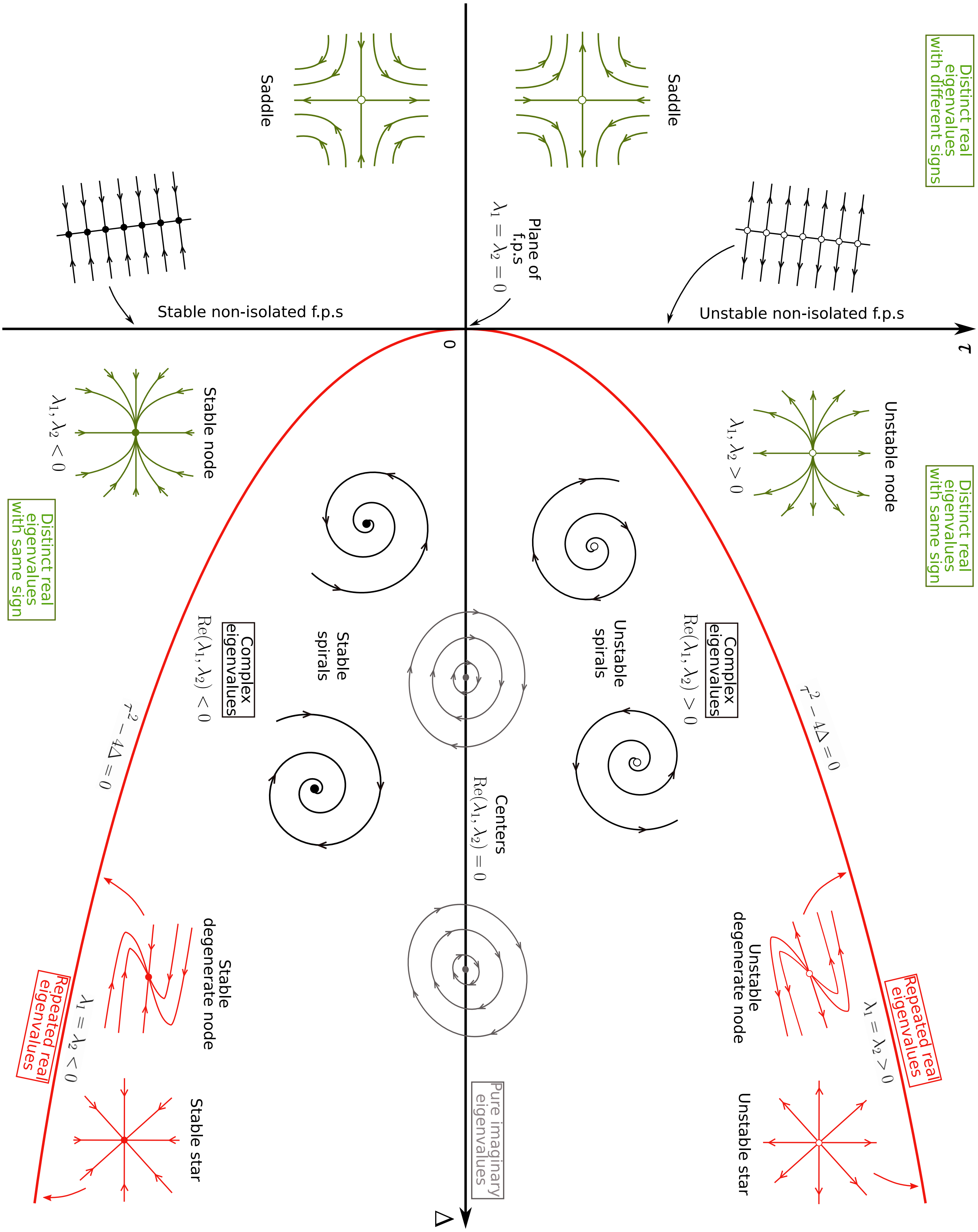
Classification of fixed points in linear homogeneous 2-D systems $\dot{\vec{x}} = A\vec{x}$ where trace $\tau = \lambda_1 + \lambda_2$ and determinant $\Delta = \lambda_1\lambda_2$ are determined by the 2×2 system matrix A.



The classification chart presented above can also be summarised in a concise flowchart:

- if $\Delta < 0$:
  Isolated fixed point
  CASE 1: **Saddle point**[1]
- if $\Delta = 0$:
  Non-isolated fixed points
  - if $\tau < 0$:
    CASE 5a: **Line of stable fixed points**[2]
  - if $\tau = 0$:
    CASE 5b: **Plane of fixed points**[3]
  - if $\tau > 0$:
    CASE 5a: **Line of unstable fixed points**[4]
- if $\Delta > 0$:
  Isolated fixed point
  - if $\tau < -\sqrt{4\Delta}$:
    CASE 2a: **Stable node**[5]
  - if $\tau = -\sqrt{4\Delta}$:
    - if there is one uniquely determined eigenvector (the other is non-unique):
      CASE 4a: **Stable degenerate node**[6]
    - if there are no uniquely determined eigenvectors (both are non-unique):
      CASE 4b: **Stable star**[7]
  - if $-\sqrt{4\Delta} < \tau < 0$:
    CASE 2b: **Stable spiral**[8]
  - if $\tau = 0$:
    CASE 3: **Centre**[9]
  - if $0 < \tau < \sqrt{4\Delta}$:
    CASE 2b: **Unstable spiral**[10]
  - if $\tau = \sqrt{4\Delta}$:
    - if there is one uniquely determined eigenvector (the other is non-unique):
      CASE 4a: **Unstable degenerate node**[11]
    - if there are no uniquely determined eigenvectors (both are non-unique):
      CASE 4b: **Unstable star**[12]
  - if $\sqrt{4\Delta} < \tau$:
    CASE 2a: **Unstable node**[13]

General notes:

- For 2-D linear systems, the above predictions are always accurate.
- For 2-D nonlinear systems, when the above are used as predictions of nonlinear dynamics:
  - The descriptions are always correct for cases 1, 5, 8, 10, and 13 but can be inaccurate for cases 2, 3, 4, 6, 7, 9, 11, and 12.
  - Ambiguous cases 6, 7, 11, and 12 at least have their stability correctly determined.
  - If the system is conservative, a prediction of case 9 is accurate.