

Solving Graphically

October 31, 2019

1 Solving for roots Graphically and Numerically:

Now, we will find the roots of an equation numerically as well as graphically, using SageMath 8.8.

Setting the variable as x :

```
[1]: var('x')
```

```
[1]: x
```

Now, creating the function $f(x) = -x + \cos(x)$

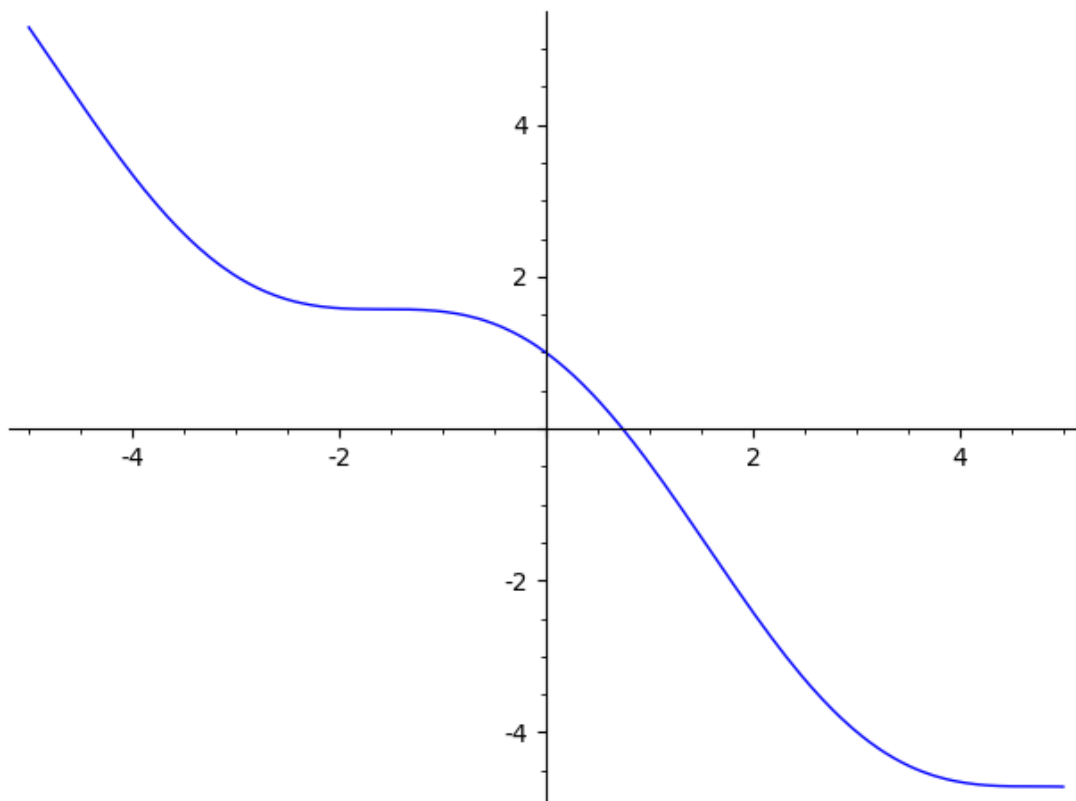
```
[2]: f(x)=-x+cos(x)
     f(x).show()
```

$-x + \cos(x)$

Now, plotting the function in the range of $[-5, 5]$

```
[3]: plot(f(x), (x, -5, 5))
```

```
[3]:
```



Finding the roots, using some numerical methods in SageMath (the `find_root` function):

(To be exact, we are finding roots in the range $(0,1)$, since it looks like the root of the above equation is in that range from the graph above)

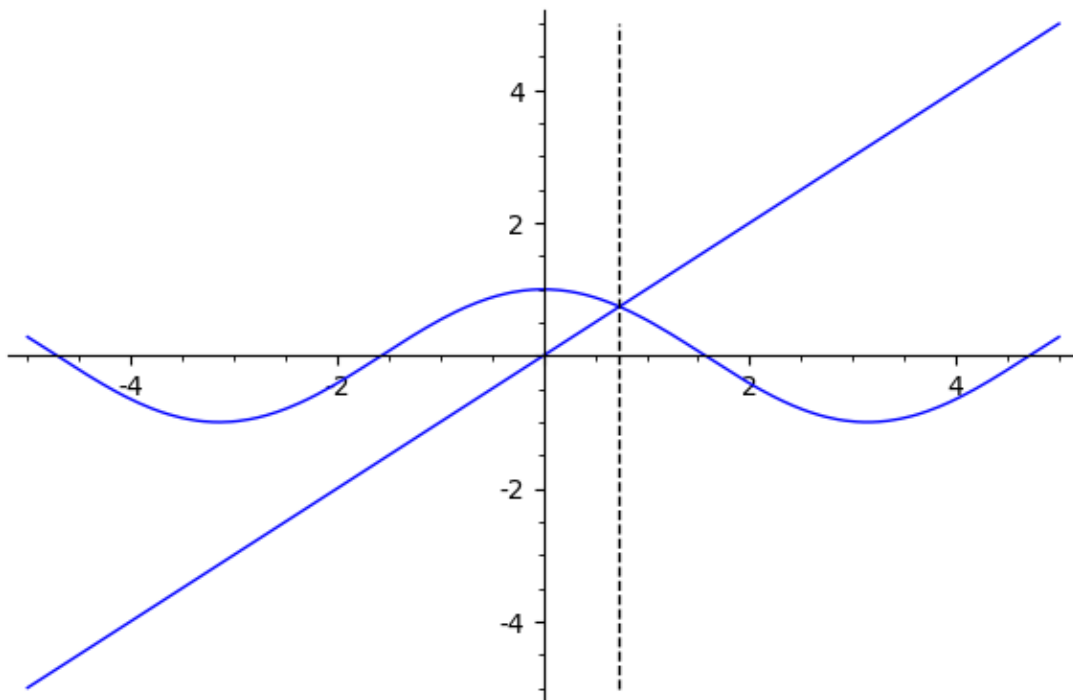
```
[4]: root = f.find_root(0,1)
      print(root)
```

0.7390851332151559

Now, we're plotting the functions $y = x$ and $y = \cos(x)$, so as to see where they intersect, and we also plot the line $x = \text{root}$, which we evaluated in the previous part, so that we can check whether the two functions meet along the same line.

```
[5]: p1 = plot(x,(x,-5,5))
      p2 = plot(cos(x),(x,-5,5))
      p3 = line([(root,-5),(root,5)],color='black',linestyle='--')
```

```
[6]: z=p1+p2+p3
      z.show()
```



Thus, we see that the two curves meet at the line where the original function was zero.

This proves that the solution of the equation $-x + \cos(x) = 0$ is at the intersection point of the two functions: $y = x$ and $y = \cos(x)$.