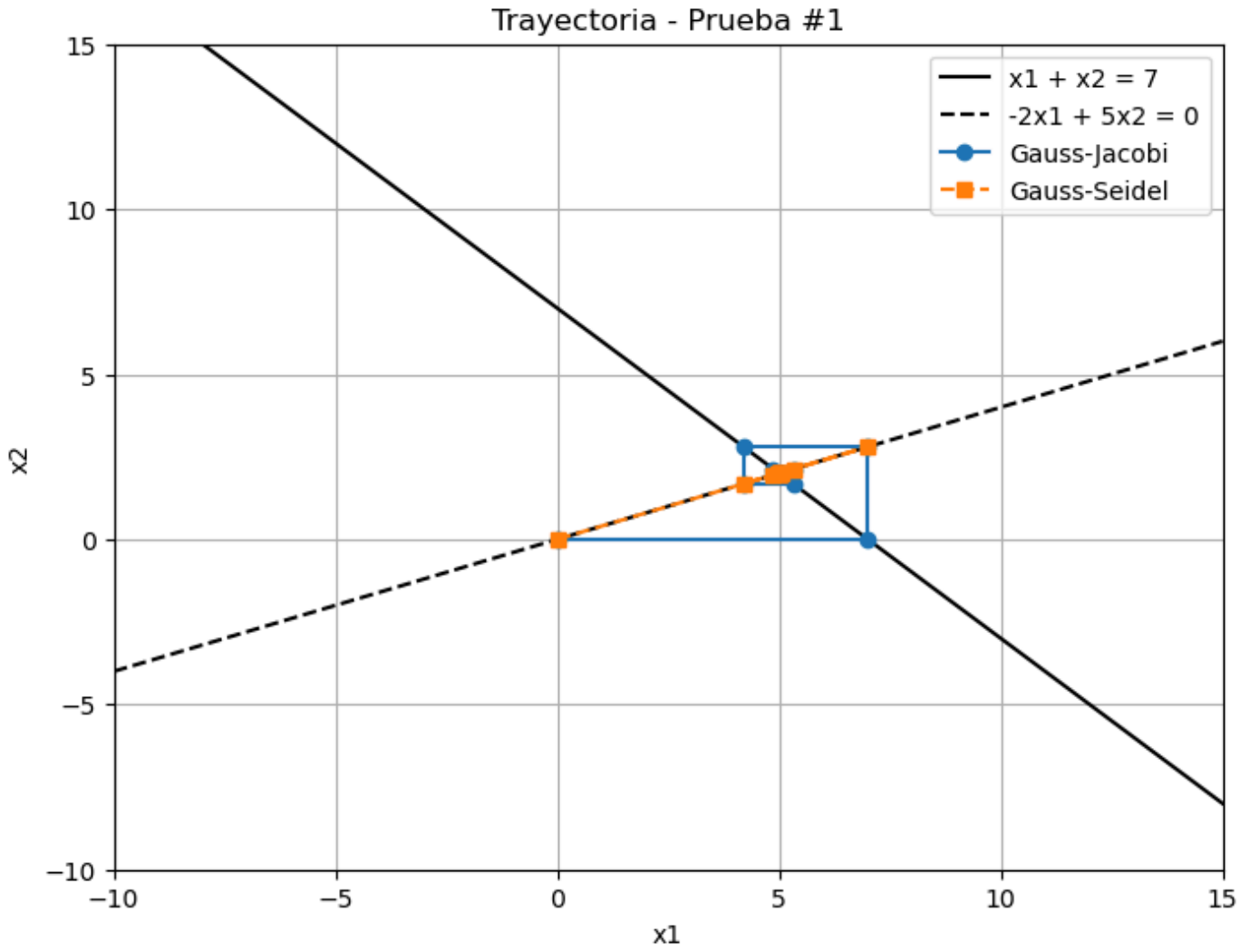
```
# Sistema
A = np.array([[1, 1], [-2, 5]], dtype=float)
b = np.array([[7], [0]], dtype=float)

# Condiciones iniciales
x0_list = [
    np.array([[0.0], [0.0]]),
    np.array([[5.0], [2.0]]),
    np.array([[100.0], [-100.0]])  # Candidata a divergencia
]


# Parámetros
tol = 1e-5
max_iter = 25
```

```
import numpy as np
import matplotlib.pyplot as plt

# Tus funciones gauss_jacobi y gauss_seidel ya deben estar definidas/importadas

def resolver_y_graficar_con_ecuaciones(x0, nombre, A, b, tol, max_iter):
    print(f"\nPrueba: {nombre} con x0 = {x0.ravel()}")

    # Ejecutar métodos
    sol_jacobi, tray_jacobi = gauss_jacobi(A=A, b=b, x0=x0, tol=tol, max_iter=max_iter)
    convergio_jacobi = len(tray_jacobi) < max_iter

    sol_seidel, tray_seidel = gauss_seidel(A=A, b=b, x0=x0, tol=tol, max_iter=max_iter)
    convergio_seidel = len(tray_seidel) < max_iter

    # Convertir trayectorias a arrays (n_iter, 2)
    tray_jacobi = np.concatenate(tray_jacobi, axis=1).T
    tray_seidel = np.concatenate(tray_seidel, axis=1).T

    # Preparar gráfico
    plt.figure(figsize=(8, 6))

    # Graficar ecuaciones:
    x_vals = np.linspace(-10, 15, 300)

    # Primera ecuación: x1 + x2 = 7  => x2 = 7 - x1
    y1 = 7 - x_vals

    # Segunda ecuación: -2x1 + 5x2 = 0 => x2 = (2/5)*x1
    y2 = (2/5) * x_vals

    plt.plot(x_vals, y1, 'k-', label='x1 + x2 = 7')
    plt.plot(x_vals, y2, 'k--', label='-2x1 + 5x2 = 0')
```

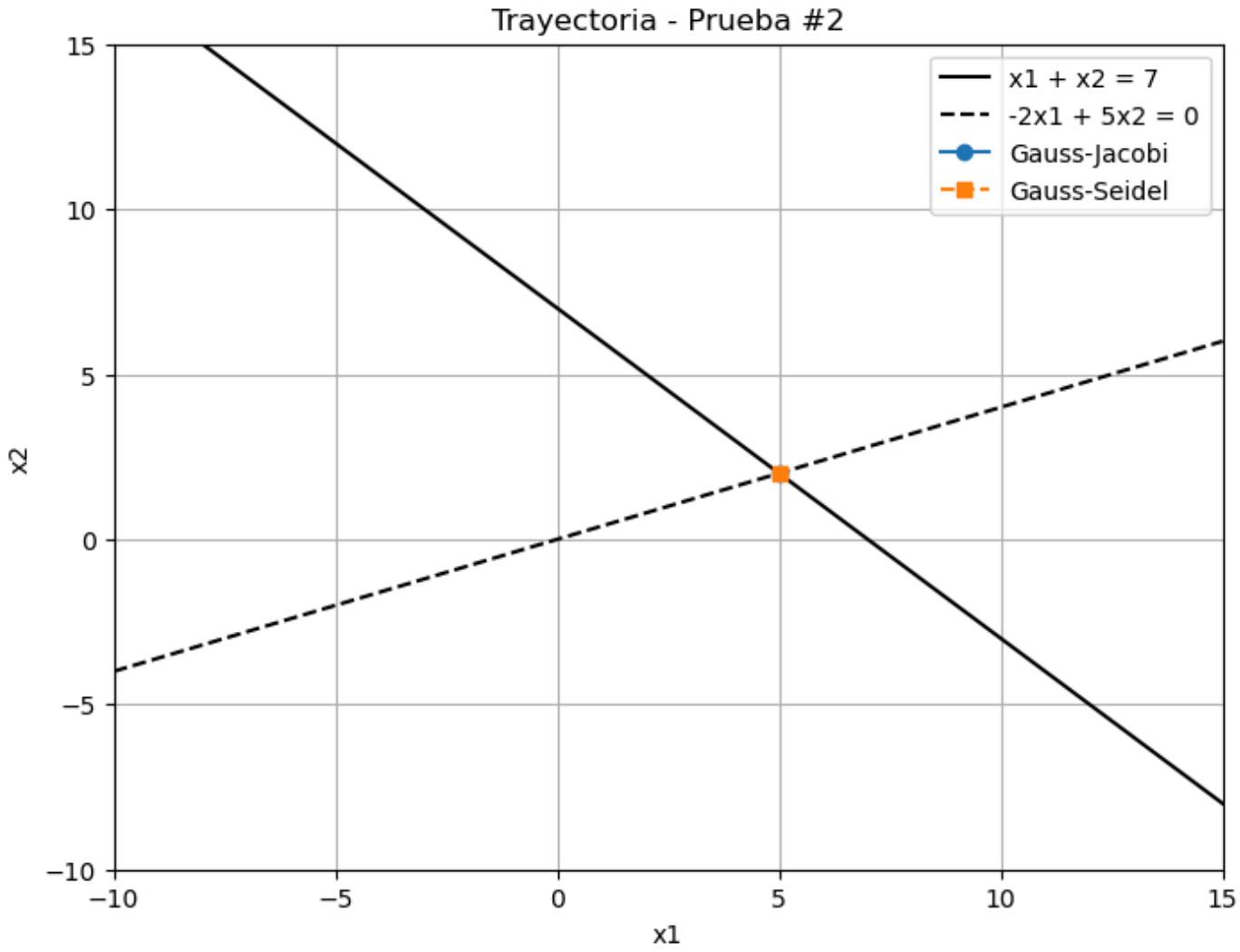
```
    # Graficar trayectorias
    plt.plot(tray_jacobi[:, 0], tray_jacobi[:, 1], 'o-', label='Gauss-Jacobi')
    plt.plot(tray_seidel[:, 0], tray_seidel[:, 1], 's--', label='Gauss-Seidel')

    # Ajustes gráficos
    plt.title(f"Trayectoria - {nombre}")
    plt.xlabel('x1')
    plt.ylabel('x2')
    plt.legend()
    plt.grid(True)
    plt.xlim(-10, 15)
    plt.ylim(-10, 15)
    plt.show()

    # Mostrar info de convergencia y soluciones
    print(f"Gauss-Jacobi: {'Convergió' if convergio_jacobi else 'Divergió'} → {sol_jacobi.ravel()}")
    print(f"Gauss-Seidel: {'Convergió' if convergio_seidel else 'Divergió'} → {sol_seidel.ravel()}")


# Parámetros y sistema
A = np.array([[1, 1], [-2, 5]], dtype=float)
b = np.array([[7], [0]], dtype=float)
tol = 1e-5
max_iter = 30

# Condiciones iniciales ordenadas
x0_list = [
    np.array([[0.0], [0.0]]),
    np.array([[5.0], [2.0]]),
    np.array([[100.0], [-100.0]])
]

# Ejecutar pruebas ordenadas
for i, x0 in enumerate(x0_list, start=1):
    resolver_y_graficar_con_ecuaciones(x0, f"Prueba #{i}", A, b, tol, max_iter)
```

```
Prueba: Prueba #1 con x0 = [0. 0.]
[07-15 17:58:12][INFO] i= 0 x: [[0. 0.]]
[07-15 17:58:12][INFO] i= 1 x: [[7. 0.]]
[07-15 17:58:12][INFO] i= 2 x: [[7.  2.8]]
[07-15 17:58:12][INFO] i= 3 x: [[4.2 2.8]]
[07-15 17:58:12][INFO] i= 4 x: [[4.2  1.68]]
[07-15 17:58:12][INFO] i= 5 x: [[5.32 1.68]]
[07-15 17:58:12][INFO] i= 6 x: [[5.32  2.128]]
[07-15 17:58:12][INFO] i= 7 x: [[4.872 2.128]]
[07-15 17:58:12][INFO] i= 8 x: [[4.872  1.9488]]
[07-15 17:58:12][INFO] i= 9 x: [[5.0512 1.9488]]
```

```
[07-15 17:58:12][INFO] i= 10 x: [[5.0512  2.02048]]
[07-15 17:58:12][INFO] i= 11 x: [[4.97952 2.02048]]
[07-15 17:58:12][INFO] i= 12 x: [[4.97952  1.991808]]
[07-15 17:58:12][INFO] i= 13 x: [[5.008192 1.991808]]
[07-15 17:58:12][INFO] i= 14 x: [[5.008192  2.0032768]]
[07-15 17:58:12][INFO] i= 15 x: [[4.9967232 2.0032768]]
[07-15 17:58:12][INFO] i= 16 x: [[4.9967232  1.99868928]]
[07-15 17:58:12][INFO] i= 17 x: [[5.00131072 1.99868928]]
[07-15 17:58:12][INFO] i= 18 x: [[5.00131072 2.00052429]]
[07-15 17:58:12][INFO] i= 19 x: [[4.99947571 2.00052429]]
[07-15 17:58:12][INFO] i= 20 x: [[4.99947571 1.99979028]]
[07-15 17:58:12][INFO] i= 21 x: [[5.00020972 1.99979028]]
[07-15 17:58:12][INFO] i= 22 x: [[5.00020972 2.00008389]]
[07-15 17:58:12][INFO] i= 23 x: [[4.99991611 2.00008389]]
[07-15 17:58:12][INFO] i= 24 x: [[4.99991611 1.99996645]]
[07-15 17:58:12][INFO] i= 25 x: [[5.00003355 1.99996645]]
[07-15 17:58:12][INFO] i= 26 x: [[5.00003355 2.00001342]]
[07-15 17:58:12][INFO] i= 27 x: [[4.99998658 2.00001342]]
[07-15 17:58:12][INFO] i= 28 x: [[4.99998658 1.99999463]]
[07-15 17:58:12][INFO] i= 29 x: [[5.00000537 1.99999463]]
[07-15 17:58:12][INFO] i= 0 x: [[0. 0.]]
[07-15 17:58:12][INFO] i= 1 x: [[7.  2.8]]
[07-15 17:58:12][INFO] i= 2 x: [[4.2  1.68]]
[07-15 17:58:12][INFO] i= 3 x: [[5.32  2.128]]
[07-15 17:58:12][INFO] i= 4 x: [[4.872  1.9488]]
[07-15 17:58:12][INFO] i= 5 x: [[5.0512  2.02048]]
[07-15 17:58:12][INFO] i= 6 x: [[4.97952  1.991808]]
[07-15 17:58:12][INFO] i= 7 x: [[5.008192  2.0032768]]
[07-15 17:58:12][INFO] i= 8 x: [[4.9967232  1.99868928]]
[07-15 17:58:12][INFO] i= 9 x: [[5.00131072 2.00052429]]
[07-15 17:58:12][INFO] i= 10 x: [[4.99947571 1.99979028]]
[07-15 17:58:12][INFO] i= 11 x: [[5.00020972 2.00008389]]
[07-15 17:58:12][INFO] i= 12 x: [[4.99991611 1.99996645]]
[07-15 17:58:12][INFO] i= 13 x: [[5.00003355 2.00001342]]
[07-15 17:58:12][INFO] i= 14 x: [[4.99998658 1.99999463]]
[07-15 17:58:12][INFO] i= 15 x: [[5.00000537 2.00000215]]
```

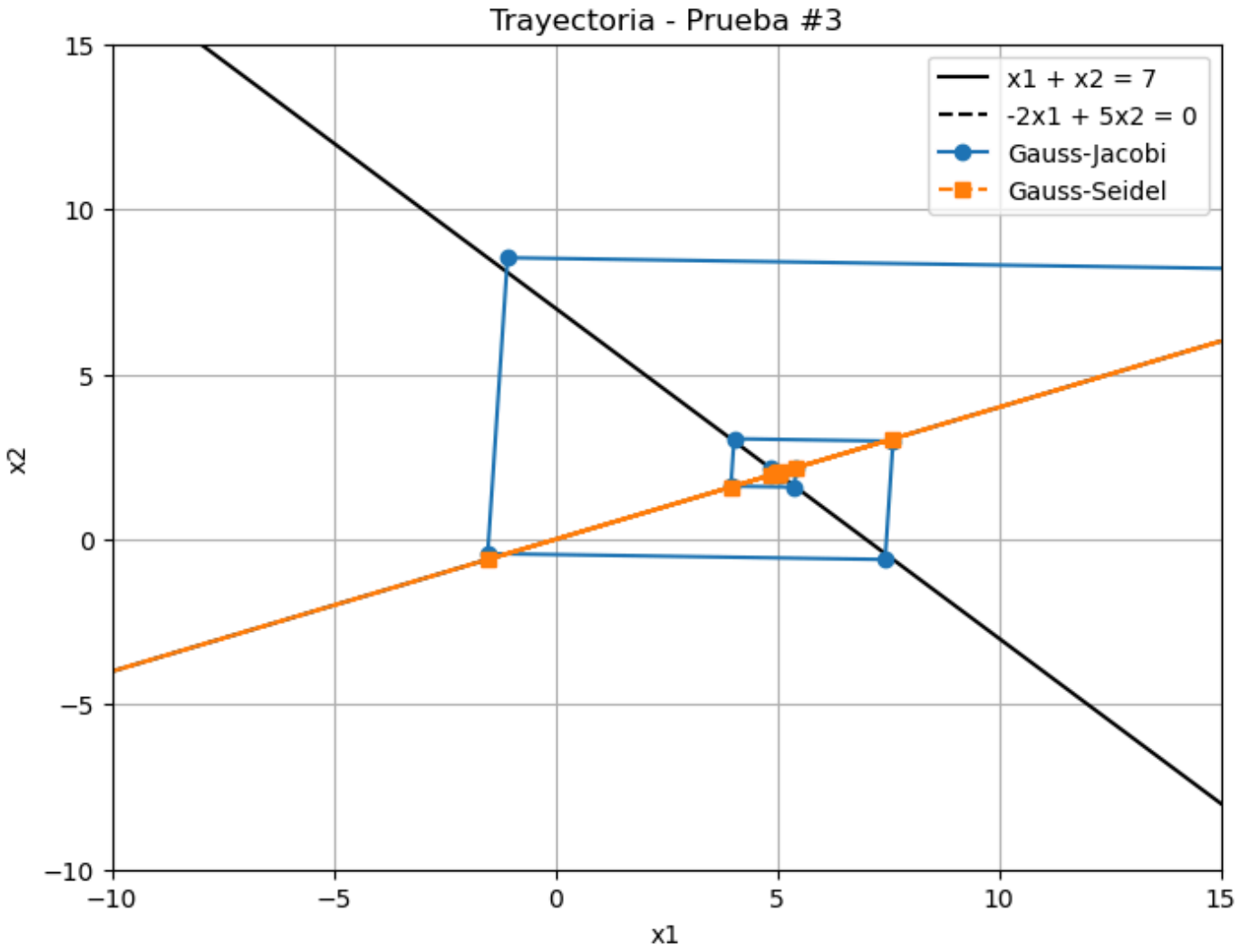



```
Gauss-Jacobi: Divergió → [5.00000537 1.99999463]
Gauss-Seidel: Convergió → [4.99999785 1.99999914]

Prueba: Prueba #2 con x0 = [5. 2.]
[07-15 17:58:12][INFO] i= 0 x: [[5. 2.]]
[07-15 17:58:12][INFO] i= 0 x: [[5. 2.]]
```




```
Gauss-Jacobi: Convergió → [5. 2.]
Gauss-Seidel: Convergió → [5. 2.]

Prueba: Prueba #3 con x0 = [ 100. -100.]
[07-15 17:58:13][INFO] i= 0 x: [[ 100. -100.]]
[07-15 17:58:13][INFO] i= 1 x: [[107.  40.]]
[07-15 17:58:13][INFO] i= 2 x: [[-33.   42.8]]
[07-15 17:58:13][INFO] i= 3 x: [[-35.8 -13.2]]
[07-15 17:58:13][INFO] i= 4 x: [[ 20.2  -14.32]]
[07-15 17:58:13][INFO] i= 5 x: [[21.32  8.08]]
[07-15 17:58:13][INFO] i= 6 x: [[-1.08   8.528]]
[07-15 17:58:13][INFO] i= 7 x: [[-1.528 -0.432]]
[07-15 17:58:13][INFO] i= 8 x: [[ 7.432  -0.6112]]
[07-15 17:58:13][INFO] i= 9 x: [[7.6112 2.9728]]
[07-15 17:58:13][INFO] i= 10 x: [[4.0272  3.04448]]
[07-15 17:58:13][INFO] i= 11 x: [[3.95552 1.61088]]
[07-15 17:58:13][INFO] i= 12 x: [[5.38912  1.582208]]
[07-15 17:58:13][INFO] i= 13 x: [[5.417792 2.155648]]
[07-15 17:58:13][INFO] i= 14 x: [[4.844352  2.1671168]]
[07-15 17:58:13][INFO] i= 15 x: [[4.8328832 1.9377408]]
[07-15 17:58:13][INFO] i= 16 x: [[5.0622592  1.93315328]]
```

```
[07-15 17:58:13][INFO] i= 17 x: [[5.06684672 2.02490368]]
[07-15 17:58:13][INFO] i= 18 x: [[4.97509632 2.02673869]]
[07-15 17:58:13][INFO] i= 19 x: [[4.97326131 1.99003853]]
[07-15 17:58:13][INFO] i= 20 x: [[5.00996147 1.98930452]]
[07-15 17:58:13][INFO] i= 21 x: [[5.01069548 2.00398459]]
[07-15 17:58:13][INFO] i= 22 x: [[4.99601541 2.00427819]]
[07-15 17:58:13][INFO] i= 23 x: [[4.99572181 1.99840616]]
[07-15 17:58:13][INFO] i= 24 x: [[5.00159384 1.99828872]]
[07-15 17:58:13][INFO] i= 25 x: [[5.00171128 2.00063753]]
[07-15 17:58:13][INFO] i= 26 x: [[4.99936247 2.00068451]]
[07-15 17:58:13][INFO] i= 27 x: [[4.99931549 1.99974499]]
[07-15 17:58:13][INFO] i= 28 x: [[5.00025501 1.9997262 ]]
[07-15 17:58:13][INFO] i= 29 x: [[5.0002738  2.00010201]]
[07-15 17:58:13][INFO] i= 0 x: [[ 100. -100.]]
[07-15 17:58:13][INFO] i= 1 x: [[107.   42.8]]
[07-15 17:58:13][INFO] i= 2 x: [[-35.8  -14.32]]
[07-15 17:58:13][INFO] i= 3 x: [[21.32   8.528]]
[07-15 17:58:13][INFO] i= 4 x: [[-1.528  -0.6112]]
[07-15 17:58:13][INFO] i= 5 x: [[7.6112  3.04448]]
[07-15 17:58:13][INFO] i= 6 x: [[3.95552  1.582208]]
[07-15 17:58:13][INFO] i= 7 x: [[5.417792  2.1671168]]
[07-15 17:58:13][INFO] i= 8 x: [[4.8328832  1.93315328]]
[07-15 17:58:13][INFO] i= 9 x: [[5.06684672 2.02673869]]
[07-15 17:58:13][INFO] i= 10 x: [[4.97326131 1.98930452]]
[07-15 17:58:13][INFO] i= 11 x: [[5.01069548 2.00427819]]
[07-15 17:58:13][INFO] i= 12 x: [[4.99572181 1.99828872]]
[07-15 17:58:13][INFO] i= 13 x: [[5.00171128 2.00068451]]
[07-15 17:58:13][INFO] i= 14 x: [[4.99931549 1.9997262 ]]
[07-15 17:58:13][INFO] i= 15 x: [[5.0002738  2.00010952]]
[07-15 17:58:13][INFO] i= 16 x: [[4.99989048 1.99995619]]
[07-15 17:58:13][INFO] i= 17 x: [[5.00004381 2.00001752]]
[07-15 17:58:13][INFO] i= 18 x: [[4.99998248 1.99999299]]
[07-15 17:58:13][INFO] i= 19 x: [[5.00000701 2.0000028 ]]
[07-15 17:58:13][INFO] i= 20 x: [[4.9999972  1.99999888]]
```




```
Gauss-Jacobi: Divergió → [5.0002738  2.00010201]
Gauss-Seidel: Convergió → [5.00000112 2.00000045]
```

Ejercicio 2

```python
# Nuevo sistema
A = np.array([[1, 1], [-2, 1]], dtype=float)
b = np.array([[6], [0]], dtype=float)
tol = 1e-5
max_iter = 30
```

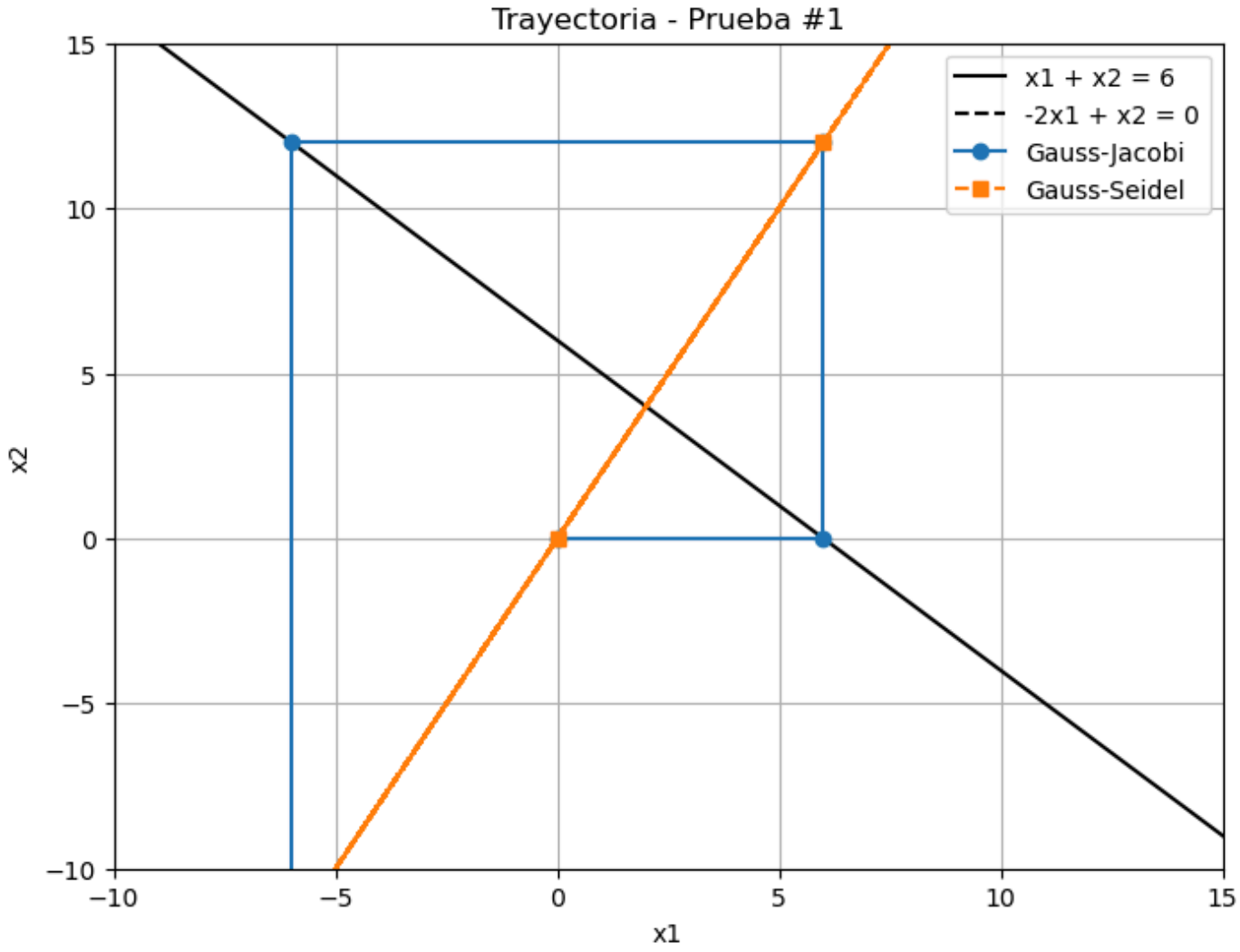
```python
x0_list = [
    np.array([[0.0], [0.0]]),
    np.array([[5.0], [2.0]]),
    np.array([[100.0], [-100.0]])  # Candidata a divergencia
]
```

```python
def resolver_y_graficar_con_ecuaciones(x0, nombre, A, b, tol, max_iter):
    print(f"\nPrueba: {nombre} con x0 = {x0.ravel()}")

    # Ejecutar métodos
    sol_jacobi, tray_jacobi = gauss_jacobi(A=A, b=b, x0=x0, tol=tol, max_iter=max_iter)
    convergio_jacobi = len(tray_jacobi) < max_iter

    sol_seidel, tray_seidel = gauss_seidel(A=A, b=b, x0=x0, tol=tol, max_iter=max_iter)
    convergio_seidel = len(tray_seidel) < max_iter

    # Convertir trayectorias
    tray_jacobi = np.concatenate(tray_jacobi, axis=1).T
    tray_seidel = np.concatenate(tray_seidel, axis=1).T

    # Preparar gráfico
    plt.figure(figsize=(8, 6))

    # Ecuaciones
    x_vals = np.linspace(-10, 15, 300)
    y1 = 6 - x_vals              # x1 + x2 = 6 → x2 = 6 - x1
    y2 = 2 * x_vals              # -2x1 + x2 = 0 → x2 = 2x1

    plt.plot(x_vals, y1, 'k-', label='x1 + x2 = 6')
    plt.plot(x_vals, y2, 'k--', label='-2x1 + x2 = 0')

    # Trayectorias
    plt.plot(tray_jacobi[:, 0], tray_jacobi[:, 1], 'o-', label='Gauss-Jacobi')
    plt.plot(tray_seidel[:, 0], tray_seidel[:, 1], 's--', label='Gauss-Seidel')

    # Ajustes visuales
    plt.title(f"Trayectoria - {nombre}")
    plt.xlabel('x1')
    plt.ylabel('x2')
    plt.legend()
    plt.grid(True)
    plt.xlim(-10, 15)
    plt.ylim(-10, 15)
    plt.show()

    # Mostrar resultados
    print(f"Gauss-Jacobi: {'Convergió' if convergio_jacobi else 'Divergió'} → {sol_jacobi.ravel()}")
    print(f"Gauss-Seidel: {'Convergió' if convergio_seidel else 'Divergió'} → {sol_seidel.ravel()}")
```

```python
for i, x0 in enumerate(x0_list, start=1):
    resolver_y_graficar_con_ecuaciones(x0, f"Prueba #{i}", A, b, tol, max_iter)
    #
```

```
Prueba: Prueba #1 con x0 = [0. 0.]
[07-15 17:44:56][INFO] i= 0 x: [[0. 0.]]
[07-15 17:44:56][INFO] i= 1 x: [[6. 0.]]
[07-15 17:44:56][INFO] i= 2 x: [[ 6. 12.]]
[07-15 17:44:56][INFO] i= 3 x: [[-6. 12.]]
[07-15 17:44:56][INFO] i= 4 x: [[ -6. -12.]]
[07-15 17:44:56][INFO] i= 5 x: [[ 18. -12.]]
[07-15 17:44:56][INFO] i= 6 x: [[18. 36.]]
[07-15 17:44:56][INFO] i= 7 x: [[-30.  36.]]
[07-15 17:44:56][INFO] i= 8 x: [[-30. -60.]]
[07-15 17:44:56][INFO] i= 9 x: [[ 66. -60.]]
[07-15 17:44:56][INFO] i= 10 x: [[ 66. 132.]]
[07-15 17:44:56][INFO] i= 11 x: [[-126.  132.]]
[07-15 17:44:56][INFO] i= 12 x: [[-126. -252.]]
[07-15 17:44:56][INFO] i= 13 x: [[ 258. -252.]]
[07-15 17:44:56][INFO] i= 14 x: [[258. 516.]]
[07-15 17:44:56][INFO] i= 15 x: [[-510.  516.]]
[07-15 17:44:56][INFO] i= 16 x: [[ -510. -1020.]]
[07-15 17:44:56][INFO] i= 17 x: [[ 1026. -1020.]]
[07-15 17:44:56][INFO] i= 18 x: [[1026. 2052.]]
[07-15 17:44:56][INFO] i= 19 x: [[-2046.  2052.]]
[07-15 17:44:56][INFO] i= 20 x: [[-2046. -4092.]]
[07-15 17:44:56][INFO] i= 21 x: [[ 4098. -4092.]]
[07-15 17:44:56][INFO] i= 22 x: [[4098. 8196.]]
[07-15 17:44:56][INFO] i= 23 x: [[-8190.  8196.]]
[07-15 17:44:56][INFO] i= 24 x: [[ -8190. -16380.]]
[07-15 17:44:56][INFO] i= 25 x: [[ 16386. -16380.]]
[07-15 17:44:56][INFO] i= 26 x: [[16386. 32772.]]
[07-15 17:44:56][INFO] i= 27 x: [[-32766.  32772.]]
[07-15 17:44:56][INFO] i= 28 x: [[-32766. -65532.]]
[07-15 17:44:56][INFO] i= 29 x: [[ 65538. -65532.]]
[07-15 17:44:56][INFO] i= 0 x: [[0. 0.]]
[07-15 17:44:56][INFO] i= 1 x: [[ 6. 12.]]
[07-15 17:44:56][INFO] i= 2 x: [[ -6. -12.]]
[07-15 17:44:56][INFO] i= 3 x: [[18. 36.]]
[07-15 17:44:56][INFO] i= 4 x: [[-30. -60.]]
[07-15 17:44:56][INFO] i= 5 x: [[ 66. 132.]]
[07-15 17:44:56][INFO] i= 6 x: [[-126. -252.]]
[07-15 17:44:56][INFO] i= 7 x: [[258. 516.]]
[07-15 17:44:56][INFO] i= 8 x: [[ -510. -1020.]]
[07-15 17:44:56][INFO] i= 9 x: [[1026. 2052.]]
[07-15 17:44:56][INFO] i= 10 x: [[-2046. -4092.]]
[07-15 17:44:56][INFO] i= 11 x: [[4098. 8196.]]
[07-15 17:44:56][INFO] i= 12 x: [[ -8190. -16380.]]
[07-15 17:44:56][INFO] i= 13 x: [[16386. 32772.]]
[07-15 17:44:56][INFO] i= 14 x: [[-32766. -65532.]]
[07-15 17:44:56][INFO] i= 15 x: [[ 65538. 131076.]]
[07-15 17:44:56][INFO] i= 16 x: [[-131070. -262140.]]
[07-15 17:44:56][INFO] i= 17 x: [[262146. 524292.]]
```

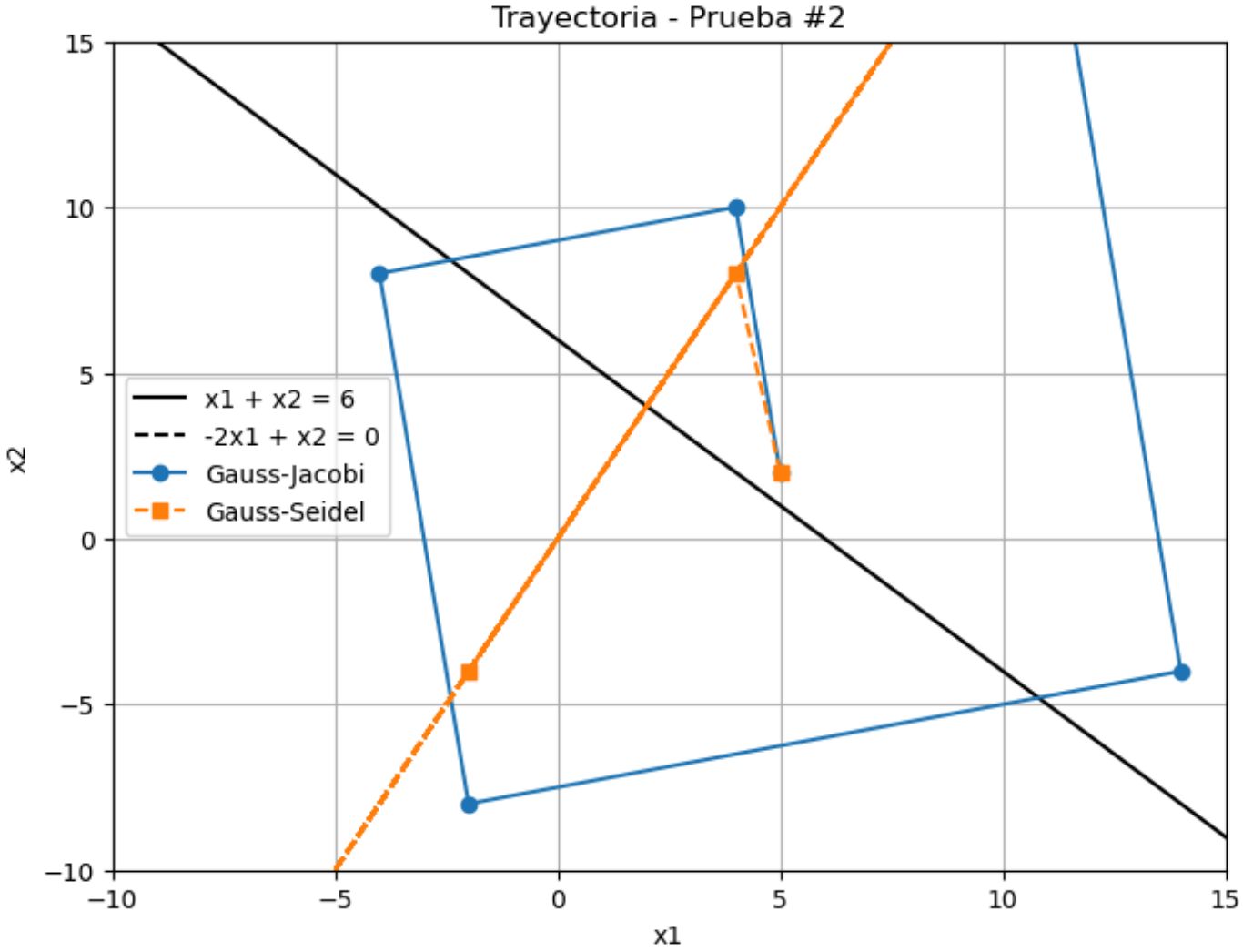
```
[07-15 17:44:56][INFO] i= 18 x: [[ -524286. -1048572.]]
[07-15 17:44:56][INFO] i= 19 x: [[1048578. 2097156.]]
[07-15 17:44:56][INFO] i= 20 x: [[-2097150. -4194300.]]
[07-15 17:44:56][INFO] i= 21 x: [[4194306. 8388612.]]
[07-15 17:44:56][INFO] i= 22 x: [[ -8388606. -16777212.]]
[07-15 17:44:56][INFO] i= 23 x: [[16777218. 33554436.]]
[07-15 17:44:56][INFO] i= 24 x: [[-33554430. -67108860.]]
[07-15 17:44:56][INFO] i= 25 x: [[6.71088660e+07 1.34217732e+08]]
[07-15 17:44:56][INFO] i= 26 x: [[-1.34217726e+08 -2.68435452e+08]]
[07-15 17:44:56][INFO] i= 27 x: [[2.68435458e+08 5.36870916e+08]]
[07-15 17:44:56][INFO] i= 28 x: [[-5.36870910e+08 -1.07374182e+09]]
[07-15 17:44:56][INFO] i= 29 x: [[1.07374183e+09 2.14748365e+09]]
```




```
Gauss-Jacobi: Divergió → [ 65538. -65532.]
Gauss-Seidel: Divergió → [1.07374183e+09 2.14748365e+09]

Prueba: Prueba #2 con x0 = [5. 2.]
[07-15 17:44:56][INFO] i= 0 x: [[5. 2.]]
[07-15 17:44:56][INFO] i= 1 x: [[ 4. 10.]]
[07-15 17:44:56][INFO] i= 2 x: [[-4.  8.]]
[07-15 17:44:56][INFO] i= 3 x: [[-2. -8.]]
[07-15 17:44:56][INFO] i= 4 x: [[14. -4.]]
```

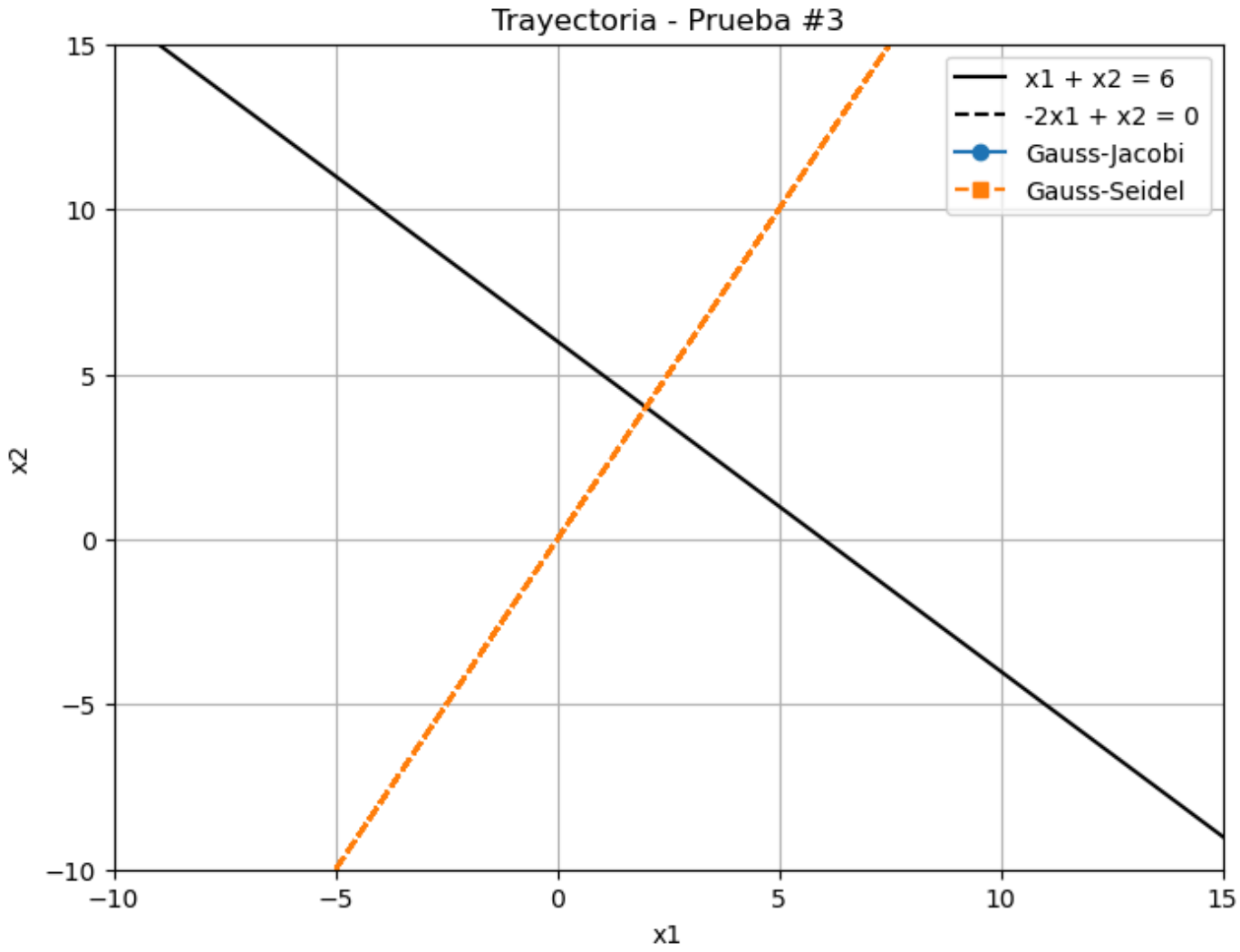
```
[07-15 17:44:56][INFO] i= 5 x: [[10. 28.]]
[07-15 17:44:56][INFO] i= 6 x: [[-22.  20.]]
[07-15 17:44:56][INFO] i= 7 x: [[-14. -44.]]
[07-15 17:44:56][INFO] i= 8 x: [[ 50. -28.]]
[07-15 17:44:56][INFO] i= 9 x: [[ 34. 100.]]
[07-15 17:44:56][INFO] i= 10 x: [[-94.  68.]]
[07-15 17:44:56][INFO] i= 11 x: [[ -62. -188.]]
[07-15 17:44:56][INFO] i= 12 x: [[ 194. -124.]]
[07-15 17:44:56][INFO] i= 13 x: [[130. 388.]]
[07-15 17:44:56][INFO] i= 14 x: [[-382.  260.]]
[07-15 17:44:56][INFO] i= 15 x: [[-254. -764.]]
[07-15 17:44:56][INFO] i= 16 x: [[ 770. -508.]]
[07-15 17:44:56][INFO] i= 17 x: [[ 514. 1540.]]
[07-15 17:44:56][INFO] i= 18 x: [[-1534.  1028.]]
[07-15 17:44:56][INFO] i= 19 x: [[-1022. -3068.]]
[07-15 17:44:56][INFO] i= 20 x: [[ 3074. -2044.]]
[07-15 17:44:56][INFO] i= 21 x: [[2050. 6148.]]
[07-15 17:44:56][INFO] i= 22 x: [[-6142.  4100.]]
[07-15 17:44:56][INFO] i= 23 x: [[ -4094. -12284.]]
[07-15 17:44:56][INFO] i= 24 x: [[12290. -8188.]]
[07-15 17:44:56][INFO] i= 25 x: [[ 8194. 24580.]]
[07-15 17:44:56][INFO] i= 26 x: [[-24574.  16388.]]
[07-15 17:44:56][INFO] i= 27 x: [[-16382. -49148.]]
[07-15 17:44:56][INFO] i= 28 x: [[ 49154. -32764.]]
[07-15 17:44:56][INFO] i= 29 x: [[32770. 98308.]]
[07-15 17:44:56][INFO] i= 0 x: [[5. 2.]]
[07-15 17:44:56][INFO] i= 1 x: [[4. 8.]]
[07-15 17:44:56][INFO] i= 2 x: [[-2. -4.]]
[07-15 17:44:56][INFO] i= 3 x: [[10. 20.]]
[07-15 17:44:56][INFO] i= 4 x: [[-14. -28.]]
[07-15 17:44:56][INFO] i= 5 x: [[34. 68.]]
[07-15 17:44:56][INFO] i= 6 x: [[ -62. -124.]]
[07-15 17:44:56][INFO] i= 7 x: [[130. 260.]]
[07-15 17:44:56][INFO] i= 8 x: [[-254. -508.]]
[07-15 17:44:56][INFO] i= 9 x: [[ 514. 1028.]]
[07-15 17:44:56][INFO] i= 10 x: [[-1022. -2044.]]
[07-15 17:44:56][INFO] i= 11 x: [[2050. 4100.]]
[07-15 17:44:56][INFO] i= 12 x: [[-4094. -8188.]]
[07-15 17:44:56][INFO] i= 13 x: [[ 8194. 16388.]]
[07-15 17:44:56][INFO] i= 14 x: [[-16382. -32764.]]
[07-15 17:44:56][INFO] i= 15 x: [[32770. 65540.]]
[07-15 17:44:56][INFO] i= 16 x: [[ -65534. -131068.]]
[07-15 17:44:56][INFO] i= 17 x: [[131074. 262148.]]
[07-15 17:44:56][INFO] i= 18 x: [[-262142. -524284.]]
[07-15 17:44:56][INFO] i= 19 x: [[ 524290. 1048580.]]
[07-15 17:44:56][INFO] i= 20 x: [[-1048574. -2097148.]]
[07-15 17:44:56][INFO] i= 21 x: [[2097154. 4194308.]]
[07-15 17:44:56][INFO] i= 22 x: [[-4194302. -8388604.]]
[07-15 17:44:56][INFO] i= 23 x: [[ 8388610. 16777220.]]
[07-15 17:44:56][INFO] i= 24 x: [[-16777214. -33554428.]]
[07-15 17:44:56][INFO] i= 25 x: [[33554434. 67108868.]]
```

```
[07-15 17:44:56][INFO] i= 26 x: [[-6.71088620e+07 -1.34217724e+08]]
[07-15 17:44:56][INFO] i= 27 x: [[1.3421773e+08 2.6843546e+08]]
[07-15 17:44:56][INFO] i= 28 x: [[-2.68435454e+08 -5.36870908e+08]]
[07-15 17:44:56][INFO] i= 29 x: [[5.36870914e+08 1.07374183e+09]]
```




```
Gauss-Jacobi: Divergió → [32770. 98308.]
Gauss-Seidel: Divergió → [5.36870914e+08 1.07374183e+09]

Prueba: Prueba #3 con x0 = [ 100. -100.]
[07-15 17:44:56][INFO] i= 0 x: [[ 100. -100.]]
[07-15 17:44:57][INFO] i= 1 x: [[106. 200.]]
[07-15 17:44:57][INFO] i= 2 x: [[-194.  212.]]
[07-15 17:44:57][INFO] i= 3 x: [[-206. -388.]]
[07-15 17:44:57][INFO] i= 4 x: [[ 394. -412.]]
[07-15 17:44:57][INFO] i= 5 x: [[418. 788.]]
[07-15 17:44:57][INFO] i= 6 x: [[-782.  836.]]
[07-15 17:44:57][INFO] i= 7 x: [[ -830. -1564.]]
[07-15 17:44:57][INFO] i= 8 x: [[ 1570. -1660.]]
[07-15 17:44:57][INFO] i= 9 x: [[1666. 3140.]]
[07-15 17:44:57][INFO] i= 10 x: [[-3134.  3332.]]
[07-15 17:44:57][INFO] i= 11 x: [[-3326. -6268.]]
[07-15 17:44:57][INFO] i= 12 x: [[ 6274. -6652.]]
```

```
[07-15 17:44:57][INFO] i= 13 x: [[ 6658. 12548.]]
[07-15 17:44:57][INFO] i= 14 x: [[-12542.  13316.]]
[07-15 17:44:57][INFO] i= 15 x: [[-13310. -25084.]]
[07-15 17:44:57][INFO] i= 16 x: [[ 25090. -26620.]]
[07-15 17:44:57][INFO] i= 17 x: [[26626. 50180.]]
[07-15 17:44:57][INFO] i= 18 x: [[-50174.  53252.]]
[07-15 17:44:57][INFO] i= 19 x: [[ -53246. -100348.]]
[07-15 17:44:57][INFO] i= 20 x: [[ 100354. -106492.]]
[07-15 17:44:57][INFO] i= 21 x: [[106498. 200708.]]
[07-15 17:44:57][INFO] i= 22 x: [[-200702.  212996.]]
[07-15 17:44:57][INFO] i= 23 x: [[-212990. -401404.]]
[07-15 17:44:57][INFO] i= 24 x: [[ 401410. -425980.]]
[07-15 17:44:57][INFO] i= 25 x: [[425986. 802820.]]
[07-15 17:44:57][INFO] i= 26 x: [[-802814.  851972.]]
[07-15 17:44:57][INFO] i= 27 x: [[ -851966. -1605628.]]
[07-15 17:44:57][INFO] i= 28 x: [[ 1605634. -1703932.]]
[07-15 17:44:57][INFO] i= 29 x: [[1703938. 3211268.]]
[07-15 17:44:57][INFO] i= 0 x: [[ 100. -100.]]
[07-15 17:44:57][INFO] i= 1 x: [[106. 212.]]
[07-15 17:44:57][INFO] i= 2 x: [[-206. -412.]]
[07-15 17:44:57][INFO] i= 3 x: [[418. 836.]]
[07-15 17:44:57][INFO] i= 4 x: [[ -830. -1660.]]
[07-15 17:44:57][INFO] i= 5 x: [[1666. 3332.]]
[07-15 17:44:57][INFO] i= 6 x: [[-3326. -6652.]]
[07-15 17:44:57][INFO] i= 7 x: [[ 6658. 13316.]]
[07-15 17:44:57][INFO] i= 8 x: [[-13310. -26620.]]
[07-15 17:44:57][INFO] i= 9 x: [[26626. 53252.]]
[07-15 17:44:57][INFO] i= 10 x: [[ -53246. -106492.]]
[07-15 17:44:57][INFO] i= 11 x: [[106498. 212996.]]
[07-15 17:44:57][INFO] i= 12 x: [[-212990. -425980.]]
[07-15 17:44:57][INFO] i= 13 x: [[425986. 851972.]]
[07-15 17:44:57][INFO] i= 14 x: [[ -851966. -1703932.]]
[07-15 17:44:57][INFO] i= 15 x: [[1703938. 3407876.]]
[07-15 17:44:57][INFO] i= 16 x: [[-3407870. -6815740.]]
[07-15 17:44:57][INFO] i= 17 x: [[ 6815746. 13631492.]]
[07-15 17:44:57][INFO] i= 18 x: [[-13631486. -27262972.]]
[07-15 17:44:57][INFO] i= 19 x: [[27262978. 54525956.]]
[07-15 17:44:57][INFO] i= 20 x: [[-5.452595e+07 -1.090519e+08]]
[07-15 17:44:57][INFO] i= 21 x: [[1.09051906e+08 2.18103812e+08]]
[07-15 17:44:57][INFO] i= 22 x: [[-2.18103806e+08 -4.36207612e+08]]
[07-15 17:44:57][INFO] i= 23 x: [[4.36207618e+08 8.72415236e+08]]
[07-15 17:44:57][INFO] i= 24 x: [[-8.72415230e+08 -1.74483046e+09]]
[07-15 17:44:57][INFO] i= 25 x: [[1.74483047e+09 3.48966093e+09]]
[07-15 17:44:57][INFO] i= 26 x: [[-3.48966093e+09 -6.97932185e+09]]
[07-15 17:44:57][INFO] i= 27 x: [[6.97932186e+09 1.39586437e+10]]
[07-15 17:44:57][INFO] i= 28 x: [[-1.39586437e+10 -2.79172874e+10]]
[07-15 17:44:57][INFO] i= 29 x: [[2.79172874e+10 5.58345749e+10]]
```




```
Gauss-Jacobi: Divergió → [1703938. 3211268.]
Gauss-Seidel: Divergió → [2.79172874e+10 5.58345749e+10]
```