question6

June 29, 2021

[1]:
```
import numpy as np
import pandas as pd

import sage.plot.scatter_plot as scatter

import matplotlib.pyplot as plt
%matplotlib inline
```

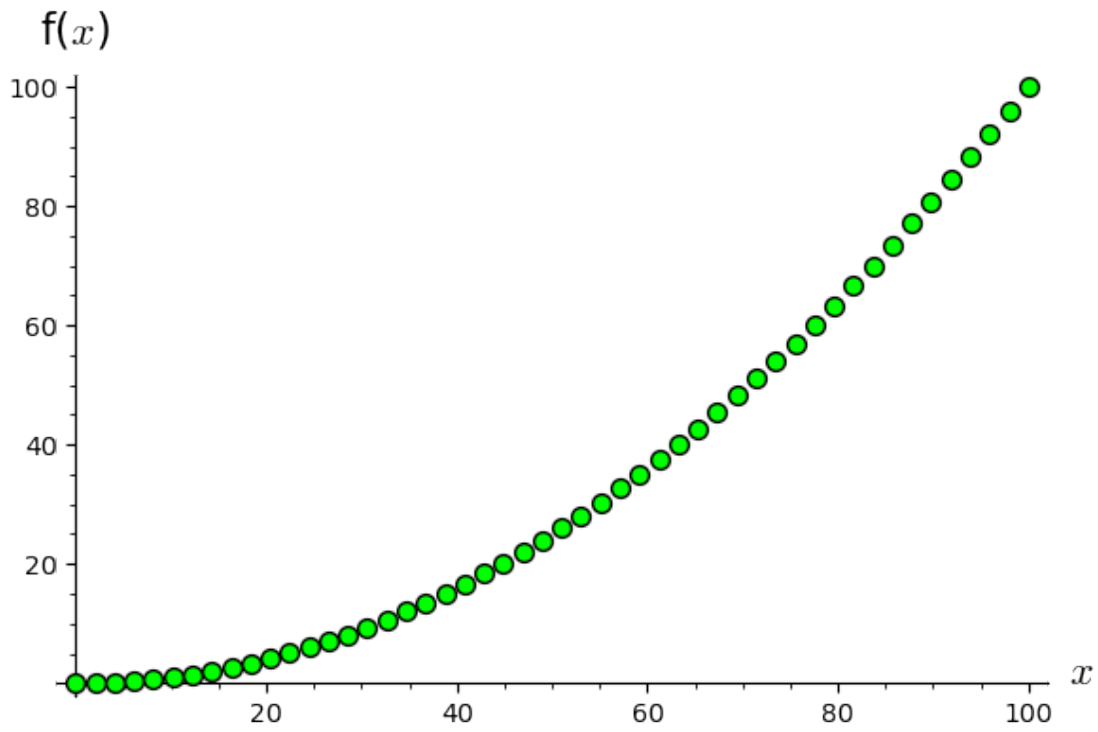
[2]:
```
def plotTangent(equation):
    deq = equation.derivative(x)

    x_data = np.linspace(0, 100, num=50)

    # Makes the equation callable
    func = fast_callable(equation, vars=[x])
    slope = fast_callable(deq, vars=[x])

    # Plotting the function
    plots = [ (x_data[i], func(x_data[i])) for i in range(len(x_data)) ]

    g = Graphics()
    g += scatter.scatter_plot(plots, facecolor='lime')

    # Plotting the tangent lines
    p = Graphics()
    data = []
    for i in range(0, len(x_data), 5):
        x0 = x_data[i]
        y0 = func(x_data[i])
        s = slope(x_data[i])

        points = [ (x, y0+s*(x-x0)) for x in [0, x0-y0/s, x0, x0*10] ]
        p += line(points)
        data.append({ "Coordinates": [x0,y0] ,"Slope": s, "X-Intercept": x0-y0/
↪s, "Y-Intercept": y0-s*x0})

    mini = min(func(x_data[0]), func(x_data[-1]))
```

```
    maxi = max(func(x_data[0]), func(x_data[-1]))

    g.save("Plotted.png", axes_labels=['$x$','f($x$)'])
    p.save("Tangents.png", axes_labels=['$x$','f($x$)'], xmin=0, xmax=100,␣
↪ymin=mini, ymax=maxi)

    return p, g, data
```

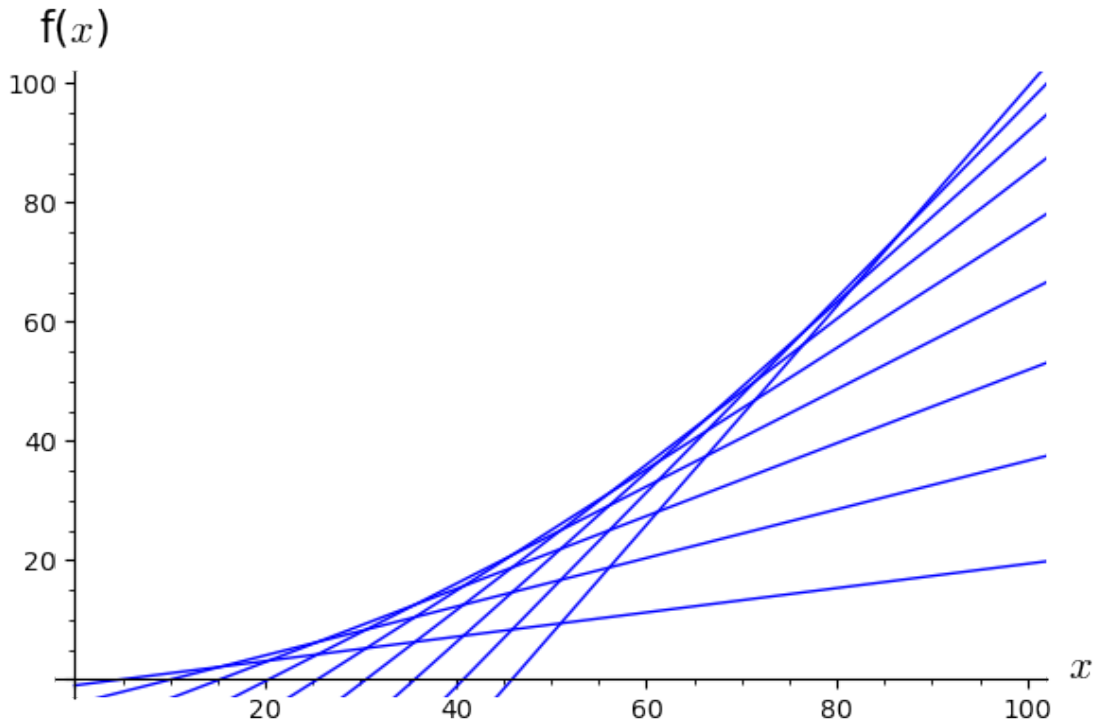
[3]:
```
p, g, data = plotTangent(0.01*x^2)
```

```
<ipython-input-2-65462b953e8f>:24: RuntimeWarning: invalid value encountered in
double_scalars
  points = [ (x, y0+s*(x-x0)) for x in [Integer(0), x0-y0/s, x0, x0*Integer(10)]
]
<ipython-input-2-65462b953e8f>:26: RuntimeWarning: invalid value encountered in
double_scalars
  data.append({ "Coordinates": [x0,y0] ,"Slope": s, "X-Intercept": x0-y0/s,
"Y-Intercept": y0-s*x0})
```

[4]:
```
g.show()
```



[5]:
```
p.show(xmin=0, xmax=100, ymin=-1, ymax=100)
```



[6]:
```
data = pd.DataFrame(data)
```

[7]:
```
data
```

[7]:

	Coordinates	Slope	X-Intercept	Y-Intercept
0	[0.0, 0.0]	0.000000	NaN	0.000000
1	[10.204081632653061, 1.0412328196584755]	0.204082	5.102041	-1.041233
2	[20.408163265306122, 4.164931278633902]	0.408163	10.204082	-4.164931
3	[30.612244897959183, 9.37109537692628]	0.612245	15.306122	-9.371095
4	[40.816326530612244, 16.659725114535608]	0.816327	20.408163	-16.659725
5	[51.02040816326531, 26.030820491461895]	1.020408	25.510204	-26.030820
6	[61.224489795918366, 37.48438150770512]	1.224490	30.612245	
7	[71.42857142857143, 51.02040816326531]	1.428571	35.714286	
8	[81.63265306122449, 66.63890045814243]	1.632653	40.816327	
9	[91.83673469387756, 84.33985839233654]	1.836735	45.918367	

```
6   -37.484382
7   -51.020408
8   -66.638900
9   -84.339858
```

[ ]: