Bio-Mathematics 214 HomeWork

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Question

$ln(\frac{u^\lambda}{v}) + u - v = k$
$ln(\frac{u^\lambda}{v}) + u - v - k = 0$
This is an implicit function in u and v. However, we can plot the solution curves on the u, v plane for various values of k and λ . Note: That λ can be negative.

Plot the solution curves for the implicit solution above using any programming language.

Python Source Code:

```
#!/usr/bin/python
def solution(e, k):
    f = lambda u, v : (ln(u**e) / v) + u   v   k
    u = linspace(1., 20., 1000)
    v = linspace(1., 20., 1000)

    f_vals = [f(x,y) for x,y in zip(u,v)]
    plot_implicit_solution(u,v, f_vals)

def plot_implicit_solution(u,v, f_vals):
    plt.plot(u, f_vals, "k ", label="f(u)")
    plt.plot(v, f_vals, "r ", label="f(v)")
    plt.title("IMPLICIT SOLUTIOIN CURVE")
    plt.xlabel("v")
    plt.ylabel("u")
    plt.legend(bbox_to_anchor=(.65, .9))
    plt.show()

if __name__ == "__main__":
    import matplotlib.pyplot as plt
    from sys import (argv, exit)
    from math import log as ln
    from numpy import linspace

    if len(argv) == 3:
        solution(int(argv[1]), int(argv[2]))
    else:
        exit("USAGE: solution.py <lambda> <k>")

else:
    from sys import exit
    exit("USAGE: solution.py <lambda> <k>")
```

Observation

We know that $v, u \geq 0$ since we are dealing with population interaction.

since k is the intergral constant, we hence know that $k \in \Re$

It is also given that $\lambda \in \Re$ or that $\lambda \in -\infty, \infty$

By using python i managed to see that, if λ is negative($-\lambda$) then from Figure 1 it is evident that the implicit function is facing up and if λ is positive($+\lambda$) then from Figure 2 it is evident that the implicit function is facing down. The change of the sign of λ keeps the shape undeformed or unchanged but it changes the orientation of the implicit function with respect to the change in the sign of λ

However, if we manipulate k the shape of the implicit function remains undeformed(unchanged), but the implicit function is shifted up/ down relative to the the value of k

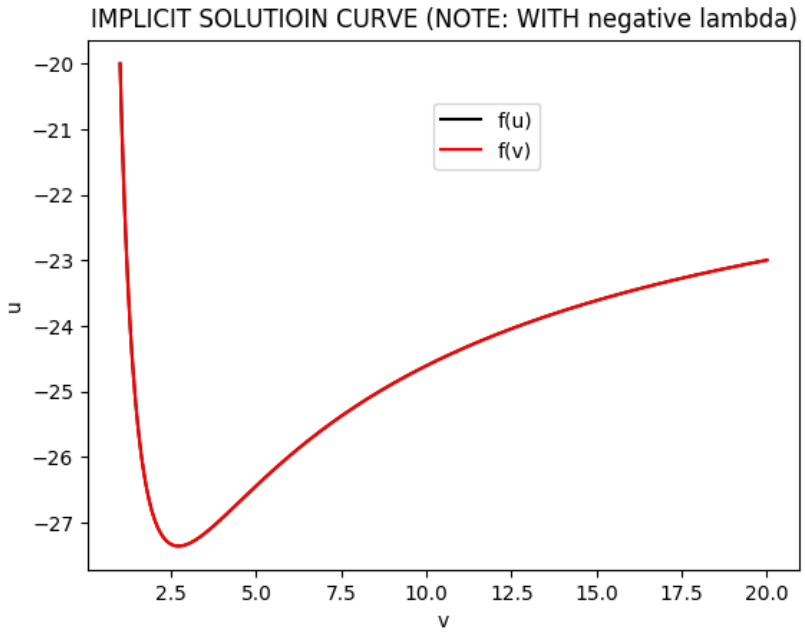

Figure 1: u vs v $[-\lambda]$

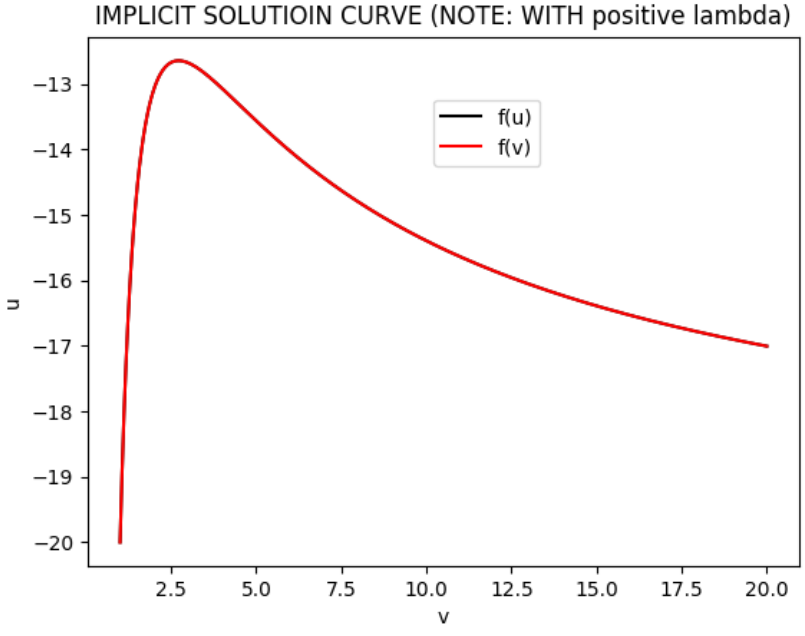

Figure 2: u and v $[+\lambda]$