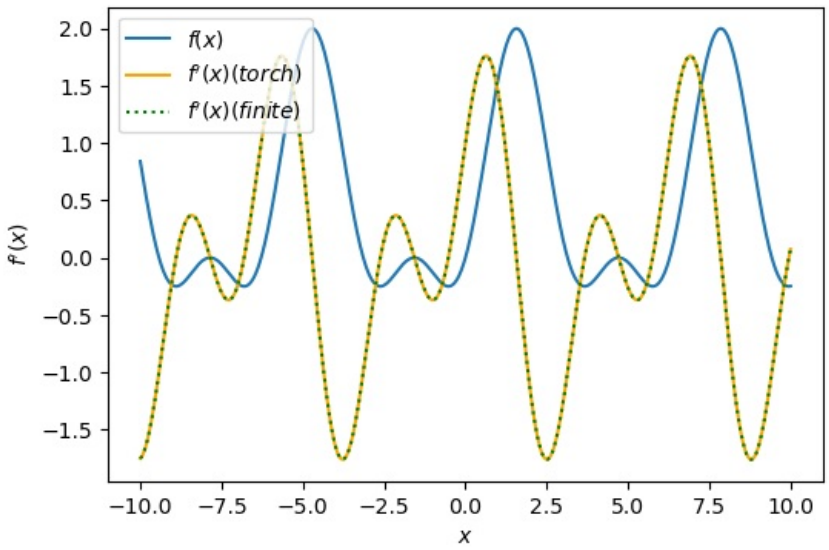
Exercise 1

This notebook calculates the derivative of a function ($\sin^3(x)$) using automatic differentiation. Check the results by calculating the derivative using a finite difference method.

In [ ]:
```
import torch
import matplotlib.pyplot as plt

# Define the function
def f(x):
    return torch.sin(x)+torch.sin(x)*torch.sin(x)

# Define the x values
x = torch.linspace(-10, 10, 1000, requires_grad=True)

# Calculate y values
y = f(x)

# Calculate derivatives with respect to all variables.
y.backward(torch.ones_like(x))

# Plot the function and its derivative
plt.figure(figsize=(6, 4))



h = 0.001
yprime = (f(x+h)-f(x-h))/(2*h)
# calculate the derivative of the function with respect to x using a finite difference method
xgrad = x.grad.detach().numpy()
x = x.detach().numpy()
y = y.detach().numpy()
yprime = yprime.detach().numpy()

plt.plot(x, y, label='$f(x)$')
plt.plot(x, xgrad, label="$f^{\prime}(x) (torch)$", color='orange') ## Plot the derivative with respect to x
plt.plot(x, yprime, ':', label="$f^{\prime}(x) (finite)$", color='green') ## Plot the derivative with respect t
plt.plot()
plt.xlabel('$x$')
plt.ylabel("$f^{\prime}(x)$")
plt.legend(loc=2)
plt.show()
```



It is the same!