

a, c)

```
xDot[σ_, x_, y_, z_] = σ * (y - x);  
yDot[r_, x_, y_, z_] = r * x - y - x * z;  
zDot[b_, x_, y_, z_] = x * y - b * z;  
  
J[x_, y_, z_, σ_, b_, r_] =  
  {{D[xDot[σ, x, y, z], x], D[xDot[σ, x, y, z], y], D[xDot[σ, x, y, z], z]},  
   {D[yDot[r, x, y, z], x], D[yDot[r, x, y, z], y], D[yDot[r, x, y, z], z]},  
   {D[zDot[b, x, y, z], x], D[zDot[b, x, y, z], y], D[zDot[b, x, y, z], z]}}  
  
solutions = J[0, 0, 0, 10, 8 / 3, 28];  
Eigenvalues[solutions] // N  
  
{{-σ, σ, 0}, {r - z, -1, -x}, {y, x, -b}}  
  
{-22.827723451163457`, 11.827723451163457`, -2.6666666666666665`}  
(*3 points, 0 stable*)
```

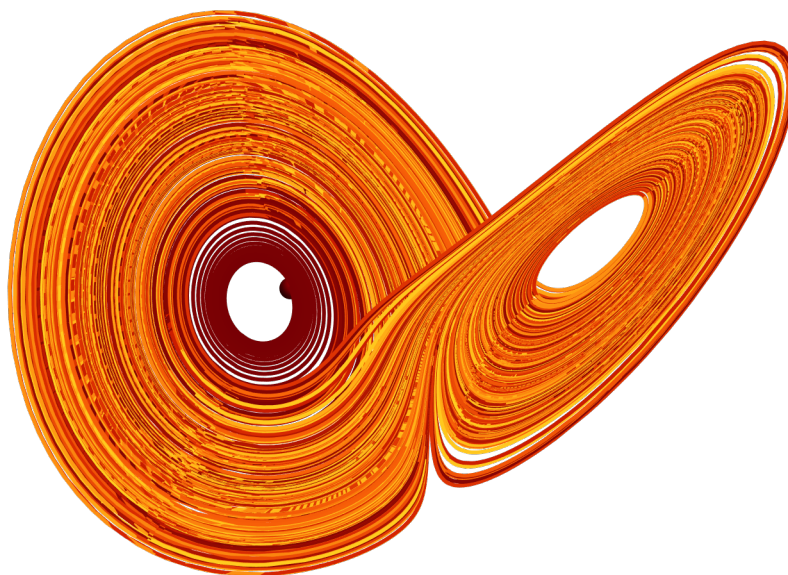
b)

```

In[70]:= Clear["Global`*"]
σV = 10;
bV = 8 / 3;
rV = 28;
IC = 0.2;
s = NDSolve[{x'[t] == σV * (y[t] - x[t]), y'[t] == rV * x[t] - y[t] - x[t] * z[t],
  z'[t] == x[t] * y[t] - bV * z[t], x[0] == y[0] == z[0] == IC},
  {x, y, z}, {t, 0, 500}, MaxSteps → 1000000];
Show[ParametricPlot3D[Evaluate[{x[t], y[t], z[t]} /. s], {t, 5, 400},
  PlotPoints → 1000, PlotStyle → Directive[Thick, RGBColor[.8, 0, 0]],
  ColorFunction → (ColorData["SolarColors", #4] &)],
Graphics3D[{ColorData["SolarColors"][0],
  Sphere[First[{x[t], y[t], z[t]} /. s] /. t → 5], .75}], RotationAction → "Clip",
Boxed → False, SphericalRegion → False, Axes → False, ImageSize → 500]
(*https://reference.wolfram.com/language/example/VisualizeTheLorenzAttractor.html*)

```

Out[76]=



d)

```
In[8]:= Tr[J[x, y, z, σ, b, r]]
```

```
Out[8]= -1 - b - σ
```