Differentiation with different function

In [25]:

```python
import numpy as np
import matplotlib.pyplot as plt
import matplotlib as mlt
import pandas as pd
from sympy import *
import math
```

In [11]:

```python
x=Symbol('x')
y=sin(x)
dy=diff(y,x)
dy
```

Out[11]:

$$\cos(x)$$

In [18]:

```python
y=1/sqrt(x)
dy=diff(y,x)
dy
```

Out[18]:

$$-\frac{1}{2x^{\frac{3}{2}}}$$

In [28]:

```python
y=(3*x**5)-(4*x**3)+(2*x**2)-5*x+7
dy=diff(y,x)
dy
```

Out[28]:

$$15x^4 - 12x^2 + 4x - 5$$

In [29]:

```python
y=x*(sqrt(x))
dy=diff(y,x)
dy
```

Out[29]:

$$\frac{3\sqrt{x}}{2}$$

In [30]:

```
1  y=(x-1)*((x**2)+2)*((x**3)-3)
2  dy=diff(y,x)
3  dy
```

Out[30]:

$$3x^2\left(x-1\right)\left(x^2+2\right)+2x\left(x-1\right)\left(x^3-3\right)+\left(x^2+2\right)\left(x^3-3\right)$$

In [31]:

```
1  y=(sqrt(x)-1)/(sqrt(x)+1)
2  dy=diff(y,x)
3  dy
```

Out[31]:

$$-\frac{\sqrt{x}-1}{2\sqrt{x}\left(\sqrt{x}+1\right)^2}+\frac{1}{2\sqrt{x}\left(\sqrt{x}+1\right)}$$

In [32]:

```
1  y=cos(exp(x)+log(x))
2  dy=diff(y,x)
3  dy
```

Out[32]:

$$-\left(e^x+\frac{1}{x}\right)\sin\left(e^x+\log\left(x\right)\right)$$

Implicit Differentiation using bulit in function

In [37]:

```
1  y=Symbol('y')
2  f=y+sin(y)-cos(x)
3  dy=idiff(f,y,x)
4  dy
```

Out[37]:

$$-\frac{\sin\left(x\right)}{\cos\left(y\right)+1}$$

Implicit Differentiation using diff function

In [40]:

```python
x, y = symbols('x, y')
f = y+sin(y)-cos(x)
diff(f,x)/diff(f,y)
dy=idiff(f,y,x)
dy
```

Out[40]:

$$-\frac{\sin(x)}{\cos(y) + 1}$$

In [41]:

```python
f = x**3+x**2*y+x*y**2+y**3-81
diff(f,x)/diff(f,y)
dy=idiff(f,y,x)
dy
```

Out[41]:

$$-\frac{3x^2 + 2xy + y^2}{x^2 + 2xy + 3y^2}$$

In [45]:

```python
f = acos(log(x))
dy=diff(f,x)
dy
```

Out[45]:

$$-\frac{1}{x\sqrt{1 - \log(x)^2}}$$

In [49]:

```python
f = acos((1-x**2)/(1+x**2))
dy=diff(f,x)
dy
```

Out[49]:

$$-\frac{-\frac{2x(1-x^2)}{(x^2+1)^2} - \frac{2x}{x^2+1}}{\sqrt{-\frac{(1-x^2)^2}{(x^2+1)^2} + 1}}$$

In [51]:

```
1  f=x**x-2**sin(x)
2  dy=diff(f,x)
3  dy
```

Out[51]:

$$-2^{\sin{(x)}} \log{(2)} \cos{(x)} + x^x (\log{(x)} + 1)$$

In [52]:

```
1  f=(x+(1/x))**x
2  dy=diff(f,x)
3  dy
```

Out[52]:

$$\left(x + \frac{1}{x}\right)^x \left(\frac{x\left(1 - \frac{1}{x^2}\right)}{x + \frac{1}{x}} + \log{\left(x + \frac{1}{x}\right)}\right)$$

In [54]:

```
1  f=(1+x)*(1+x**2)*(1+x**4)*(1+x**8)
2  dy=diff(f,x)
3  dy
```

Out[54]:

$$8x^7 (x + 1) \left(x^2 + 1\right) \left(x^4 + 1\right) + 4x^3 (x + 1) \left(x^2 + 1\right) \left(x^8 + 1\right) + 2x (x + 1) \left(x^4 + 1\right) \left(x^8$$

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In [55]:

```
1  f = y**x-x**y
2  diff(f,x)/diff(f,y)
3  dy=idiff(f,y,x)
4  dy
```

Out[55]:

$$\frac{-xy^{x+1} \log{(y)} + x^y y^2}{x\left(xy^x - x^y y \log{(x)}\right)}$$

In [56]:

```
1  f=asin((2**x+1)/(1+4**x))
2  dy=diff(f,x)
3  dy
```

Out[56]:

$$\frac{\frac{2^x \log{(2)}}{4^x+1} - \frac{4^x(2^x+1)\log{(4)}}{(4^x+1)^2}}{\sqrt{-\frac{(2^x+1)^2}{(4^x+1)^2} + 1}}$$

In [ ]:

```
1
```