12 September 2013

1 o

i)

```
<< VectorAnalysis`;
SetCoordinates[Cartesian[x, y, z]];
ClearAll[x, y, z];
f[x_, y_] := Exp[-x] + x Cos[2 y]
Grad[f[x, y]]
Grad[f[x, y]] /. {x → -1, y → Pi / 4}
Print["fxy = ", D[D[f[x, y], x], y]]
Print["fxy|P = ",
 D[D[f[x, y], x], y] /. {x → -1, y → Pi / 4}]
```

$\{-e^{-x} + \text{Cos}[2\,y],\ -2\,x\,\text{Sin}[2\,y],\ 0\}$

$\{-e,\ 2,\ 0\}$

$f_{xy} = -2\,\text{Sin}[2\,y]$

$f_{xy}|P = -2$

ii)

```
g[x_, y_] := x y
D[g[x, y], x]
D[g[x, y], y]
Solve[{D[g[x, y], x] == 0, D[g[x, y], y] == 0}, {x, y}]
```

y

x

{{y → 0, x → 0}}

```
A = D[D[g[x, y], x], x] /. {x → 0, y → 0}
B = D[D[g[x, y], x], y] /. {x → 0, y → 0}
C1 = D[D[g[x, y], y], y] /. {x → 0, y → 0}
z = A * C1 - B^2
```

0

1

0

-1

D < 0 *σημεßο καμπÞς*

2 o

i)

```
Integrate[x^2 - y, y]
Integrate[x^2 - y, {y, -x, x}]
Integrate[x^2 - y, {x, -1, 1}, {y, -x, x}]
```

$x^2 y - \frac{y^2}{2}$

$2 x^3$

0

ii)

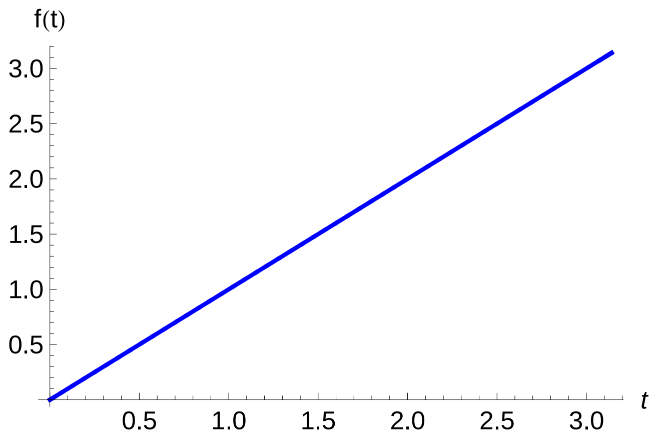
```
DSolve[y'[x] + y[x] == Exp[-2 x], y[x], x]
```

$\{\{y[x] \to -e^{-2 x} + e^{-x} C[1]\}\}$

3 o

i)

```
fgr = Plot[t, {t, 0, Pi}, PlotStyle → Thick,
  ColorFunction -> Function[Blue],
  AxesLabel → {t, "f(t)"},
  BaseStyle → {FontFamily → "Arial", FontSize → 12}]
```




```
T = Pi;
a0 = (2 / T) * Integrate[t, {t, 0, Pi}];
Print["a0=", a0]
```

$a_0 = \pi$

```
an = (2 / T) *
  Integrate[t * Cos[(2 * n * Pi * t) / T], {t, 0, Pi}]
Print["an=", an /. {Cos[2 n π] → 1, Sin[2 n π] → 0}]
```

$$\frac{-1 + \mathrm{Cos}[2\, n\, \pi] + 2\, n\, \pi\, \mathrm{Sin}[2\, n\, \pi]}{2\, n^2\, \pi}$$

an=0

```
bn = (2 / T) *
  Integrate[t * Sin[(2 * n * Pi * t) / T], {t, 0, Pi}]
Print["bn=", bn /. {Cos[2 n π] → 1, Sin[2 n π] → 0}]
```

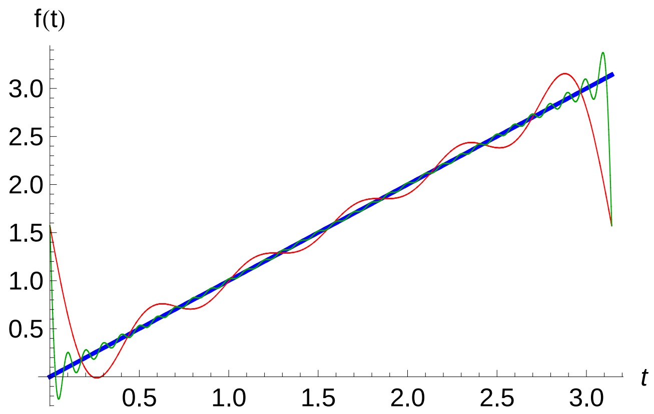
$$\frac{-2\, n\, \pi\, \mathrm{Cos}[2\, n\, \pi] + \mathrm{Sin}[2\, n\, \pi]}{2\, n^2\, \pi}$$

$bn = -\frac{1}{n}$

```
bn = (2 / T) *
    Integrate[t * Sin[(2 * n * Pi * t) / T], {t, 0, Pi}] /.
   {Cos[2 n π] → 1, Sin[2 n π] → 0}
```

$$-\frac{1}{n}$$

```
Table[bn, {n, 1, 31}];
S5 = Sum[bn Sin[2 n t], {n, 1, 5}];
S31 = Sum[bn Sin[2 n t], {n, 1, 31}];
gf5 = Plot[a0 / 2 + S5, {t, 0, Pi},
    PlotRange → All, ColorFunction -> Function[Red]];
gf31 = Plot[a0 / 2 + S31, {t, 0, Pi}, PlotRange → All,
    ColorFunction -> Function[Darker[Green]]];
fg = Show[fgr, gf5, gf31, PlotRange → All,
   BaseStyle → {FontFamily → "Arial", FontSize → 12}]
```



ii)

```
ClearAll[x, y, z]
f[x_, y_, z_] := Sqrt[x^2 + y^2 + z^2]
Print["fx=", D[f[x, y, z], x]]
Print["fy=", D[f[x, y, z], y]]
Print["fz=", D[f[x, y, z], z]]
Print["df/dt = ", FullSimplify[
  D[f[x, y, z], x] D[Cos[t], t] + D[f[x, y, z], y]
     D[Sin[t], t] + D[f[x, y, z], x] D[t, t] /.
    {x → Cos[t], y → Sin[t], z → t}]]
```

$f_x = \frac{x}{\sqrt{x^2 + y^2 + z^2}}$

$f_y = \frac{y}{\sqrt{x^2 + y^2 + z^2}}$

$f_z = \frac{z}{\sqrt{x^2 + y^2 + z^2}}$

$\frac{df}{dt} = \frac{\text{Cos}[t]}{\sqrt{1 + t^2}}$