

# LAB 1 Examples & hints - MATH 242

## FALL 2020

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#### Part I

```
In[1]:= f = x^2 + 2 x^3 * Exp[x]
```

```
Out[1]= x2 + 2 ex x3
```

#### Derivatives and Substitutions

```
In[2]:= D[f, x]
```

```
D[D[f, x], x]
```

```
Out[2]= 2 x + 6 ex x2 + 2 ex x3
```

```
Out[3]= 2 + 12 ex x + 12 ex x2 + 2 ex x3
```

```
In[4]:= D[f, {x, 2}]
```

```
Out[4]= 2 + 12 ex x + 12 ex x2 + 2 ex x3
```

```
In[5]:= f /. x → 2
```

```
Out[5]= 4 + 16 e2
```

#### Integrals

```
In[6]:= g = 1 / (1 + x^2)
```

```
h = Integrate[g, x]
```

```
(h /. x → 1) - (h /. x → 0)
```

```
Out[6]= 1  
1 + x2
```

```
Out[7]= ArcTan[x]
```

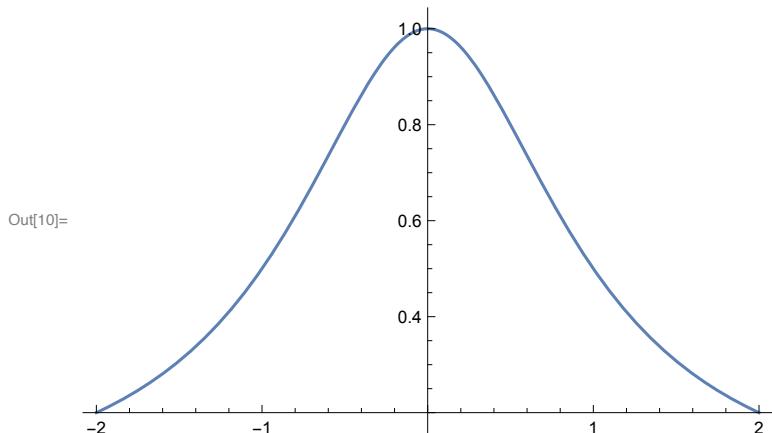
```
Out[8]= π  
4
```

```
In[9]:= Integrate[1/(1+x^2), {x, 0, 1}]
```

$$\text{Out}[9]= \frac{\pi}{4}$$

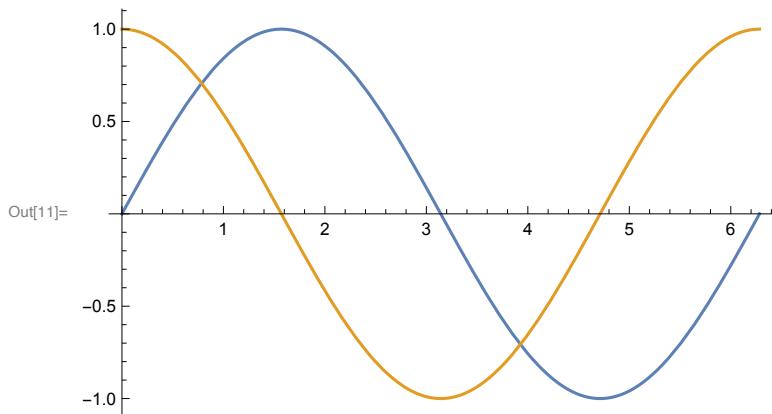
## Plots

```
In[10]:= Plot[1/(1+x^2), {x, -2, 2}]
```

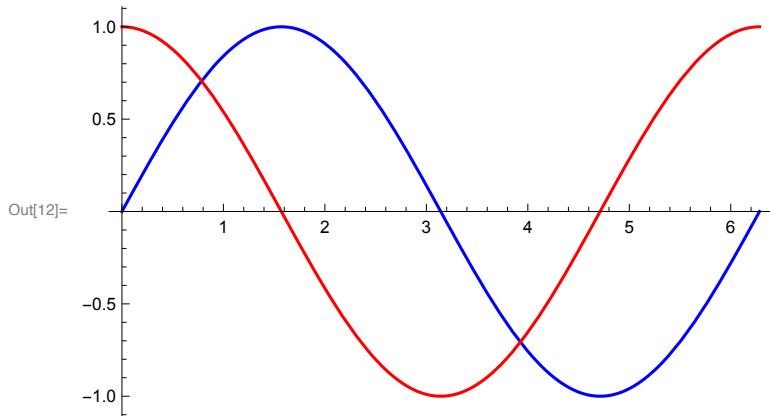


## A Bit More on Plots

```
In[11]:= Plot[{Sin[x], Cos[x]}, {x, 0, 2 * Pi}]
```



```
In[12]:= Plot[{Sin[x], Cos[x]}, {x, 0, 2 * Pi}, PlotStyle -> {Blue, Red}]
```



## Part 2

```
In[13]:= Clear[f]
f[x_] = x * Exp[x^2]
f[1]
```

Out[14]=  $e^{x^2} x$

Out[15]=  $e$

```
In[16]:= D[f[x], x]
f'[x]
```

Out[16]=  $e^{x^2} + 2 e^{x^2} x^2$

Out[17]=  $e^{x^2} + 2 e^{x^2} x^2$

```
In[18]:= f''[2]
Integrate[f[x], x]
```

Out[18]=  $44 e^4$

Out[19]=  $\frac{e^{x^2}}{2}$

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## Assignment Questions

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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.

**Q1**

(a)

$$\text{Out}[62]= \frac{1}{1 + x^2}$$

$$\text{Out}[63]= -\frac{48 x^3}{(1 + x^2)^4} + \frac{24 x}{(1 + x^2)^3}$$

(b)

$$\text{Out}[65]= -\frac{144}{625}$$

(c) and (d)

$$\text{Out}[43]= \frac{1}{1 + x^2}$$

$$\text{Out}[44]= -\frac{48 x^3}{(1 + x^2)^4} + \frac{24 x}{(1 + x^2)^3}$$

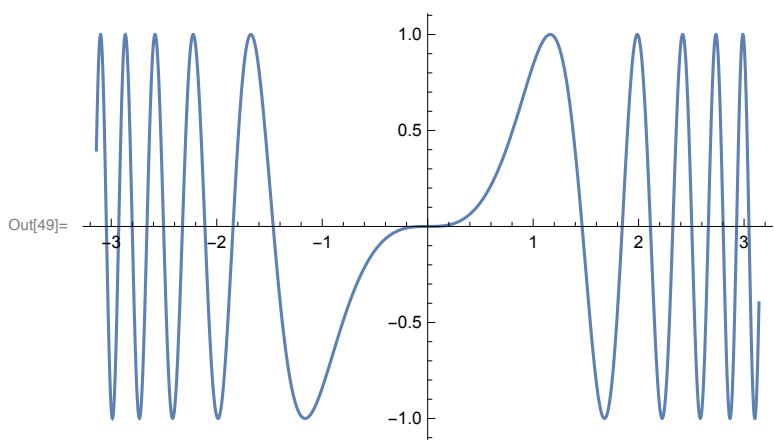
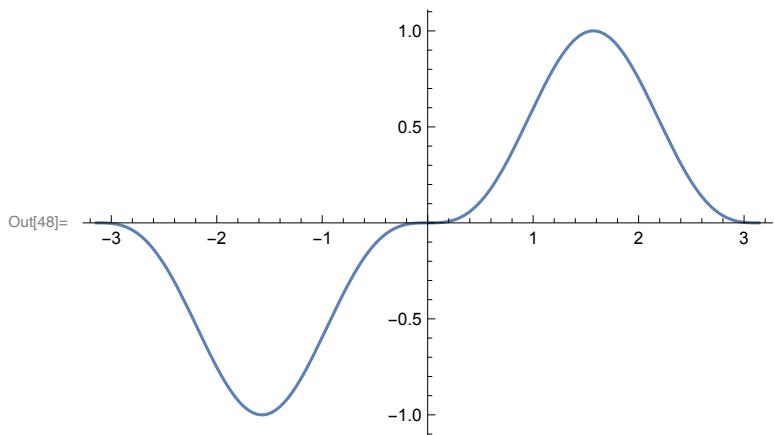
$$\text{Out}[45]= -\frac{36}{625}$$

**Q2**

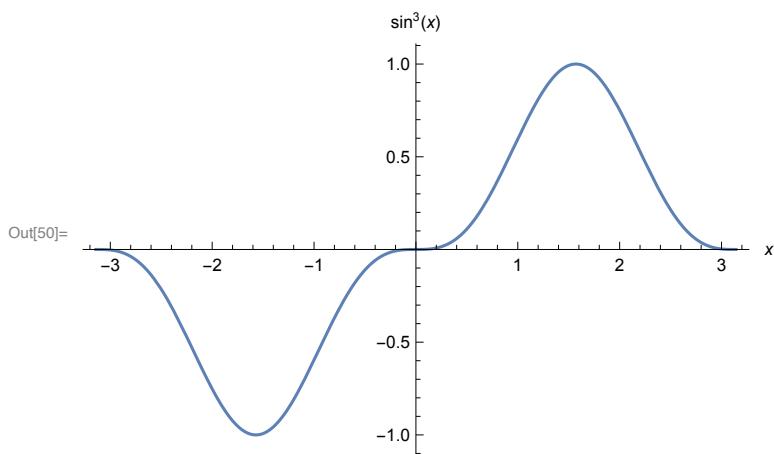
$$\text{Out}[70]= \frac{1}{3} (-1 + e^8)$$

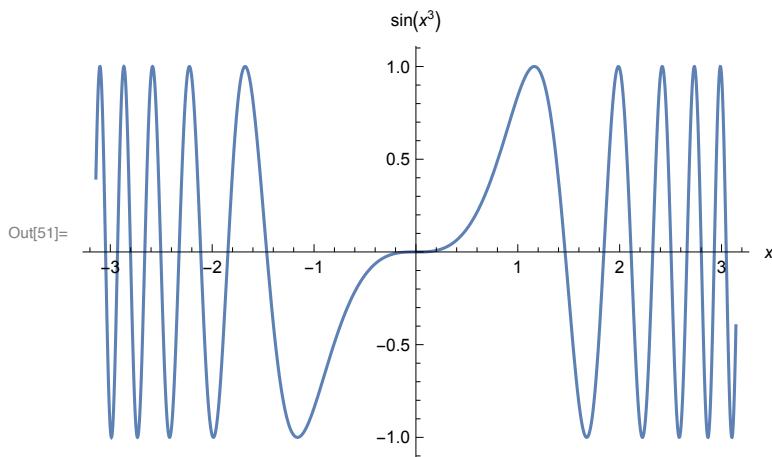
$$\text{Out}[71]= -4 \pi (-6 + \pi^2)$$

Q3



Q4



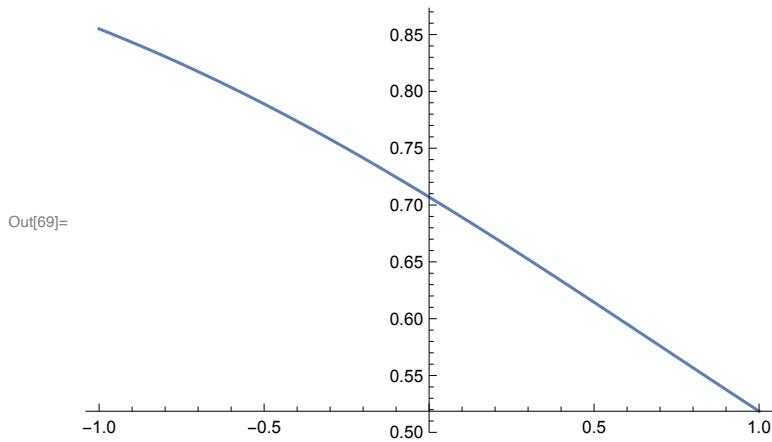
**Q5**

$$\text{Out}[54]= \frac{1}{\sqrt{1 + e^x}}$$

$$\text{Out}[66]= -\frac{e^{1/3}}{2 (1 + e^{1/3})^{3/2}} + \frac{21 e^{2/3}}{4 (1 + e^{1/3})^{5/2}} - \frac{45 e}{4 (1 + e^{1/3})^{7/2}} + \frac{105 e^{4/3}}{16 (1 + e^{1/3})^{9/2}}$$

$$\text{Out}[67]= -2 \operatorname{ArcTanh}[\sqrt{1 + e^x}]$$

$$\text{Out}[68]= 2 (\operatorname{ArcTanh}[\sqrt{2}] - \operatorname{ArcTanh}[\sqrt{1 + e}])$$

**Q6**

$$\text{Out}[76]= \frac{1 - \operatorname{ArcTan}[x]}{-\cos[x] + \sin[x]}$$

$$\text{Out}[77]= \frac{1 - \frac{\pi}{3}}{-\cos[\sqrt{3}] + \sin[\sqrt{3}]}$$