

21BDS0340

Abhinav Dinesh Srivatsa

Course Code: BMAT101L

Course Number: VL2021220106765

Course Slot: L9, L10

Digital Lab Assignment 1

Problem 1

Write the MATLAB code for derivative of different order for $y = x^4 - 3x^3 + 2$ and plot in one window and use it to plot in different sub windows. Use colour, marker, labelling, legend syntaxes.

Code:

```
syms x
f = x^4 - 3*x^3 + 2

df = diff(f) % first derivative
ddf = diff(df) % second derivative

subplot(2,2,1)
fplot(f, "r", "LineWidth", 1.5)
hold on
fplot(df, "b", "LineWidth", 1.5)
fplot(ddf, "g", "LineWidth", 1.5)
xlabel("x")
ylabel("y")
legend(string(f), string(df), string(ddf))

subplot(2,2,2)
fplot(f, "r", "LineWidth", 1.5)
xlabel("x")
ylabel("y")
legend(string(f))

subplot(2,2,3)
fplot(df, "b", "LineWidth", 1.5)
xlabel("x")
ylabel("y")
legend(string(df))

subplot(2,2,4)
fplot(ddf, "g", "LineWidth", 1.5)
xlabel("x")
ylabel("y")
legend(string(ddf))
hold off
```

Output:

```
>> Question1
```

f =

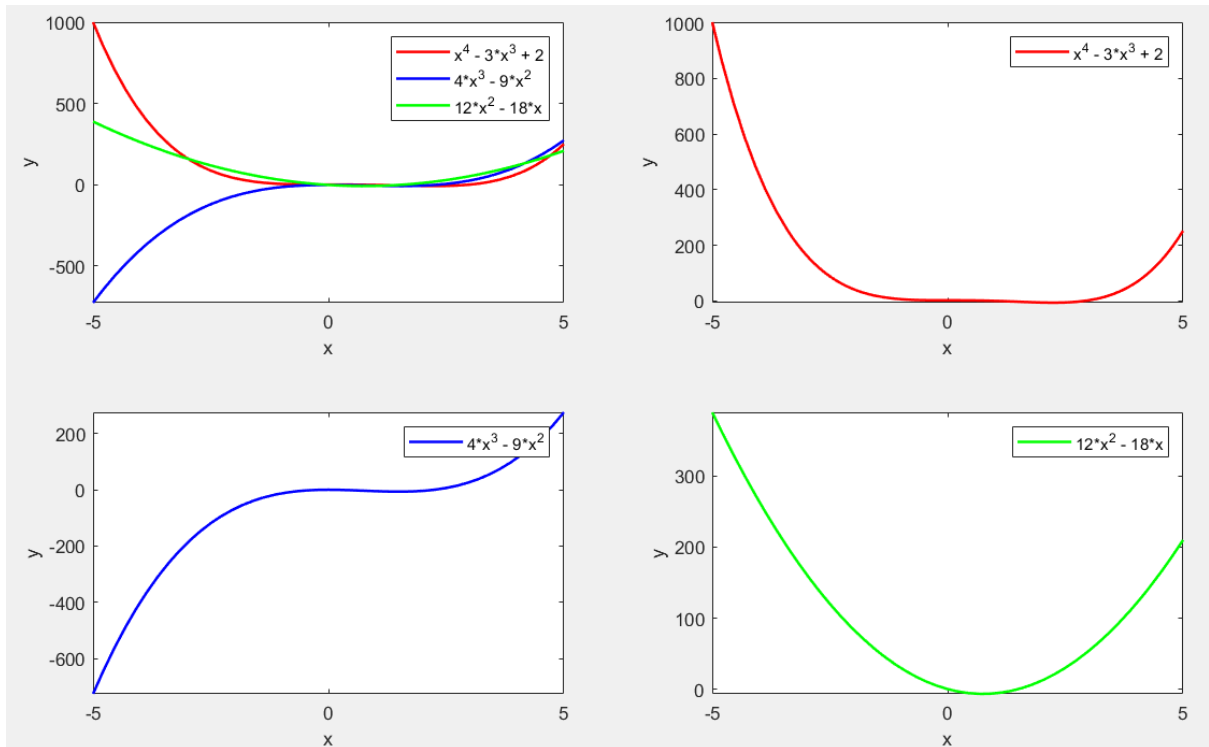
$$x^4 - 3x^3 + 2$$

df =

$$4x^3 - 9x^2$$

ddf =

$$12x^2 - 18x$$



Problem 2

Use the limit syntax and write the code for checking differentiability of any arbitrary function at any point. Plot the function and tangent line at the differentiable point. Choose function and points yourself.

Code:

```
syms x h
f = input("Enter function: ");
x_value = input("Enter place to check differentiability, x = ");

lim_eq = (subs(f, x + h) - subs(f, x))/h;
limit_f = limit(lim_eq, h, 0);

fplot(f, "LineWidth", 1.5)
hold on
legend(string(f))
try
    lim_value = subs(limit_f, x_value)

    % building tangent line
    y_value = subs(f, x_value);
    g = lim_value * (x - x_value) + y_value;
    fplot(g, "LineWidth", 1.5)
    legend(string(f), string(g))
catch
    disp(['The function is not differentiable at x = ',
num2str(lim)])
end

hold off
```

Output:

```
>> Question2
```

```
Enter function:  $x^4 - 3x^3 + 2$ 
```

```
Enter place to check differentiability,  $x = 3$ 
```

```
lim_value =
```

```
27
```

```
>> Question2
```

```
Enter function:  $x^4 - 3x^3 + 2$ 
```

```
Enter place to check differentiability,  $x = 3$ 
```

```
lim_value =
```

```
27
```

```
tangent =
```

```
 $27x - 79$ 
```

