# 201600779 김영민

In [1]:

```python
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:

```python
def numerical_diff(f,x):
    h = 1e-9
    return (f(x+h) - f(x)) / h
```

In [3]:

```python
def f1(x):
    return x**2
def f2(x):
    return x**3 + x**2 + x
def f3(x):
    return x*np.sin(x*x*x+3)
def f4(x):
    return np.cos(np.sqrt(np.exp(x)+1)/2)
```

In [4]:

```python
for f in [f1,f2,f3,f4]:
    print(numerical_diff(f,2))
```

4.000000330961484
17.000001406586307
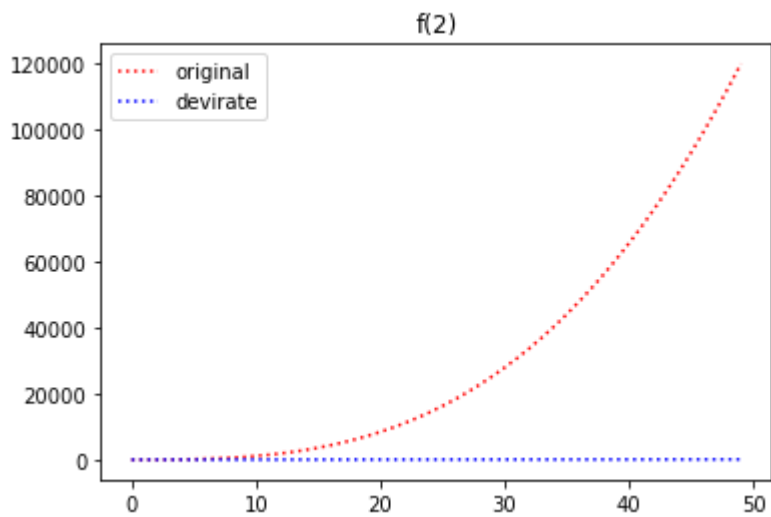-0.8937732776104211
-0.6329948787353601

In [5]:

```python
def draw_plot(f,title=''):
    a = np.array(range(50))
    original = [f(i) for i in a]
    devirate = [numerical_diff(f1,i) for i in a]

    plt.plot(original,'r:',label = 'original')
    plt.plot(devirate,'b:',label = 'devirate')
    plt.title(title)
    plt.legend()
    plt.show()
```
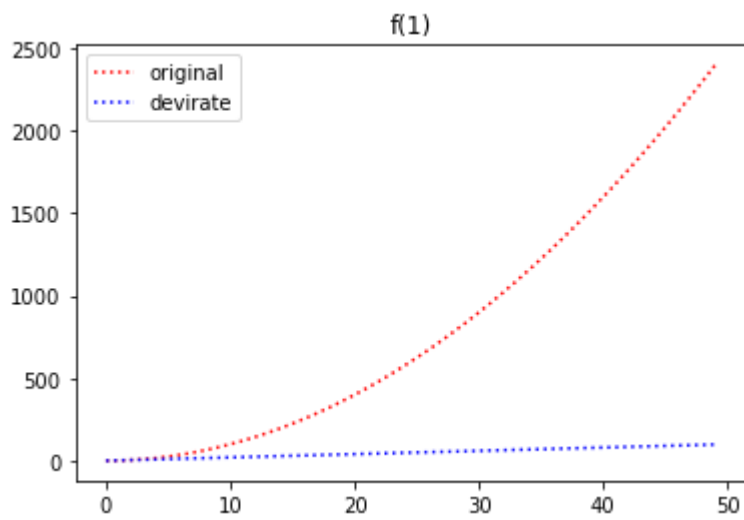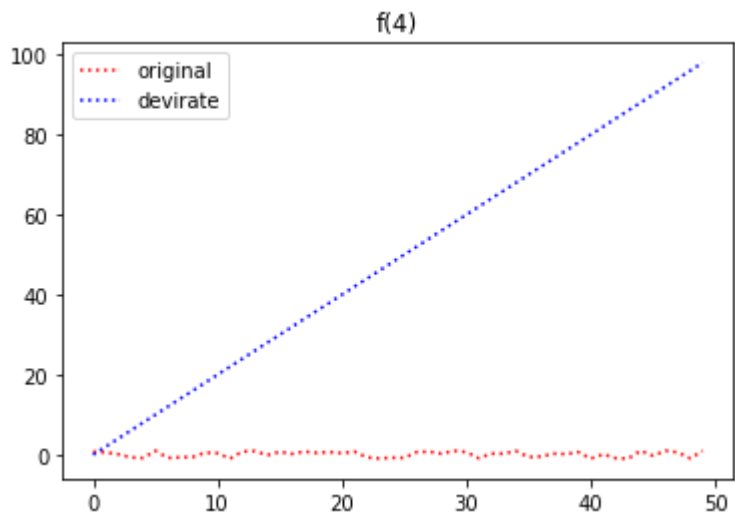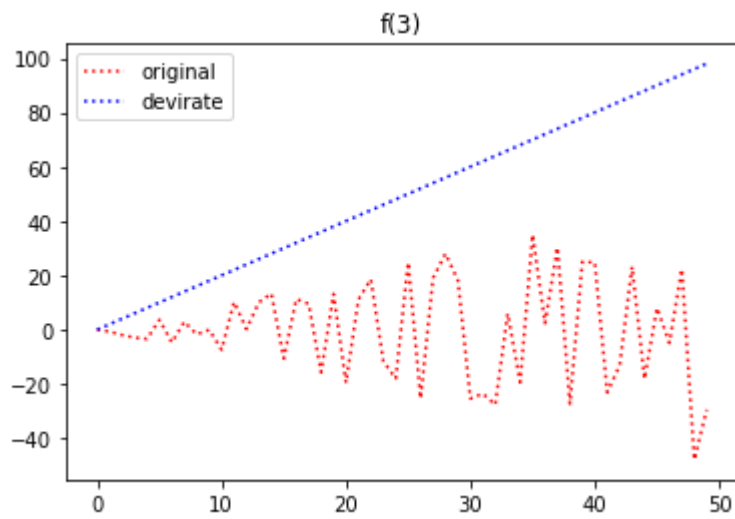
In [6]:

```python
for f,t in zip([f1,f2,f3,f4],['f(1)','f(2)','f(3)','f(4)']):
    draw_plot(f,t)
```

f(3)



f(4)

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