In[ ]:=
```
Clear[x, a, b, c, d, equation, roots]

(*Define the coefficients*)
a = 1;
b = -2;
c = -3;
d = 4;

(*Define the equation*)
equation = a * x^3 + b * x^2 + c * x + d;

(*Solve the equation numerically using NSolve*)
roots = NSolve[equation == 0, x];

(*Display the roots*)
roots
```

Out[ ]=
```
{{x → -1.56155}, {x → 1.}, {x → 2.56155}}
```

In[ ]:=
```
Clear[x, a, b, c, d, equation, roots]

(*Define the coefficients*)
a = 1;
b = -2;
c = -3;
d = 4;

(*Define the equation*)
equation = a * x^3 + b * x^2 + c * x + d;

(*Loop to check roots for each ten numbers in the range[-100,100]*)
rootsList = {};

For[start = -100, start ≤ 100, start = start + 10,
 roots = NSolve[{equation == 0, start ≤ x < start + 10}, x];
 rootsList = Join[rootsList, roots];]

(*Display the roots*)
rootsList
```

Out[ ]=
```
{{x → -1.56155}, {x → 1.}, {x → 2.56155}}
```

```
Clear[x, a, b, c, d, equation, roots]

(*Define the coefficients*)

(*Define the equation*)
equation = a * x^3 + b * x^2 + c * x + d;

(*Loop to check roots for each ten numbers in the range[-100,100]*)
rootsList = {};

For[start = -100, start ≤ 100, start = start + 10,
 roots = NSolve[{equation == 0, start ≤ x < start + 10}, x];
 rootsList = Join[rootsList, roots];]

(*Display the roots*)
rootsList

FindRoot[{α x - β y - γ z + ψ x^2 - δ y z, -α x + β y + γ z + θ y^2 - ϵ x Abs[z],
  ξ - α x + β y + γ z - η Abs[y] x}, {{x, 1000}, {y, 1000}, {z, 1000}}]
```

In[ ]:=
```
Clear[x, a, b, c, d, equation, roots]
equation = x^3 - 6 * x^2 + 11 x + 6

FindRoot[equation, {x, 10}]
```

Out[ ]=
$$6 + 11\,x - 6\,x^2 + x^3$$

Out[ ]=
$$\{x \to -0.434841\}$$

In[•]:=
```
Clear[x, a, b, c, d, equation, roots]
```

```
For[i = -10, i < 10, i++]
 For [j = -10, j < 10, j++]
FindRoot[{x^3 * y + 4 * y^2 - 3 x y, x y^4 - 8 y^3 + 7 x^2 y - 8}, {{x, i}, {y, j}}]
```

Out[•]=
```
{x → 2.47105, y → -1.91881}
```

```
{x → 2.4710451213615308`, y → -1.9188060683963832`}
```

In[•]:=
```
Clear[x, a, b, c, d, equation, roots]

(*Define the coefficients*)
a = 1;
b = -2;
c = -3;
d = 4;

(*Define the equation*)
equation = a * x^3 + b * x^2 + c * x + d;

(*Loop to check roots for each ten numbers in the range[-100,100]*)
rootsList = {};

For[start = -100, start ≤ 100, start = start + 10,
 roots = NSolve[{equation == 0, start ≤ x < start + 10}, x];
 rootsList = Join[rootsList, roots];]

(*Display the roots*)
rootsList
```

Out[•]=
```
{{x → -1.56155}, {x → 1.}, {x → 2.56155}}
```

In[ ]:=

```
Clear[x, a, b, c, d, equation, roots]
equation = x^3 * y + 4 * y^2 - 3 xy;
equation1 = xy^4 - 8 y^3 + 7 x^2 y - 8;

rootsList = {};

For[start = -10, start ≤ 10, start = start + 1, roots = NSolve[
   {equation == 0, start ≤ x < start + 1, equation1 == 0, start ≤ y ≤ start + 1}, x, y];

 rootsList = Join[rootsList, roots];]

rootsList
```

NSolve: 警告：y 不是一个有效的域指定. 假定它是一个需要消除的变量.

NSolve: 警告：y 不是一个有效的域指定. 假定它是一个需要消除的变量.

NSolve: 警告：y 不是一个有效的域指定. 假定它是一个需要消除的变量.

General: 在本次计算中，NSolve::bdomv 的进一步输出将被抑制.

Out[ ]=

```
{}
```

SetDelayed: $\left(-8 + xy^4 + 7\,x^2\,y - 8\,y^3\right)[x\_, y\_]$ 中的标签 Plus 被保护.

Table: 迭代器 {x, range_x} 没有适当的边界.

Table: 迭代器 {x, range_x} 没有适当的边界.

Out[ ]=

```
Table[{x, y, equation1[x, y]}, {x, range_x}, {y, range_y}]

(*This is  for  absolute value  y,and z have different situation*)
```

```
ClearAll

α = 0.05 ;
β = 0.01 ;
γ = 0.05 ;
δ = 0.02 ;
ϵ = 0;
ζ = 0.01 ;
η = 0 ;
Θ = 1.0 ;
ψ = -0.1;
```

In[•]:=
```
FindRoot[{α x - β y - γ z + ψ x^2 - δ y z, -α x + β y + γ z + Θ y^2 - ϵ x z, ζ - α x + β y + γ z - η y x},
 {{x, 1000}, {y, 1000}, {z, 1000}}]
```

Out[•]=
```
{x → 0.289824, y → 0.0972025, z → 0.0985556}

{x → 0.28982442362707644`, y → 0.09720252647933221`, z → 0.0985555845431781`}
```

In[•]:=
```
FindRoot[{α x - β y - γ z + ψ x^2 - δ y z, -α x + β y + γ z + Θ y^2 z + ϵ x z, ζ - α x + β y + γ z + η y x},
 {{x, 1000}, {y, 1000}, {z, 1000}}]
```

FindRoot: 线搜索把步长降低到由 AccuracyGoal 和 PrecisionGoal
指定的容差范围内，但是无法使优化目标函数的值减小得足够多. 您可能需要多于 MachinePrecision
位的工作精度以满足这些容差.

Out[•]=
```
{x → -0.31527, y → 0.012177, z → -0.512961}
```

In[•]:=
```
FindRoot[{α x - β y - γ z + ψ x^2 - δ y z, -α x + β y + γ z + Θ y^2 + ϵ x z, ζ - α x + β y + γ z - η y x},
 {{x, 1000}, {y, 1000}, {z, 1000}}]
```

Out[•]=
```
{x → 0.292069, y → 0.0884856, z → 0.100216}
```

In[•]:=
```
FindRoot[{α x - β y - γ z + ψ x^2 - δ y z, -α x + β y + γ z + Θ y^2 - ϵ x z, ζ - α x + β y + γ z + η y x},
 {{x, 1000}, {y, 1000}, {z, 1000}}]
```

```
{x → -0.3063541197571247`, y → 0.11317880799639801`, z → -0.49431708725750717`}
```

```
(*This is for the special case 2,
maybe this one also should have four situation *)
```

```
FindRoot[{α x - β y - γ z + ψ x^2 - δ y z, -α x + β y + γ z + Θ y^2 - ϵ x z, ξ - α x + β y + γ z + η y x},
 {{x, 1000}, {y, 1000}, {z, 1000}}]
```

Out[ ]=

```
{x → -0.306354, y → 0.113179, z → -0.494317}
```

In[ ]:=

```
α = 0.05 ;
β = 0.01 ;
γ = 0.05 ;
δ = 0 ;
ϵ = 0.03;
ξ = 0.01 ;
η = 0 ;
Θ = 1.0 ;
ψ = -0.1;
```

In[ ]:=

```
FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z},
 {x, 100}, {y, 100}, {z, 100}]
```

FindRoot: 在 {x, y, z} = {100., 100., 100.} 处，函数值
{100. α − 100. β − 100. γ + 10000. ψ, −100. α + 100. β + 100. γ − 10000. ϵ + 10000. θ, −100. α + 100. β + 100. γ + ζ} 不是由数字组成的维度为 {3} 的列表.

In[•]:=
```
FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ζ - α x + β y + γ z},
 {x, 100}, {y, 100}, {z, 100}]
```

```
Clear[α, β, γ, ϵ, ζ, Θ, ψ, x, y, z]
ClearAll
FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ζ - α x + β y + γ z},
 {x, -1}, {y, 100}, {z, 100}]
```

FindRoot: 在 {x, y, z} = {100., 100., 100.} 处，函数值
{100. α − 100. β − 100. γ + 10000. ψ, −100. α + 100. β + 100. γ − 10000. ϵ + 10000. θ, −100. α + 100. β + 100. γ + ζ} 不是由数字组成的维度为 {3} 的列表.

Out[•]=
```
FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ζ - α x + β y + γ z},
 {x, 100}, {y, 100}, {z, 100}]
```

Out[•]=
```
ClearAll
```

FindRoot: 在 {x, y, z} = {−1., 100., 100.} 处，函数值
{−1. α − 100. β − 100. γ + 1. ψ, 1. α + 100. β + 100. γ + 100. ϵ + 10000. θ, 1. α + 100. β + 100. γ + ζ}
不是由数字组成的维度为 {3} 的列表.

Out[•]=
```
FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ζ - α x + β y + γ z},
 {x, -1}, {y, 100}, {z, 100}]
```

In[•]:=
```
For[i = -10, i < 10, i++; For [j = -10, j < 10, j++;
  Print[FindRoot[{x^3 * y + 4 * y^2 - 3 x y, x y^4 - 8 y^3 + 7 x^2 y - 8}, {x, 1}, {y, j}],
   ", i= ", i, ", j=", j]
 ]]
```

```
{x → 2.47105, y → -1.91881}, i= -9, j=-9
{x → 2.47105, y → -1.91881}, i= -9, j=-8
{x → 2.47105, y → -1.91881}, i= -9, j=-7
{x → 2.47105, y → -1.91881}, i= -9, j=-6
{x → 2.47105, y → -1.91881}, i= -9, j=-5
{x → 2.47105, y → -1.91881}, i= -9, j=-4
{x → 2.47105, y → -1.91881}, i= -9, j=-3
```

FindRoot: 线搜索把步长降低到由 AccuracyGoal 和 PrecisionGoal
指定的容差范围内，但是无法使优化目标函数的值减小得足够多. 您可能需要多于 MachinePrecision
位的工作精度以满足这些容差.

```
{x → -0.42134, y → -0.826914}, i= -9, j=-2
```

FindRoot: 无法在 100 次迭代中收敛到要求的准确度或者精度.

{x → 1.45676, y → 0.395532}, i= -9, j=-1

FindRoot: 在点 {x, y} = {1., 0.} 碰到奇异雅克比. 尝试扰动初始点.

{x → 1., y → 0.}, i= -9, j=0

FindRoot: 线搜索把步长降低到由 AccuracyGoal 和 PrecisionGoal 指定的容差范围内，但是无法使优化目标函数的值减小得足够多. 您可能需要多于 MachinePrecision 位的工作精度以满足这些容差.

{x → 1.52276, y → 0.418185}, i= -9, j=1

FindRoot: 线搜索把步长降低到由 AccuracyGoal 和 PrecisionGoal 指定的容差范围内，但是无法使优化目标函数的值减小得足够多. 您可能需要多于 MachinePrecision 位的工作精度以满足这些容差.

General: 在本次计算中，FindRoot::lstol 的进一步输出将被抑制.

{x → 1.53155, y → 0.421222}, i= -9, j=2

{x → 1.59568, y → 0.443617}, i= -9, j=3

{x → 1.53993, y → 0.424128}, i= -9, j=4

{x → 1.53585, y → 0.422711}, i= -9, j=5

FindRoot: 无法在 100 次迭代中收敛到要求的准确度或者精度.

{x → 1.51819, y → 0.416607}, i= -9, j=6

{x → 1.51775, y → 0.416456}, i= -9, j=7

{x → 1.60327, y → 0.446295}, i= -9, j=8

{x → 1.56941, y → 0.434397}, i= -9, j=9

{x → 1.62076, y → 0.452481}, i= -9, j=10

{x → 2.47105, y → -1.91881}, i= -8, j=-9

{x → 2.47105, y → -1.91881}, i= -8, j=-8

{x → 2.47105, y → -1.91881}, i= -8, j=-7

{x → 2.47105, y → -1.91881}, i= -8, j=-6

{x → 2.47105, y → -1.91881}, i= -8, j=-5

{x → 2.47105, y → -1.91881}, i= -8, j=-4

{x → 2.47105, y → -1.91881}, i= -8, j=-3

{x → -0.42134, y → -0.826914}, i= -8, j=-2

FindRoot: 无法在 100 次迭代中收敛到要求的准确度或者精度.

General: 在本次计算中，FindRoot::cvmit 的进一步输出将被抑制.

{x → 1.45676, y → 0.395532}, i= -8, j=-1

FindRoot: 在点 {x, y} = {1., 0.} 碰到奇异雅克比. 尝试扰动初始点.

{x → 1., y → 0.}, i= -8, j=0

{x → 1.52276, y → 0.418185}, i= -8, j=1

{x → 1.53155, y → 0.421222}, i= -8, j=2

{x → 1.59568, y → 0.443617}, i= -8, j=3

{x → 1.53993, y → 0.424128}, i= -8, j=4

{x → 1.53585, y → 0.422711}, i= -8, j=5

{x → 1.51819, y → 0.416607}, i= -8, j=6

{x → 1.51775, y → 0.416456}, i= -8, j=7

{x → 1.60327, y → 0.446295}, i= -8, j=8

{x → 1.56941, y → 0.434397}, i= -8, j=9

{x → 1.62076, y → 0.452481}, i= -8, j=10

{x → 2.47105, y → -1.91881}, i= -7, j=-9

{x → 2.47105, y → -1.91881}, i= -7, j=-8

{x → 2.47105, y → -1.91881}, i= -7, j=-7

{x → 2.47105, y → -1.91881}, i= -7, j=-6

{x → 2.47105, y → -1.91881}, i= -7, j=-5

{x → 2.47105, y → -1.91881}, i= -7, j=-4

{x → 2.47105, y → -1.91881}, i= -7, j=-3

{x → -0.42134, y → -0.826914}, i= -7, j=-2

{x → 1.45676, y → 0.395532}, i= -7, j=-1

••• FindRoot: 在点 {x, y} = {1., 0.} 碰到奇异雅克比. 尝试扰动初始点.

••• General: 在本次计算中，FindRoot::jsing 的进一步输出将被抑制.

{x → 1., y → 0.}, i= -7, j=0

{x → 1.52276, y → 0.418185}, i= -7, j=1

{x → 1.53155, y → 0.421222}, i= -7, j=2

{x → 1.59568, y → 0.443617}, i= -7, j=3

{x → 1.53993, y → 0.424128}, i= -7, j=4

{x → 1.53585, y → 0.422711}, i= -7, j=5

{x → 1.51819, y → 0.416607}, i= -7, j=6

{x → 1.51775, y → 0.416456}, i= -7, j=7

{x → 1.60327, y → 0.446295}, i= -7, j=8

{x → 1.56941, y → 0.434397}, i= -7, j=9

{x → 1.62076, y → 0.452481}, i= -7, j=10

{x → 2.47105, y → -1.91881}, i= -6, j=-9

{x → 2.47105, y → -1.91881}, i= -6, j=-8

{x → 2.47105, y → -1.91881}, i= -6, j=-7

```
{x → 2.47105, y → -1.91881}, i= -6, j=-6
{x → 2.47105, y → -1.91881}, i= -6, j=-5
{x → 2.47105, y → -1.91881}, i= -6, j=-4
{x → 2.47105, y → -1.91881}, i= -6, j=-3
{x → -0.42134, y → -0.826914}, i= -6, j=-2
{x → 1.45676, y → 0.395532}, i= -6, j=-1
{x → 1., y → 0.}, i= -6, j=0
{x → 1.52276, y → 0.418185}, i= -6, j=1
{x → 1.53155, y → 0.421222}, i= -6, j=2
{x → 1.59568, y → 0.443617}, i= -6, j=3
{x → 1.53993, y → 0.424128}, i= -6, j=4
{x → 1.53585, y → 0.422711}, i= -6, j=5
{x → 1.51819, y → 0.416607}, i= -6, j=6
{x → 1.51775, y → 0.416456}, i= -6, j=7
{x → 1.60327, y → 0.446295}, i= -6, j=8
{x → 1.56941, y → 0.434397}, i= -6, j=9
{x → 1.62076, y → 0.452481}, i= -6, j=10
{x → 2.47105, y → -1.91881}, i= -5, j=-9
{x → 2.47105, y → -1.91881}, i= -5, j=-8
{x → 2.47105, y → -1.91881}, i= -5, j=-7
{x → 2.47105, y → -1.91881}, i= -5, j=-6
{x → 2.47105, y → -1.91881}, i= -5, j=-5
{x → 2.47105, y → -1.91881}, i= -5, j=-4
{x → 2.47105, y → -1.91881}, i= -5, j=-3
{x → -0.42134, y → -0.826914}, i= -5, j=-2
{x → 1.45676, y → 0.395532}, i= -5, j=-1
{x → 1., y → 0.}, i= -5, j=0
{x → 1.52276, y → 0.418185}, i= -5, j=1
{x → 1.53155, y → 0.421222}, i= -5, j=2
{x → 1.59568, y → 0.443617}, i= -5, j=3
{x → 1.53993, y → 0.424128}, i= -5, j=4
{x → 1.53585, y → 0.422711}, i= -5, j=5
{x → 1.51819, y → 0.416607}, i= -5, j=6
{x → 1.51775, y → 0.416456}, i= -5, j=7
{x → 1.60327, y → 0.446295}, i= -5, j=8
{x → 1.56941, y → 0.434397}, i= -5, j=9
```

```
{x → 1.62076, y → 0.452481}, i= -5, j=10
{x → 2.47105, y → -1.91881}, i= -4, j=-9
{x → 2.47105, y → -1.91881}, i= -4, j=-8
{x → 2.47105, y → -1.91881}, i= -4, j=-7
{x → 2.47105, y → -1.91881}, i= -4, j=-6
{x → 2.47105, y → -1.91881}, i= -4, j=-5
{x → 2.47105, y → -1.91881}, i= -4, j=-4
{x → 2.47105, y → -1.91881}, i= -4, j=-3
{x → -0.42134, y → -0.826914}, i= -4, j=-2
{x → 1.45676, y → 0.395532}, i= -4, j=-1
{x → 1., y → 0.}, i= -4, j=0
{x → 1.52276, y → 0.418185}, i= -4, j=1
{x → 1.53155, y → 0.421222}, i= -4, j=2
{x → 1.59568, y → 0.443617}, i= -4, j=3
{x → 1.53993, y → 0.424128}, i= -4, j=4
{x → 1.53585, y → 0.422711}, i= -4, j=5
{x → 1.51819, y → 0.416607}, i= -4, j=6
{x → 1.51775, y → 0.416456}, i= -4, j=7
{x → 1.60327, y → 0.446295}, i= -4, j=8
{x → 1.56941, y → 0.434397}, i= -4, j=9
{x → 1.62076, y → 0.452481}, i= -4, j=10
{x → 2.47105, y → -1.91881}, i= -3, j=-9
{x → 2.47105, y → -1.91881}, i= -3, j=-8
{x → 2.47105, y → -1.91881}, i= -3, j=-7
{x → 2.47105, y → -1.91881}, i= -3, j=-6
{x → 2.47105, y → -1.91881}, i= -3, j=-5
{x → 2.47105, y → -1.91881}, i= -3, j=-4
{x → 2.47105, y → -1.91881}, i= -3, j=-3
{x → -0.42134, y → -0.826914}, i= -3, j=-2
{x → 1.45676, y → 0.395532}, i= -3, j=-1
{x → 1., y → 0.}, i= -3, j=0
{x → 1.52276, y → 0.418185}, i= -3, j=1
{x → 1.53155, y → 0.421222}, i= -3, j=2
{x → 1.59568, y → 0.443617}, i= -3, j=3
{x → 1.53993, y → 0.424128}, i= -3, j=4
{x → 1.53585, y → 0.422711}, i= -3, j=5
```

{x → 1.51819, y → 0.416607}, i= -3, j=6

{x → 1.51775, y → 0.416456}, i= -3, j=7

{x → 1.60327, y → 0.446295}, i= -3, j=8

{x → 1.56941, y → 0.434397}, i= -3, j=9

{x → 1.62076, y → 0.452481}, i= -3, j=10

{x → 2.47105, y → -1.91881}, i= -2, j=-9

{x → 2.47105, y → -1.91881}, i= -2, j=-8

{x → 2.47105, y → -1.91881}, i= -2, j=-7

{x → 2.47105, y → -1.91881}, i= -2, j=-6

{x → 2.47105, y → -1.91881}, i= -2, j=-5

{x → 2.47105, y → -1.91881}, i= -2, j=-4

{x → 2.47105, y → -1.91881}, i= -2, j=-3

{x → -0.42134, y → -0.826914}, i= -2, j=-2

{x → 1.45676, y → 0.395532}, i= -2, j=-1

{x → 1., y → 0.}, i= -2, j=0

{x → 1.52276, y → 0.418185}, i= -2, j=1

{x → 1.53155, y → 0.421222}, i= -2, j=2

{x → 1.59568, y → 0.443617}, i= -2, j=3

{x → 1.53993, y → 0.424128}, i= -2, j=4

{x → 1.53585, y → 0.422711}, i= -2, j=5

{x → 1.51819, y → 0.416607}, i= -2, j=6

{x → 1.51775, y → 0.416456}, i= -2, j=7

{x → 1.60327, y → 0.446295}, i= -2, j=8

{x → 1.56941, y → 0.434397}, i= -2, j=9

{x → 1.62076, y → 0.452481}, i= -2, j=10

{x → 2.47105, y → -1.91881}, i= -1, j=-9

{x → 2.47105, y → -1.91881}, i= -1, j=-8

{x → 2.47105, y → -1.91881}, i= -1, j=-7

{x → 2.47105, y → -1.91881}, i= -1, j=-6

{x → 2.47105, y → -1.91881}, i= -1, j=-5

{x → 2.47105, y → -1.91881}, i= -1, j=-4

{x → 2.47105, y → -1.91881}, i= -1, j=-3

{x → -0.42134, y → -0.826914}, i= -1, j=-2

{x → 1.45676, y → 0.395532}, i= -1, j=-1

{x → 1., y → 0.}, i= -1, j=0

{x → 1.52276, y → 0.418185}, i= -1, j=1

```
{x → 1.53155, y → 0.421222}, i= -1, j=2
{x → 1.59568, y → 0.443617}, i= -1, j=3
{x → 1.53993, y → 0.424128}, i= -1, j=4
{x → 1.53585, y → 0.422711}, i= -1, j=5
{x → 1.51819, y → 0.416607}, i= -1, j=6
{x → 1.51775, y → 0.416456}, i= -1, j=7
{x → 1.60327, y → 0.446295}, i= -1, j=8
{x → 1.56941, y → 0.434397}, i= -1, j=9
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{x → 2.47105, y → -1.91881}, i= 0, j=-3
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{x → 2.47105, y → -1.91881}, i= 1, j=-4
{x → 2.47105, y → -1.91881}, i= 1, j=-3
```

```
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{x → 1., y → 0.}, i= 1, j=0
{x → 1.52276, y → 0.418185}, i= 1, j=1
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{x → 1.59568, y → 0.443617}, i= 1, j=3
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{x → 1.51775, y → 0.416456}, i= 1, j=7
{x → 1.60327, y → 0.446295}, i= 1, j=8
{x → 1.56941, y → 0.434397}, i= 1, j=9
{x → 1.62076, y → 0.452481}, i= 1, j=10
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{x → 2.47105, y → -1.91881}, i= 2, j=-3
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{x → 1.59568, y → 0.443617}, i= 2, j=3
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{x → 1.51775, y → 0.416456}, i= 2, j=7
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{x → 1.56941, y → 0.434397}, i= 2, j=9
{x → 1.62076, y → 0.452481}, i= 2, j=10
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{x → 2.47105, y → -1.91881}, i= 3, j=-8
{x → 2.47105, y → -1.91881}, i= 3, j=-7
```

```
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{x → 2.47105, y → -1.91881}, i= 3, j=-4
{x → 2.47105, y → -1.91881}, i= 3, j=-3
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{x → 1.45676, y → 0.395532}, i= 3, j=-1
{x → 1., y → 0.}, i= 3, j=0
{x → 1.52276, y → 0.418185}, i= 3, j=1
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{x → 1.59568, y → 0.443617}, i= 3, j=3
{x → 1.53993, y → 0.424128}, i= 3, j=4
{x → 1.53585, y → 0.422711}, i= 3, j=5
{x → 1.51819, y → 0.416607}, i= 3, j=6
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{x → 2.47105, y → -1.91881}, i= 4, j=-3
{x → -0.42134, y → -0.826914}, i= 4, j=-2
{x → 1.45676, y → 0.395532}, i= 4, j=-1
{x → 1., y → 0.}, i= 4, j=0
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{x → 1.59568, y → 0.443617}, i= 4, j=3
{x → 1.53993, y → 0.424128}, i= 4, j=4
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{x → 1.51819, y → 0.416607}, i= 4, j=6
{x → 1.51775, y → 0.416456}, i= 4, j=7
{x → 1.60327, y → 0.446295}, i= 4, j=8
{x → 1.56941, y → 0.434397}, i= 4, j=9
```

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{x → 2.47105, y → -1.91881}, i= 5, j=-4

{x → 2.47105, y → -1.91881}, i= 5, j=-3

{x → -0.42134, y → -0.826914}, i= 5, j=-2

{x → 1.45676, y → 0.395532}, i= 5, j=-1

{x → 1., y → 0.}, i= 5, j=0

{x → 1.52276, y → 0.418185}, i= 5, j=1

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{x → 1.59568, y → 0.443617}, i= 5, j=3

{x → 1.53993, y → 0.424128}, i= 5, j=4

{x → 1.53585, y → 0.422711}, i= 5, j=5

{x → 1.51819, y → 0.416607}, i= 5, j=6

{x → 1.51775, y → 0.416456}, i= 5, j=7

{x → 1.60327, y → 0.446295}, i= 5, j=8

{x → 1.56941, y → 0.434397}, i= 5, j=9

{x → 1.62076, y → 0.452481}, i= 5, j=10

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{x → 2.47105, y → -1.91881}, i= 6, j=-8

{x → 2.47105, y → -1.91881}, i= 6, j=-7

{x → 2.47105, y → -1.91881}, i= 6, j=-6

{x → 2.47105, y → -1.91881}, i= 6, j=-5

{x → 2.47105, y → -1.91881}, i= 6, j=-4

{x → 2.47105, y → -1.91881}, i= 6, j=-3

{x → -0.42134, y → -0.826914}, i= 6, j=-2

{x → 1.45676, y → 0.395532}, i= 6, j=-1

{x → 1., y → 0.}, i= 6, j=0

{x → 1.52276, y → 0.418185}, i= 6, j=1

{x → 1.53155, y → 0.421222}, i= 6, j=2

{x → 1.59568, y → 0.443617}, i= 6, j=3

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```
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{x → 1.51775, y → 0.416456}, i= 6, j=7
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{x → 1.56941, y → 0.434397}, i= 6, j=9
{x → 1.62076, y → 0.452481}, i= 6, j=10
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{x → 2.47105, y → -1.91881}, i= 7, j=-8
{x → 2.47105, y → -1.91881}, i= 7, j=-7
{x → 2.47105, y → -1.91881}, i= 7, j=-6
{x → 2.47105, y → -1.91881}, i= 7, j=-5
{x → 2.47105, y → -1.91881}, i= 7, j=-4
{x → 2.47105, y → -1.91881}, i= 7, j=-3
{x → -0.42134, y → -0.826914}, i= 7, j=-2
{x → 1.45676, y → 0.395532}, i= 7, j=-1
{x → 1., y → 0.}, i= 7, j=0
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{x → 1.51775, y → 0.416456}, i= 7, j=7
{x → 1.60327, y → 0.446295}, i= 7, j=8
{x → 1.56941, y → 0.434397}, i= 7, j=9
{x → 1.62076, y → 0.452481}, i= 7, j=10
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{x → 2.47105, y → -1.91881}, i= 8, j=-8
{x → 2.47105, y → -1.91881}, i= 8, j=-7
{x → 2.47105, y → -1.91881}, i= 8, j=-6
{x → 2.47105, y → -1.91881}, i= 8, j=-5
{x → 2.47105, y → -1.91881}, i= 8, j=-4
{x → 2.47105, y → -1.91881}, i= 8, j=-3
{x → -0.42134, y → -0.826914}, i= 8, j=-2
{x → 1.45676, y → 0.395532}, i= 8, j=-1
{x → 1., y → 0.}, i= 8, j=0
{x → 1.52276, y → 0.418185}, i= 8, j=1
```

```
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{x → 1.59568, y → 0.443617}, i= 8, j=3
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{x → 1.53585, y → 0.422711}, i= 8, j=5
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{x → 1.60327, y → 0.446295}, i= 8, j=8
{x → 1.56941, y → 0.434397}, i= 8, j=9
{x → 1.62076, y → 0.452481}, i= 8, j=10
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{x → 2.47105, y → -1.91881}, i= 9, j=-8
{x → 2.47105, y → -1.91881}, i= 9, j=-7
{x → 2.47105, y → -1.91881}, i= 9, j=-6
{x → 2.47105, y → -1.91881}, i= 9, j=-5
{x → 2.47105, y → -1.91881}, i= 9, j=-4
{x → 2.47105, y → -1.91881}, i= 9, j=-3
{x → -0.42134, y → -0.826914}, i= 9, j=-2
{x → 1.45676, y → 0.395532}, i= 9, j=-1
{x → 1., y → 0.}, i= 9, j=0
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{x → 1.59568, y → 0.443617}, i= 9, j=3
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{x → 1.60327, y → 0.446295}, i= 9, j=8
{x → 1.56941, y → 0.434397}, i= 9, j=9
{x → 1.62076, y → 0.452481}, i= 9, j=10
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{x → 2.47105, y → -1.91881}, i= 10, j=-8
{x → 2.47105, y → -1.91881}, i= 10, j=-7
{x → 2.47105, y → -1.91881}, i= 10, j=-6
{x → 2.47105, y → -1.91881}, i= 10, j=-5
{x → 2.47105, y → -1.91881}, i= 10, j=-4
{x → 2.47105, y → -1.91881}, i= 10, j=-3
```

```
{x → -0.42134, y → -0.826914}, i= 10, j=-2
{x → 1.45676, y → 0.395532}, i= 10, j=-1
{x → 1., y → 0.}, i= 10, j=0
{x → 1.52276, y → 0.418185}, i= 10, j=1
{x → 1.53155, y → 0.421222}, i= 10, j=2
{x → 1.59568, y → 0.443617}, i= 10, j=3
{x → 1.53993, y → 0.424128}, i= 10, j=4
{x → 1.53585, y → 0.422711}, i= 10, j=5
{x → 1.51819, y → 0.416607}, i= 10, j=6
{x → 1.51775, y → 0.416456}, i= 10, j=7
{x → 1.60327, y → 0.446295}, i= 10, j=8
{x → 1.56941, y → 0.434397}, i= 10, j=9
{x → 1.62076, y → 0.452481}, i= 10, j=10
```

In[•]:=
```
FindRoot[{x^3 * y + 4 * y^2 - 3 x y, x y^4 - 8 y^3 + 7 x^2 y - 8}, {x, 9}, {y, 7}]
```

FindRoot: 线搜索把步长降低到由 AccuracyGoal 和 PrecisionGoal
指定的容差范围内，但是无法使优化目标函数的值减小得足够多. 您可能需要多于 MachinePrecision
位的工作精度以满足这些容差.

Out[•]=
```
{x → 1.58031, y → 0.438212}
```

In[•]:=
```
xyrule = FindRoot[{x^3 * y + 4 * y^2 - 3 x y, x y^4 - 8 y^3 + 7 x^2 y - 8}, {x, 1.5}, {y, .42}]
```

FindRoot: 线搜索把步长降低到由 AccuracyGoal 和 PrecisionGoal
指定的容差范围内，但是无法使优化目标函数的值减小得足够多. 您可能需要多于 MachinePrecision
位的工作精度以满足这些容差.

Out[•]=
```
{x → 1.50907, y → 0.413465}
```

In[•]:=
```
{x^3 * y + 4 * y^2 - 3 x y, x y^4 - 8 y^3 + 7 x^2 y - 8} /. xyrule
```

Out[•]=
```
{0.232882, -1.93029}
```

In[•]:=
```
Clear[x, a, b, c, d, y, equation, roots]
```

In[•]:=
```
equation = x^3 y + 2 x^2 + 9 x y;
equation2 = 4 y^4 - 5 x y^3 + 9 x y;

For[i = -5, i < 5, i++;
 xyrule = FindRoot[{equation, equation2}, {x, 1}, {y, i}] ×
    rasiduals = {equation, equation2} /. xyrule ×
     Print[xyrule, "", rasiduals, "x = 1", "," "y = ", i]
]
```

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                    9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                            9 x y - 5 x y^3 + 4 y^4} /. {Null (x → 4.00203 × 10^-40),
                            Null (y → 2.39972 × 10^-8)}))))))))) rasidualsx = 1, y = -4
```

ReplaceAll: {Null ({2 x^2 + 9 x y + x^3 y, 9 x y − 5 x y^3 + 4 y^4} /.
Null ({Times[≪2≫] + Times[≪3≫] + Times[≪2≫], Times[≪3≫] + Times[≪3≫] + Times[≪2≫]} /.
Null ({≪2≫} /. Times[≪2≫])))}

既不是替换规则列表，也不是一个有效的分派表，因此无法用来替换.

Set: rasiduals {x → 2.28457 × 10^−40, y → −2.42626 × 10^−8} 中的标签 Times 被保护.

ReplaceAll: {Null (x → 4.00203 × 10^−40), Null (y → 2.39972 × 10^−8)}

既不是替换规则列表，也不是一个有效的分派表，因此无法用来替换.

ReplaceAll: {Null ({2 x^2 + 9 x y + x^3 y, 9 x y − 5 x y^3 + 4 y^4} /. {Null (x → 4.00203 × 10^−40), Null (y → 2.39972 × 10^−8)}))}

既不是替换规则列表，也不是一个有效的分派表，因此无法用来替换.

General: 在本次计算中，ReplaceAll::reps 的进一步输出将被抑制.

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y -
              5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y -
                      5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null
                        ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                              9 x y - 5 x y^3 + 4 y^4} /. {Null (x → 4.00203 × 10^-40), Null
                                (y → 2.39972 × 10^-8)})))))))))) rasidualsx = 1, y = -3
```

Set: rasiduals {x → 8.34682 × 10^−40, y → −2.47133 × 10^−8} 中的标签 Times 被保护.

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                    9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                            9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                                4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                  {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                                        10^-8)}))))))))))) rasidualsx = 1, y = -2
```

Set: rasiduals {x → 1.11492 × 10^−38, y → −3.02672 × 10^−8} 中的标签 Times 被保护.

General: 在本次计算中，Set::write 的进一步输出将被抑制. ⓘ

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                  9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                    Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                          9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                  {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                                    10^-8)}))))))))))))) rasidualsx = 1, y = -1
```

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                  9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                    Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                          9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                    {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                                    10^-8)})))))))))))))) rasidualsx = 1, y = 0
```

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                  9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                    Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                          9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                    Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                    {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                                    10^-8)}))))))))))))))) rasidualsx = 1, y = 1
```

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                    9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                            9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                                4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                    Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                      {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                                      10^-8)}))))))))))))))))rasidualsx = 1, y = 2
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
              4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                    9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                            9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                                4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                    Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                                      {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                                      10^-8)}))))))))))))))))rasidualsx = 1, y = 3
```

```
{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
          4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
            9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
              Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                  9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                    4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                     Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                       Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                        10^-8)})))))))))))))))))rasidualsx = 1, y = 4

{2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
  Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
      Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
          4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
            9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
              Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y,
                  9 x y - 5 x y^3 + 4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 +
                    4 y^4} /. Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                     Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                       Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        Null ({2 x^2 + 9 x y + x^3 y, 9 x y - 5 x y^3 + 4 y^4} /.
                        {Null (x → 4.00203 × 10^-40), Null (y → 2.39972 ×
                        10^-8)}))))))))))))))))))rasidualsx = 1, y = 5
```

In[ ]:=

```
FindRoot[{x^3 y + 2 x^2 + 9 x y, 4 y^4 - 5 x y^3 + 9 x y}, {x, 1}, {y, 4}]
```

Out[ ]=

$$\{x \to 1.68081 \times 10^{-39}, y \to 2.7359 \times 10^{-8}\}$$

```
In[•]:= For[i = -5, i < 5, i++;
          xyrule = FindRoot[{x^3 y + 2 x^2 + 9 x y, 4 y^4 - 5 x y^3 + 9 x y}, {x, 1}, {y, 4.6}]
        ]
```

```
In[•]:= (*3.12-3.27*)
        (*We give the value for x and loop in y and z, first we find the roots,
        then we verify the loop is working and give 2 known roots. *)
```

```
In[•]:=
        (*This is for subcause2*)
```

```
In[•]:= ClearAll
```

```
Out[•]=
        ClearAll
```

```
In[•]:=
        xyrule = FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z},
          {x, 1}, {y, -5}, {z, -5}]
```

```
Out[•]=
        {x → 0.316228, y → -0.102138, z → 0.136655}
```

```
In[•]:= {α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z} /. xyrule
```

```
Out[•]=
        {-8.67362 × 10^-19, -6.93889 × 10^-18, -8.67362 × 10^-19}
```

```
In[•]:= For[i = -5, i < 5, i++;
          xyrule = FindRoot[{α x - β y - γ z + ψ x^2,
              -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z}, {x, 1}, {y, i}, {z, i}];
          rasiduals =
           {α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z} /. xyrule;
          Print[xyrule, "", rasiduals, "x =1", ",", "y= ", "z = ", i ]
        ]
```

$\{x \to 0.316228, y \to -0.102138, z \to 0.136655\}$

$\{0., -1.73472 \times 10^{-18}, -1.73472 \times 10^{-18}\}$ x =1,y= z = −4

$\{x \to 0.316228, y \to -0.102138, z \to 0.136655\}$

$\{0., -5.37764 \times 10^{-17}, -1.73472 \times 10^{-18}\}$ x =1,y= z = −3

$\{x \to 0.316228, y \to -0.102138, z \to 0.136655\}$

$\{0., -1.73472 \times 10^{-18}, -1.73472 \times 10^{-18}\}$ x =1,y= z = −2

$\{x \to 0.316228, y \to -0.102138, z \to 0.136655\}$

$\{0., -1.73472 \times 10^{-18}, -1.73472 \times 10^{-18}\}$ x =1,y= z = −1

$\{x \to 0.316228, y \to 0.101505, z \to 0.0959267\}$

$\{1.73472 \times 10^{-18}, -2.60209 \times 10^{-18}, -3.46945 \times 10^{-18}\}$ x =1,y= z = 0

$\{x \to 0.316228, y \to 0.101505, z \to 0.0959267\}\{0., -8.67362 \times 10^{-19}, -1.73472 \times 10^{-18}\}$ x =1,y= z = 1

$\{x \to 0.316228, y \to 0.101505, z \to 0.0959267\}\{0., -1.73472 \times 10^{-18}, -1.73472 \times 10^{-18}\}$ x =1,y= z = 2

$\{x \to 0.316228, y \to 0.101505, z \to 0.0959267\}$

$\{-8.67362 \times 10^{-19}, 1.1189 \times 10^{-16}, -8.67362 \times 10^{-19}\}$ x =1,y= z = 3

$\{x \to 0.316228, y \to 0.101505, z \to 0.0959267\}\{0., -1.73472 \times 10^{-18}, -1.73472 \times 10^{-18}\}$ x =1,y= z = 4

$\{x \to 0.316228, y \to 0.101505, z \to 0.0959267\}\{0., 0., -1.73472 \times 10^{-18}\}$ x =1,y= z = 5

In[ ]:=

```
(*This is for x = -1*)
ClearAll
```

Out[ ]=

```
ClearAll
```

In[ ]:=

```
xyrule = FindRoot[{α x - β y - γ z + ψ x^2, -α x + β y + γ z + θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z},
  {x, -1}, {y, -5}, {z, -5}]
```

Out[ ]=

$\{x \to -0.316228, y \to -0.0917911, z \to -0.49787\}$

In[ ]:=

```
{α x - β y - γ z + ψ x^2, -α x + β y + γ z + θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z} /. xyrule
```

Out[ ]=

$\{0., -1.38778 \times 10^{-17}, 6.93889 \times 10^{-18}\}$

```
For[i = -5, i < 5, i++;
 xyrule = FindRoot[{α x - β y - γ z + ψ x^2,
    -α x + β y + γ z + θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z}, {x, -1}, {y, i}, {z, i}];
 rasiduals =
  {α x - β y - γ z + ψ x^2, -α x + β y + γ z + θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z} /. xyrule;

 Print[xyrule, "", rasiduals, "x =-1", ",", "y= ", "z = ", i ]
]
```

$$\{x \to -0.316228,\ y \to -0.0917911,\ z \to -0.49787\}$$
$$\left\{0.,\ -3.46945\times10^{-18},\ -6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = -4$$

$$\{x \to -0.316228,\ y \to -0.0917911,\ z \to -0.49787\}$$
$$\left\{0.,\ 4.82253\times10^{-16},\ 6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = -3$$

$$\{x \to -0.316228,\ y \to -0.0917911,\ z \to -0.49787\}$$
$$\left\{0.,\ 1.04083\times10^{-17},\ 6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = -2$$

$$\{x \to -0.316228,\ y \to -0.0917911,\ z \to -0.49787\}$$
$$\left\{0.,\ -3.46945\times10^{-18},\ -6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = -1$$

$$\{x \to -0.316228,\ y \to -0.0917911,\ z \to -0.49787\}$$
$$\left\{3.46945\times10^{-18},\ -4.51028\times10^{-17},\ 3.46945\times10^{-18}\right\}\ x = -1,\ y = \ z = 0$$

$$\{x \to -0.316228,\ y \to 0.0911586,\ z \to -0.534459\}$$
$$\left\{0.,\ -3.46945\times10^{-18},\ -6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = 1$$

$$\{x \to -0.316228,\ y \to 0.0911586,\ z \to -0.534459\}$$
$$\left\{3.46945\times10^{-18},\ 0.,\ 3.46945\times10^{-18}\right\}\ x = -1,\ y = \ z = 2$$

$$\{x \to -0.316228,\ y \to 0.0911586,\ z \to -0.534459\}$$
$$\left\{0.,\ -3.46945\times10^{-18},\ -6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = 3$$

$$\{x \to -0.316228,\ y \to 0.0911586,\ z \to -0.534459\}$$
$$\left\{0.,\ -3.46945\times10^{-18},\ -6.93889\times10^{-18}\right\}\ x = -1,\ y = \ z = 4$$

$$\{x \to -0.316228,\ y \to 0.0911586,\ z \to -0.534459\}$$
$$\left\{3.46945\times10^{-18},\ 2.42861\times10^{-17},\ 3.46945\times10^{-18}\right\}\ x = -1,\ y = \ z = 5$$

(*This is for April 2,defined a 3x3 matrics for Jacobian,x y, z*)

In[•]:=
```
ClearAll
```

In[•]:=
```
ClearAll
```

```
mat = {{α + 2 ψ x, -β, -γ}, {-α - ϵ Abs[z], β + 2 θ y, γ - ϵ z/Abs[z] x}, {-α, β, γ}}
mat // MatrixForm
```

Out[•]=
```
ClearAll
```

Out[•]=
$$\left\{\{0.05 - 0.2\,x,\ -0.01,\ -0.05\},\ \left\{-0.05 - 0.01\,\text{Abs}[z],\ 0.01 + 2.\,y,\ 0.05 - \frac{0.01\,x\,z}{\text{Abs}[z]}\right\},\ \{-0.05,\ 0.01,\ 0.05\}\right\}$$

In[•]:=
$$\begin{pmatrix} 0.05` - 0.2` x & -0.01` & -0.05` \\ -0.05` - 0.01` \text{Abs}[z] & 0.01` + 2.` y & 0.05` - \frac{0.01` x z}{\text{Abs}[z]} \\ -0.05` & 0.1` & 0.05` \end{pmatrix}$$

```
Det[mat]
```

Out[•]=
$$\left\{\{0.05 - 0.2\,x,\ -0.01,\ -0.05\},\ \left\{-0.05 - 0.01\,\text{Abs}[z],\ 0.01 + 2.\,y,\ 0.05 - \frac{0.01\,x\,z}{\text{Abs}[z]}\right\},\ \{-0.05,\ 0.1,\ 0.05\}\right\}$$

Out[•]=
$$0. + 1.35525 \times 10^{-20}\,x - 0.02\,x\,y - \frac{0.00002\,x^2\,z}{\text{Abs}[z]}$$

In[•]:=
```
For[i = -5, i < 5, i++;
 xyrule = FindRoot[{α x - β y - γ z + ψ x^2,
    -α x + β y + γ z + θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z}, {x, -1}, {y, i}, {z, i}];
 rasiduals =
  {α x - β y - γ z + ψ x^2, -α x + β y + γ z + θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z} /. xyrule;
 rasiduals = {mat} /. xyrule;
 Print[xyrule, "", rasiduals, "x =-1", ",", "y= ", "z = ", i ] ×
  Print[xyrule, "", rasiduals, "x =-1", ",", "y= ", "z = ", i ]
]
```

```
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -4
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -4
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -3
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -3
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -2
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -2
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -1
```

```
{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = -1

{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 0

{x → -0.316228, y → -0.0917911, z → -0.49787}
 {{{0.113246, -0.01, -0.05}, {-0.0549787, -0.173582, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 0

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 1

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 1

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 2

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 2

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 3

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 3

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 4

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 4

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 5

{x → -0.316228, y → 0.0911586, z → -0.534459}
 {{{0.113246, -0.01, -0.05}, {-0.0553446, 0.192317, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =-1,y= z = 5
```

In[ ]:=

```
For[i = -5, i < 5, i++;
 xyrule = FindRoot[{α x - β y - γ z + ψ x^2,
    -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z}, {x, 1}, {y, i}, {z, i}];
 rasiduals =
  {α x - β y - γ z + ψ x^2, -α x + β y + γ z + Θ y^2 - ϵ x Abs[z], ξ - α x + β y + γ z} /. xyrule;
 rasiduals = {mat} /. xyrule;
 Print[xyrule, "", rasiduals, "x =1", ",", "y= ", "z = ", i ] ×
  Print[xyrule, "", rasiduals, "x =1", ",", "y= ", "z = ", i ]
]
(*This is for the plot*)
ClearAll
```

```
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -4
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -4
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -3
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -3
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -2
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -2
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -1
{x → 0.316228, y → -0.106322, z → 0.137492}
 {{{-0.0132456, -0.01, -0.05}, {-0.0513749, -0.202644, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = -1
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 0
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 0
```

```
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 1
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 1
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 2
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 2
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 3
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 3
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 4
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 4
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 5
{x → 0.316228, y → 0.104425, z → 0.0953428}
 {{{-0.0132456, -0.01, -0.05}, {-0.0509534, 0.218849, 0.0468377}, {-0.05, 0.01, 0.05}}}
 x =1,y= z = 5
```

Out[ ]=

```
ClearAll
```

In[ ]:=

```
α = .05;
β = .01;
γ = .05;
δ = .02;
ϵ = .03;
ζ = .01;
η = .05;
θ = 1;
ψ = -.1;
```

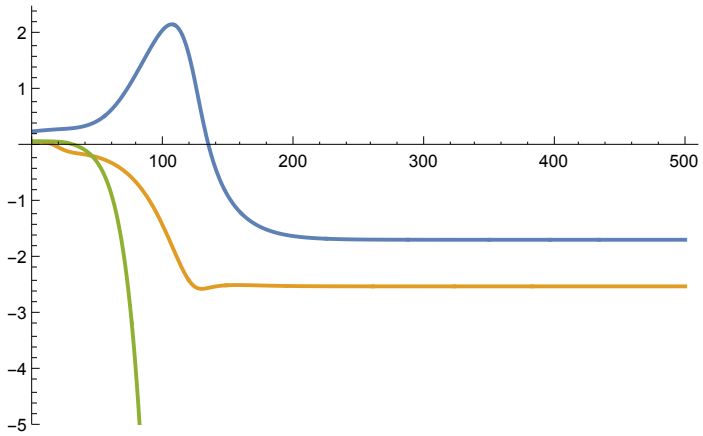
```
s = NDSolve[{x'[t] == α x[t] + β y[t] - γ z[t] + ψ x[t]^2 - δ z[t] × y[t],
    y'[t] == β y[t] - α x[t] + γ z[t] + Θ y[t]^2 - ϵ Abs[z[t]] × x[t],
    z'[t] == ζ + γ z[t] - α x[t] + β y[t] - η x[t] × Abs[y[t]],
    x[0] == 0.2753, y[0] == 0.0283, z[0] == 0.011}, {x, y, z}, {t, 500}]
```

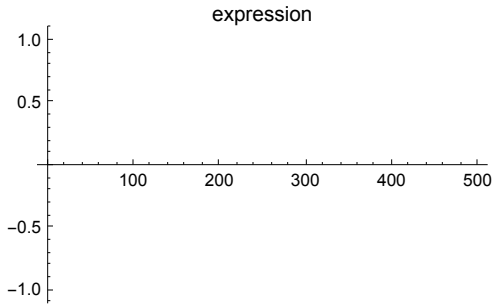
Out[ ]=

```
{{x → InterpolatingFunction[ Domain: {{0., 500.}}  Output: scalar ],
  y → InterpolatingFunction[ Domain: {{0., 500.}}  Output: scalar ],
  z → InterpolatingFunction[ Domain: {{0., 500.}}  Output: scalar ]}}
```

```
Plot[Evaluate[{x[t], y[t], z[t]} /. s], {t, 0, 500}, PlotRange → {2.5, -5}]
Plot[{x[t], y[t], z[t]}, {t, 0, 500}, PlotLabel → "expression"]
```

Out[ ]=





In[ ]:=

```
ClearAll
```

Out[ ]=

```
ClearAll
```