

(\* Πρώτη παραλλαγή του βασικού μοντέλου Lotka-Volterra (θηρευτών-θηραμάτων) \*)

a = 30;

b = 1;

c = 15;

d = 1;

k = 26;

tend = 2;

x0 = 2; y0 = 2;

x = .;

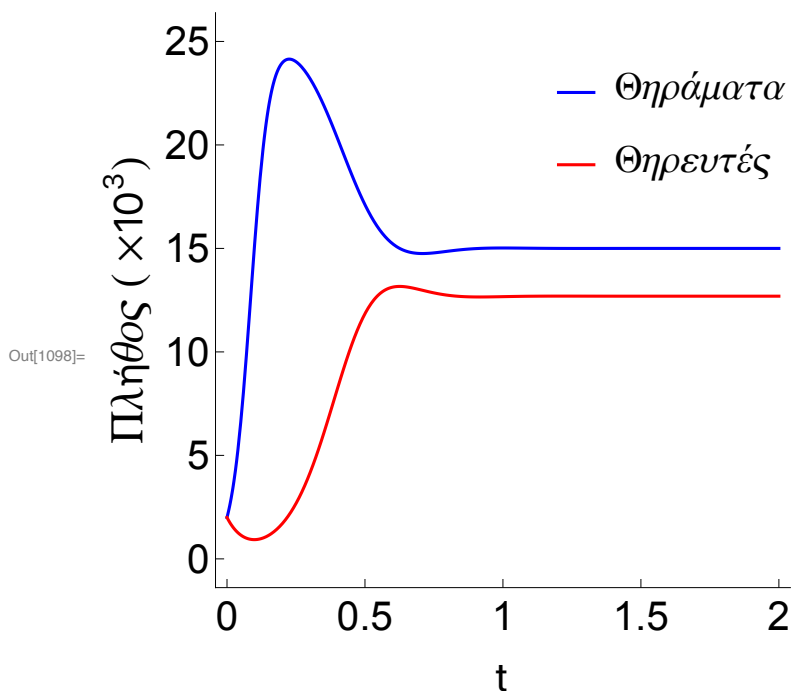
y = .;

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In[1095]:= Sol = NDSolve[{D[x[t], t] == a * x[t] * (1 - x[t] / k) - b * x[t] * y[t], D[y[t], t] ==
  -c * y[t] + d * x[t] * y[t], x[0] == x0, y[0] == y0}, {x, y}, {t, 0, tend}];
Plot1 = Plot[Evaluate[x[t] /. First[Sol]], {t, 0, tend}, PlotPoints -> 200,
  Mesh -> False, AxesLabel -> {t, x}, PlotRange -> All, PlotStyle -> Blue,
  FrameLabel -> {Style["t", FontFamily -> "MS Serif", FontSize -> 21],
  Style["Πλήθος ( ×103)", FontFamily -> "MS Serif", FontSize -> 21]},
  RotateLabel -> True, Frame -> {{Automatic, False}, {Automatic, False}}];
Plot2 = Plot[Evaluate[y[t] /. First[Sol]], {t, 0, tend}, PlotPoints -> 200,
  Mesh -> False, AxesLabel -> {t, y}, PlotRange -> All, PlotStyle -> Red];

MP0 = Show[Plot1, Plot2, PlotRange -> {{0, tend}, {0, 25}}, Epilog ->
  Inset[Column[{LineLegend[{Blue, Red}, {"Θηράματα", "Θηρευτές"}], LabelStyle ->
    {FontFamily -> "Times New Roman", FontSize -> 21, FontSlant -> Italic}}],
  Scaled[{0.8, 0.8}]], MaxRecursion -> 0, PlotPoints -> {200, 100},
  AspectRatio -> 1, AxesOrigin -> {0, 0}, RotateLabel -> True,
  LabelStyle -> {21, GrayLevel[0]},
  FrameTicks -> {{{0, 5, 10, 15, 20, 25}, None}, {{0, 0.5, 1, 1.5, 2}, None}}]

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In[1099]:= Sol1 = NDSolve[{D[x[t], t] == a * x[t] * (1 - x[t] / k) - b * x[t] * y[t], D[y[t], t] ==
  -c * y[t] + d * x[t] * y[t], x[0] == x0, y[0] == y0}, {x, y}, {t, 0, tend}];

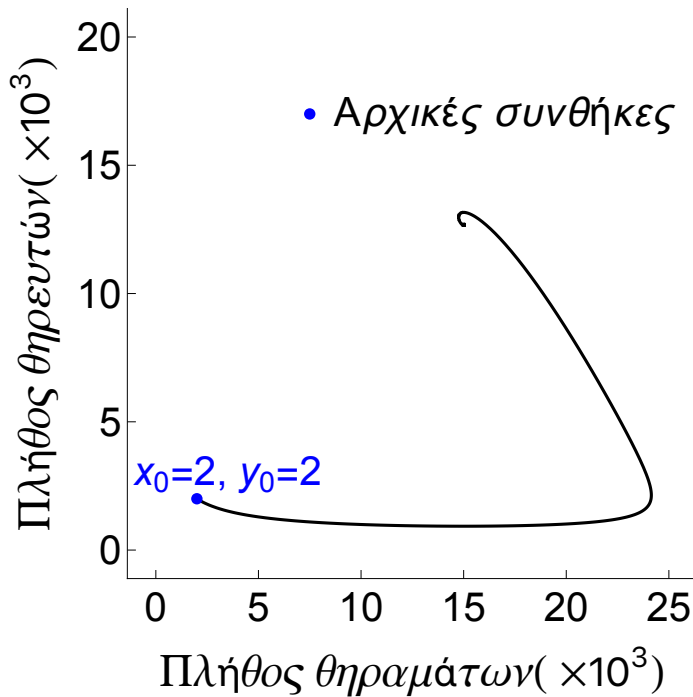
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In[1100]:= P1 =
  ParametricPlot[{Evaluate[x[t] /. First[Sol1]], Evaluate[y[t] /. First[Sol1]]},
    {t, 0, tend}, PlotPoints → 200, Mesh → False, PlotRange → All, PlotStyle → Black,
    FrameLabel → {Style["Πλήθος θηραμάτων ( ×103)", FontFamily → "MS Serif",
      FontSize → 21, FontColor → Black], Style["Πλήθος θηρευτών ( ×103)",
      FontFamily → "MS Serif", FontSize → 21, FontColor → Black]},
    RotateLabel → True, Frame → {{Automatic, False}, {Automatic, False}},
    Epilog →
      {Inset[Graphics[{Black, Text[Style["Αρχικές συνθήκες", 21]]}], {17, 17}],
      Inset[Graphics[{Blue, Text[Style["x0=2, y0=2", 21]]}], {3.5, 3}]}];
G0 = Graphics[{PointSize[0.02], Blue, Point[{7.5, 17}]}];
G1 = Graphics[{PointSize[0.02], Blue, Point[{x0, y0}]}];
In[1103]:= MP0 = Show[P1, G0, G1, PlotRange → {{0, 25}, {0, 20}},
  MaxRecursion → 0, PlotPoints → {200, 100}, AspectRatio → 1,
  AxesOrigin → {0, 0}, RotateLabel → True, LabelStyle → {21, GrayLevel[0]},
  FrameTicks → {{{0, 5, 10, 15, 20, 25}, None}, {{0, 5, 10, 15, 20, 25}, None}}]

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Out[1103]=



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In[1104]:= (*Phase plane *)  
StreamPlot[{a * x * (1 - x / k) - b * x * y, -c * y + d * x * y},  
{x, 0, 25}, {y, 0, 25}, StreamPoints -> 2000, StreamScale -> Full]
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