

# Lab 2 Example and Hints - MATH 242

## FALL 2020

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#### Some Mathematica Commands

```
In[1]:= z := {2, 4, 6, 8}  
z[[3]]  
Out[2]= 6
```

This gives the third element in the list z which is 6.

```
In[3]:= z = Append[z, 10]  
Out[3]= {2, 4, 6, 8, 10}
```

This add the number 10 to the end of the list z.

```
In[4]:= z[[5]]  
Out[4]= 10
```

This gives the 5th element in the (updated) list z which is 10.

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#### For Loops

```
In[5]:= For[  
    i = 1,  
    i < 4,  
    i++,  
    Print[i]  
]  
1  
2  
3
```

```
In[6]:= For[
  i = 1,
  i <= 4,
  i++,
  Print[i]
]

1
2
3
4

In[7]:= For[
  i = -1,
  i < 4,
  i++,
  Print[i]
]

-1
0
1
2
3
```

## Assignment Questions

Note : Here's the output for your reference. You may check your answer with mine. But you need to submit the complete codes (input) and output for any credits. And remember to answer the short response questions such as “What do you notice?”.

### Q1

```
Out[8]= -5 x + x3

Out[12]= {4.8, 3.44953, 2.67426, 2.32457, 2.24088,
          2.23608, 2.23607, 2.23607, 2.23607, 2.23607}

Out[13]= 2.23607
```

---

## Q2

```
Out[17]= {1, -1, 1, -1, 1, -1, 1, -1, 1, -1, 1}
```

---

## Q3

```
Out[21]= {0.5, -0.0588235, 0.000081586, -2.17224×10-13, 0., 0., 0., 0., 0., 0.}
```

---

## Q4

```
Out[23]= 1 + Cos[π x]
```

```
Out[27]= {0.1, 2.10973, 3.93815, 0.672157, 0.852291,  
0.9275, 0.963908, 0.981973, 0.990989, 0.995495, 0.997747}
```

```
Out[32]= {0.09, 2.32656, 2.89169, 2.94637, 2.97325,  
2.98663, 2.99332, 2.99666, 2.99833, 2.99916, 2.99958}
```

---

## Q5

```
Out[37]= {2., -2.5992×1015, -2.5992×1015, -2.5992×1015, -2.5992×1015, -2.5992×1015,  
-2.5992×1015, -2.5992×1015, -2.5992×1015, -2.5992×1015, -2.5992×1015}
```

---

## Q6

(essay question, no computation output)

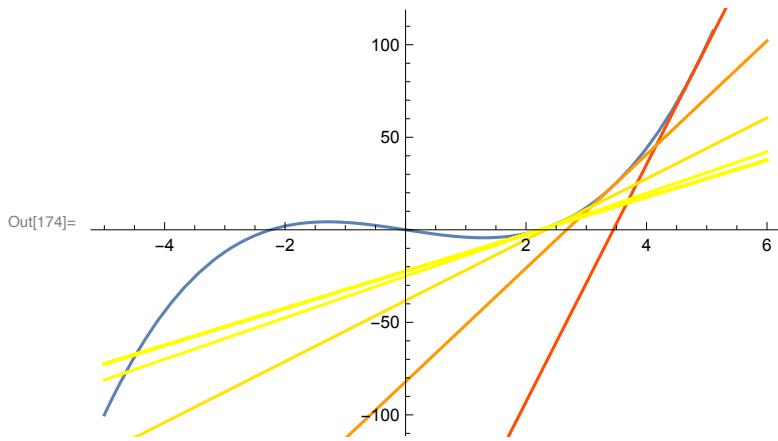
---

## Supplementary plots

Note: These plots are for reference. You don't need to do these plots in your assignment. But if you think it might help you explain any questions, feel free to copy/modify the following codes.

What happened in Q1

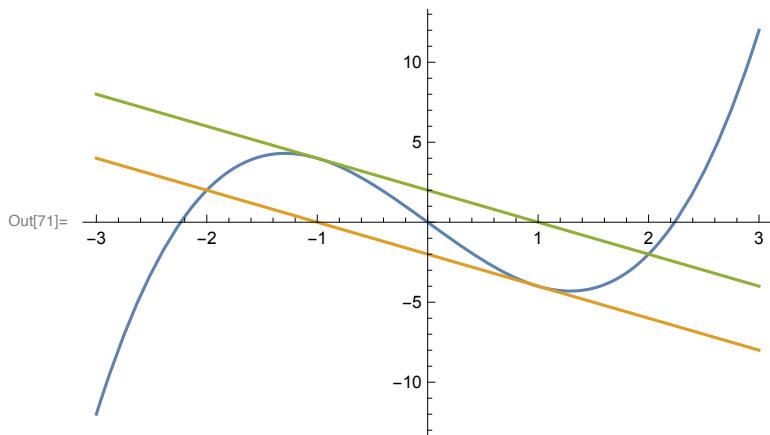
```
In[164]:= Clear[f]
Clear[y]
Clear[z]
Clear[pz]
f[x_] := x^3 - 5 x
y[x_, a_] := f[a] + f'[a] (x - a)
iterations = 10;
z = {4.8};
pz = {Plot[{f[x]}, {x, -5, 6}]};
For[j = 1, j <= iterations, j++, z = Append[z, z[[j]] - f[z[[j]]]/f'[z[[j]]]];
pz = Append[pz, Plot[y[x, z[[j]]], {x, -5, 6}, PlotStyle -> RGBColor[5 j, 0.3 j, 0]]];
Show[pz]
```



Note : The red line is the first line, orange is the second, and so on.

## Why Q2 failed

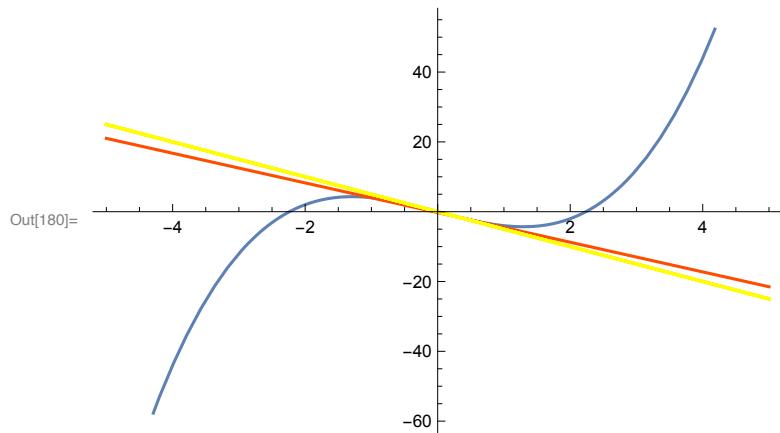
```
In[71]:= Plot[{f[x], y[x, 1], y[x, -1]}, {x, -3, 3}]
```



Note: The orange line is the first tangent line given by initial guess  $x=1$ , the green line is the second line at  $x=-1$ . These two lines are parallel so the sequence will just oscillate between -1 and 1.

## What happened in Q3

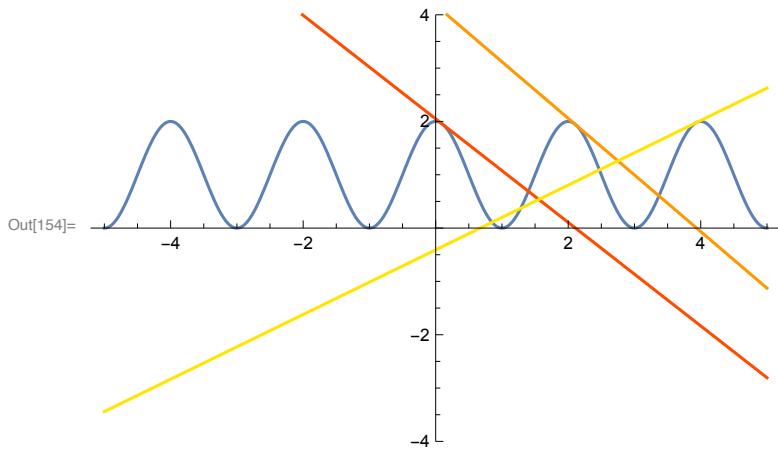
```
In[175]:= Clear[z]
Clear[pz]
z = {.5};
pz = {Plot[{f[x]}, {x, -5, 5}]};
For[j = 1, j <= iterations, j++, z = Append[z, z[[j]] - f[z[[j]]]/f'[z[[j]]]];
pz = Append[pz, Plot[y[x, z[[j]]], {x, -5, 5}, PlotStyle -> RGBColor[5 j, 0.3 j, 0]]];
Show[pz]
```



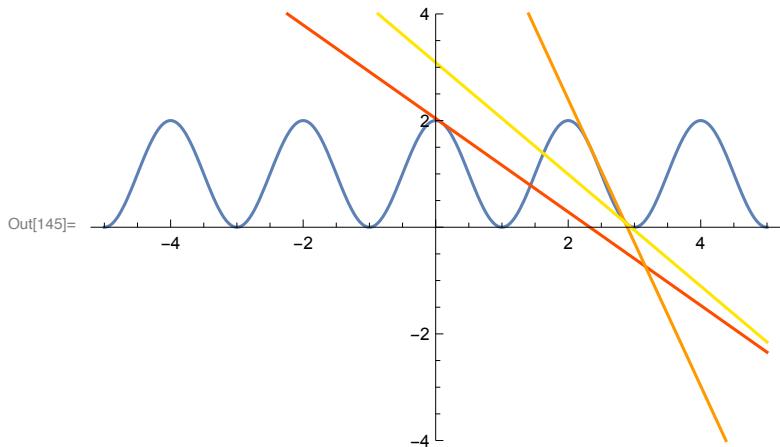
Note : The red line is the first line, orange is the second, and so on.

## What happened in Q4

```
In[146]:= Clear[f]
Clear[y]
f[x_] := Cos[Pi x] + 1
y[x_, a_] := f[a] + f'[a] (x - a)
iterations = 3;
z = {.1};
pz = {Plot[{f[x]}, {x, -5, 5}, PlotRange -> {-4, 4}]};
For[j = 1, j <= iterations, j++, z = Append[z, z[[j]] - f[z[[j]]]/f'[z[[j]]]];
pz = Append[pz, Plot[y[x, z[[j]]], {x, -5, 5},
PlotStyle -> RGBColor[5 j, 0.3 j, 0], PlotRange -> {-4, 4}]]];
Show[
pz]
```



```
In[141]:= Clear[z, pz];
z = {.09};
pz = {Plot[{f[x]}, {x, -5, 5}, PlotRange -> {-4, 4}]};
For[j = 1, j <= iterations, j++, z = Append[z, z[[j]] - f[z[[j]]]/f'[z[[j]]]];
pz = Append[pz, Plot[y[x, z[[j]]], {x, -5, 5},
PlotStyle -> RGBColor[5 j, 0.3 j, 0], PlotRange -> {-4, 4}]]]
Show[
pz]
```



## Why Q5 failed

```
In[157]:= Plot[{f[x], y[x, 2]}, {x, -10, 10}, PlotRange -> {-4, 4}]
```

