8 February 2016

GROUP A

1 o

i)

```
z = -1 - I
Arg[z]
```

$-1 - i$

$-\frac{3\pi}{4}$

ii)

```
Clear[x]
Integrate[1 / (x^2 + 6 x + 10), x]
Integrate[1 / (x^2 + 6 x + 10), {x, 0, +Infinity}]
```

ArcTan[3 + x]

$\frac{1}{2}(\pi - 2\,\mathrm{ArcTan}[3])$

2 o

ii)

```
A = {{I, -1}, {1, -I}};
MatrixForm[A]
Print["|A| = ", Det[A]]
Print["Inverse matrix A = ",
 Inverse[A] // MatrixForm]
```

$$\begin{pmatrix} i & -1 \\ 1 & -i \end{pmatrix}$$

|A| = 2

Inverse matrix A = $\begin{pmatrix} -\frac{i}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{i}{2} \end{pmatrix}$

ii)

In[10]:=
```
Integrate[x Sin[2 x], x]
Integrate[x Sin[2 x], {x, 0, Pi}]
```

Out[10]= $-\frac{1}{2} x \operatorname{Cos}[2 x] + \frac{1}{4} \operatorname{Sin}[2 x]$

Out[11]= $-\frac{\pi}{2}$

3 o

i)

```
ClearAll[f, x];
f[x_] := Log[1 - x^2]
Print["Roots f(x) : ", Solve[f[x] == 0, x]]
Print["Derivative  f'(x)  :  ", Factor[D[f[x], x]]]
Print["Critical Point    :  ",
 Solve[D[f[x], x] == 0, x], " approximately : ",
 N[Solve[D[f[x], x] == 0, x]]]
```

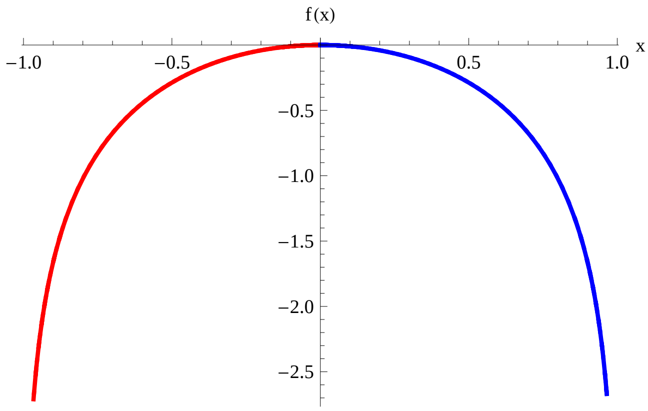
Roots f(x) : {{x → 0}}

Derivative f′(x) : $\frac{2x}{(-1+x)(1+x)}$

Critical Point : {{x → 0}} approximately : {{x → 0.}}

The curve of the function f (x) = ln (1 - x^2), when - 1 ≤ x ≤ 1

```
ClearAll[f, x]; f[x_] := Log[1 - x^2]
fgr1 = Plot[f[x], {x, -1, 0}, PlotStyle → Thick,
   ColorFunction -> Function[Red]];
fgr2 = Plot[f[x], {x, 0, 1}, PlotStyle → Thick,
   ColorFunction -> Function[Blue]];
fgr = Show[fgr1, fgr2, PlotRange -> All,
  AxesLabel → {"x", "f(x)"}]
```



ii) MACLAURIN's POLYNOMIAL

```
Print["Derivative  f''(x)  :  ",
 Factor[D[D[f[x], x], x]]]
Print["Maclaurin's polynomial : ",
 Series[f[x], {x, 0, 2}]]
```

Derivative f''(x) : $-\frac{2\left(1+x^2\right)}{(-1+x)^2\,(1+x)^2}$

Maclaurin's polynomial : $-x^2+O[x]^3$

GROUP B

1 o

i)

In[1]:=
```
z = -1 + I
Arg[z]
```

Out[1]= $-1 + i$

Out[2]= $\frac{3\pi}{4}$

ii)

In[3]:=
```
Clear[x]
Integrate[1 / (x^2 + 4 x + 5), x]
Integrate[1 / (x^2 + 4 x + 5), {x, 0, +Infinity}]
```

Out[4]= ArcTan[2 + x]

Out[5]= $\frac{1}{2}(\pi - 2\,\text{ArcTan}[2])$

2 o

ii)

In[6]:=
```
A = {{I, 1}, {-1, -I}};
MatrixForm[A]
Print["|A| = ", Det[A]]
Print["Inverse matrix A = ",
 Inverse[A] // MatrixForm]
```

Out[7]//MatrixForm=

$$\begin{pmatrix} i & 1 \\ -1 & -i \end{pmatrix}$$

|A| = 2

Inverse matrix A = $\begin{pmatrix} -\frac{i}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{i}{2} \end{pmatrix}$

ii)

In[12]:=
```
Integrate[x Cos[2 x], x]
Integrate[x Cos[2 x], {x, 0, Pi}]
```

Out[12]= $\frac{1}{4}$ Cos[2 x] + $\frac{1}{2}$ x Sin[2 x]

Out[13]= 0

3 o

i)

In[14]:=
```
ClearAll[f, x];
f[x_] := Log[4 - x^2]
Print["Roots f(x) : ", Solve[f[x] == 0, x]]
Print["Derivative  f'(x)  :  ", Factor[D[f[x], x]]]
Print["Critical Point    :  ",
 Solve[D[f[x], x] == 0, x], " approximately : ",
 N[Solve[D[f[x], x] == 0, x]]]
```

Roots f(x) : $\{\{x \to -\sqrt{3}\}, \{x \to \sqrt{3}\}\}$

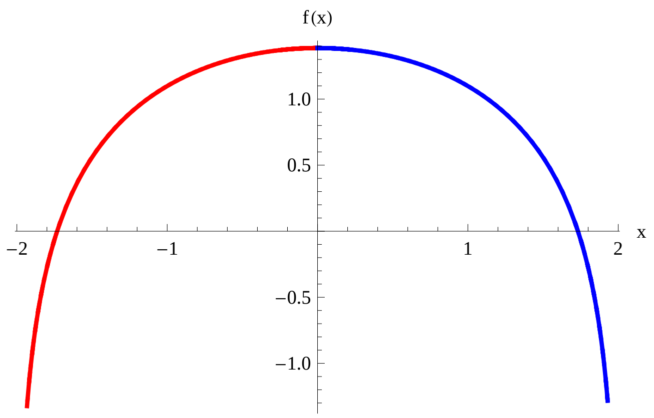
Derivative f'(x) : $\frac{2x}{(-2+x)(2+x)}$

Critical Point   : $\{\{x \to 0\}\}$ approximately : $\{\{x \to 0.\}\}$

The curve of the function f (x) = ln (1 - x^2), when $-2 \le x \le 2$

In[23]:=
```
ClearAll[f, x]; f[x_] := Log[4 - x^2]
fgr1 = Plot[f[x], {x, -2, 0}, PlotStyle → Thick,
   ColorFunction -> Function[Red]];
fgr2 = Plot[f[x], {x, 0, 2}, PlotStyle → Thick,
   ColorFunction -> Function[Blue]];
fgr = Show[fgr1, fgr2, PlotRange -> All,
  AxesLabel → {"x", "f(x)"}]
```

Out[26]=



ii) MACLAURIN's POLYNOMIAL

In[27]:=
```
Print["Derivative  f''(x)  :  ",
 Factor[D[D[f[x], x], x]]]
Print["Maclaurin's polynomial : ",
 Series[f[x], {x, 0, 2}]]
```

Derivative f''(x) : $-\frac{2\left(4+x^2\right)}{(-2+x)^2\,(2+x)^2}$

Maclaurin's polynomial : $\text{Log}[4]-\frac{x^2}{4}+O[x]^3$