18 July 2013

1 o

ii)

In[43]:=
```
<< VectorAnalysis‘;
ClearAll[x, y, z]
SetCoordinates[Cartesian[x, y, z]];
Clear[x]; Clear[y]; Clear[z];
F[x_, y_, z_] := {y z^2, x z^2, 2 x y z}
F[x, y, z];
Curl[F[x, y, z]]
```

Out[49]=
```
{0, 0, 0}
```

Potential

In[50]:=
```
ϕ[x_, y_, z_] := x y z^2
```

In[51]:=
```
Print["Linear Integral: ", ϕ[2, 1, 3] - ϕ[1, -1, 1]]
```

```
Linear Integral: 19
```

ii)

In[52]:=
```
Print["Polynomial y=ax+b"]
Fit[{{1, 1.5}, {1.5, 2},
  {2.2, -0.5}, {2.8, 1}}, {1, x}, x]
```

```
Polynomial y=ax+b
```

Out[53]=
```
2.305221 - 0.6961178 x
```

2 o

i)

```
Clear[f]; Clear[x];
f[x_] := Log[1 + x^2]
f[x]
a = 0; b = 0.5; h = 0.1; n = (b - a) / h;
Print[N[f[a], 5]]
Sb0 = f[a] + f[b]; Sb1 = 0;
Do[a += h; Sb1 += f[a];
 Print[N[f[a], 5]], {i, 1, n - 1}]
Print[N[f[b]], 5]
Sb = h * (Sb0 + 2 Sb1) / 2;
Print["Composite Trapezoidal I(f)=", Sb]
```

$$\text{Log}\left[1 + x^2\right]$$

```
0
0.009950331
0.03922071
0.0861777
0.14842
0.22314365
Composite Trapezoidal I(f)=0.03953405
```

ii)

In[56]:=
```
ClearAll[s, t]
Print["g(t) = ", FullSimplify[
  InverseLaplaceTransform[s / (s^2 + 2 s + 5), s, t]]]
```

$$g(t) = \frac{1}{2} e^{-t} (2 \text{Cos}[2 t] - \text{Sin}[2 t])$$

3 o

In[69]:=
```
ClearAll[n]
T = 2;
(4 / 2) * Integrate[t * Sin[(2 * n * Pi * t) / T], t]
bn = (4 / 2) *
     Integrate[t * Sin[(2 * n * Pi * t) / T], {t, 0, 1}] /.
   {Cos[n π] → (-1)^n, Sin[n π] → 0};
Print["b_n = ", bn]
```

Out[71]=
$$2\left(-\frac{t\,\text{Cos}[n\,\pi\,t]}{n\,\pi}+\frac{\text{Sin}[n\,\pi\,t]}{n^2\,\pi^2}\right)$$

$$b_n = -\frac{2\,(-1)^n}{n\,\pi}$$

ii)

In[62]:=
```
y = InterpolatingPolynomial[
    {{0, 0.1}, {0.3, -0.5}, {0.7, 0.3}}, x];
Print["P_2(x) = ", Expand[y]]
```

$$P_2(x) = 0.1 - 3.714286\,x + 5.714286\,x^2$$