Computational Methods in Physics (PHY 365)

FA23

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Lab 9

MATLAB's gradient function

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  - Here FX corresponds to ∂F/∂x, the differences in "x" (horizontal) direction.
  - The spacing between points is assumed to be 1.

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- [FX , FY] = gradient(F) returns the x and y components of the two-dimensional numerical gradient of matrix F.
- [_____] = gradient(F , h) uses h as a uniform spacing between points in each direction.

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- Calculating the first and second derivatives

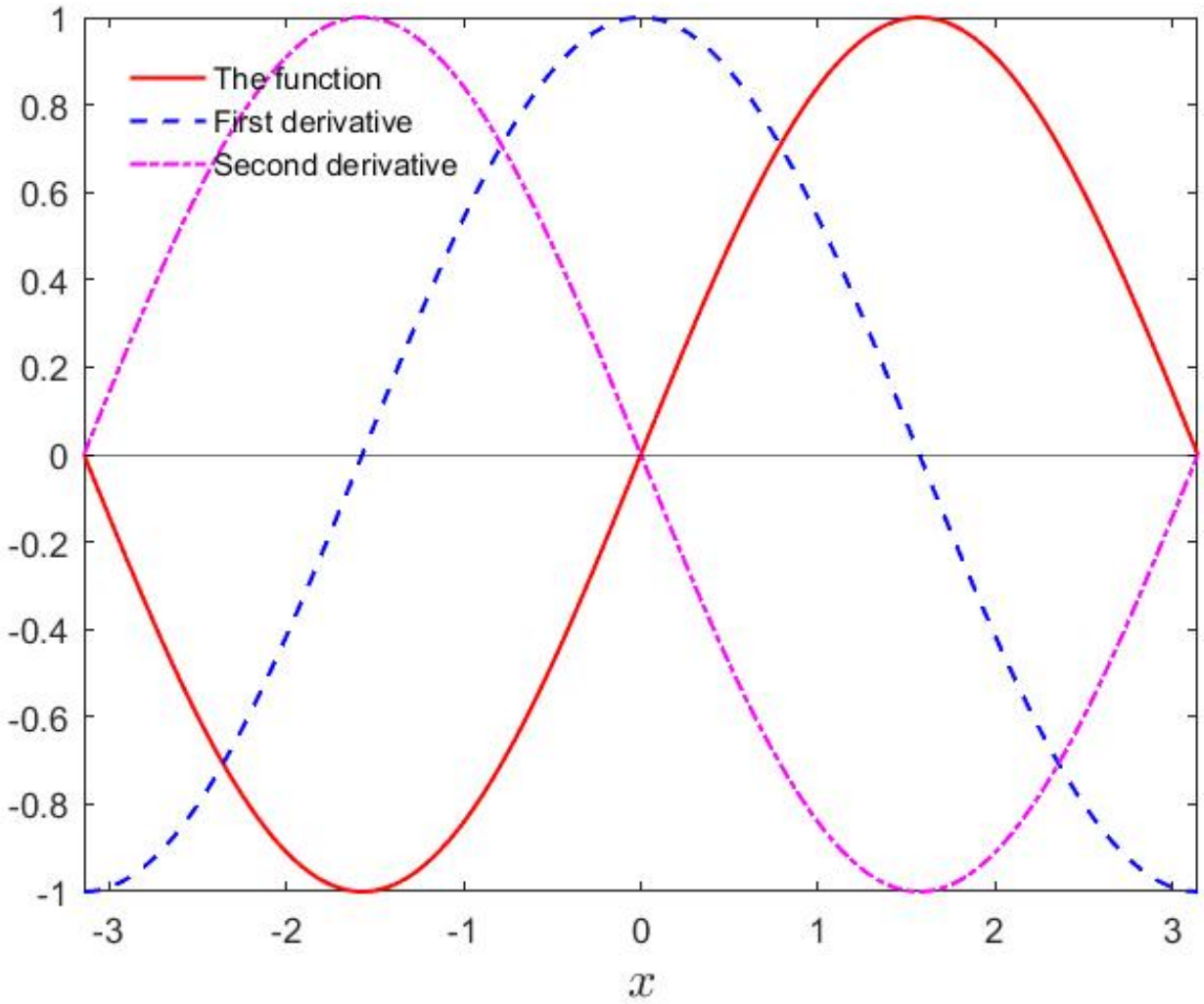
```
grad_1 = gradient(f_x, step_size);
grad_2 = gradient(grad_1 , step_size);
```

MATLAB's gradient function

- Plotting

  plot(x_vec , f_x ,'r' , x_vec , grad_1 , 'b--' , x_vec , grad_2 , 'm-.')

MATLAB's gradient function



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- Y = diff(f) differentiates the function "f" with respect to the symbolic scalar variable determined by symvar(f , 1).
- Y = diff(f , var) differentiates the function with respect to the differentiation parameter "var".
- The parameter var can be
  - a symbolic scalar variable, such as x,
  - a symbolic function, such as f(x), or
  - a derivative function, such as diff(f(t) , t).

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  - a symbolic scalar variable, such as x,
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  - a derivative function, such as diff(f(t) , t).
- Y = diff(f , var , n) computes the nth derivative of f with respect to var.

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- a1 = diff(f);

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- a1 = diff(f);

- a2 = diff(f , x);

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- syms x;
- f = 3 * x^4 + 50 * x^2 – 10;
- a1 = diff(f);
- a2 = diff(f , x);
- a3 = diff(f , x , 2);

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- f = 3 * x^4 + 50 * x^2 – 10;
- a1 = diff(f);
- a2 = diff(f , x);
- a3 = diff(f , x , 2);
- a4 = diff (a2);

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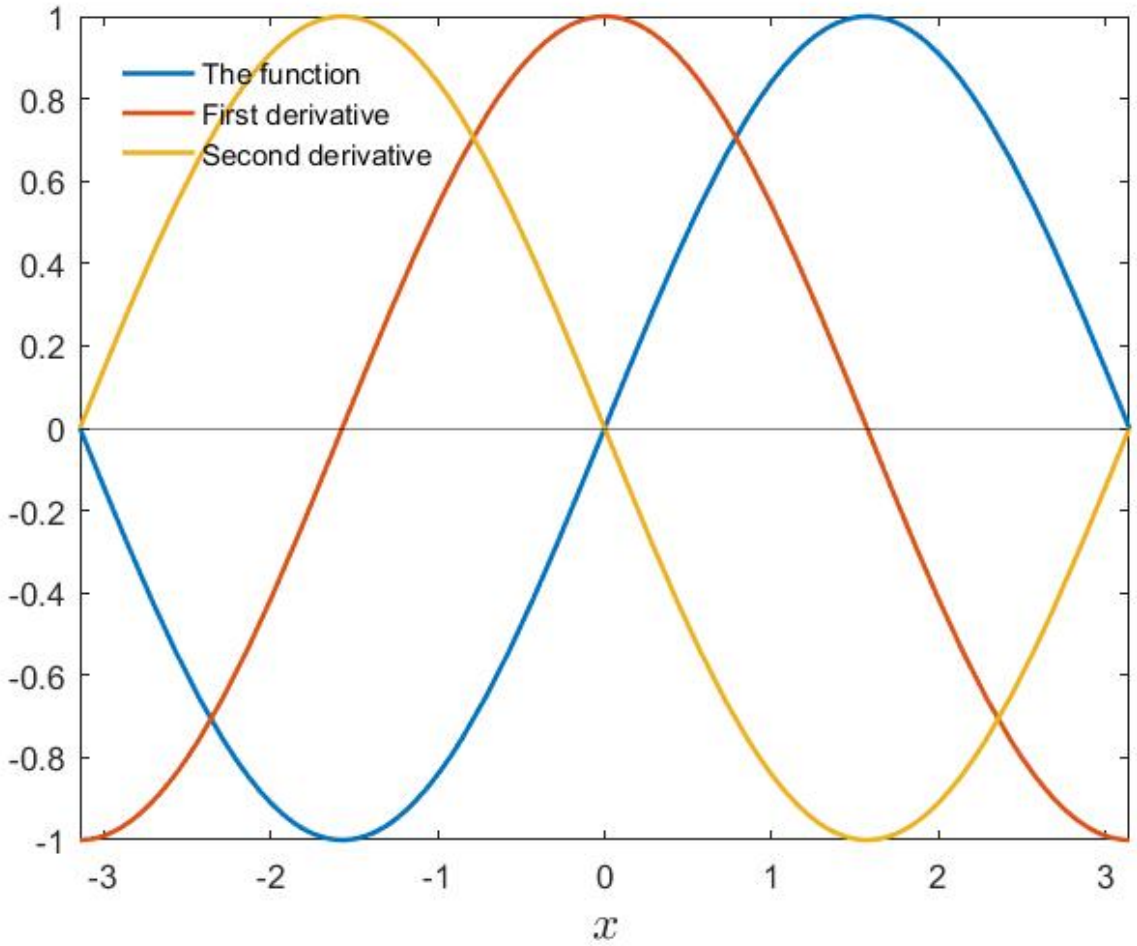
- Problem: Determine the (symbolic) first and second derivatives of $\sin(x)$ using diff function.

MATLAB's diff function

- Problem: Determine the (symbolic) first and second derivatives of sin (x) using diff function.



References

- https://www.mathworks.com/help/matlab/ref/gradient.html
- https://www.mathworks.com/help/symbolic/diff.html
- https://www.mathworks.com/help/symbolic/sym.gradient.html