19 September 2013

1 o

i)

In[17]:=
```
<< VectorAnalysis';
ClearAll[x, y, z]
SetCoordinates[Cartesian[x, y, z]];
ClearAll[x, y, z];
f[x_, y_, z_] := x y^3 z^2
Print["graf(f) = ", Grad[f[x, y, z]]]
Print["graf(f)|(-1,1,2) = ",
 Grad[f[x, y, z]] /. {x → -1, y → 1, z → 2}]
Print["Laplacian ~f = ",
 Simplify[Laplacian[f[x, y, z]]]]
Print["Laplacian ~f|(-1,1,2) = ",
 Simplify[Laplacian[f[x, y, z]]] /.
  {x → -1, y → 1, z → 2}]
```

$\text{graf(f)} = \left\{y^3 z^2,\ 3 x y^2 z^2,\ 2 x y^3 z\right\}$

$\text{graf(f)|(-1,1,2)} = \{4, -12, -4\}$

$\text{Laplacian ~f} = 2 x y \left(y^2 + 3 z^2\right)$

$\text{Laplacian ~f|(-1,1,2)} = -26$

ii)

In[43]:=
```
ClearAll[x, y]
x1 = -1; y1 = 1; x2 = 1; y2 = 2;
x[t_] := t x2 + (1 - t) x1
y[t_] := t y2 + (1 - t) y1
Print["x(t) = ", x[t]]
Print["y(t) = ", y[t]]
xd[t_] := D[x[t], t]
yd[t_] := D[y[t], t]
Print["x'(t) = ", xd[t]]
Print["y'(t) = ", yd[t]]
P[t_] := x[t] - y[t]
Q[t_] := x[t] + y[t]
Print["P(t) = ", P[t]]
Print["Q(t) = ", Q[t]]
Print["P(t)x'(t)+Q(t)y'(t) =",
 Simplify[P[t] xd[t] + Q[t] yd[t]]]
z = Integrate[P[t] xd[t] + Q[t] yd[t], {t, 0, 1}];
Print["Linear Integral: ", z]
```

```
x(t) = -1 + 2 t
y(t) = 1 + t
x'(t) = 2
y'(t) = 1
P(t) = -2 + t
Q(t) = 3 t
P(t)x'(t)+Q(t)y'(t) =-4 + 5 t
Linear Integral: -3/2
```

2 o

i)

```
ClearAll[f, x];
f[x_] := 1 / (1 + x^4)
f[x]
a = 0; b = 0.4; 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]
```

$$\frac{1}{1+x^4}$$

```
1.0000
0.9999
0.9984026
0.9919651
0.9750395
Composite Trapezoidal I(f)=0.3977787
```

ii)

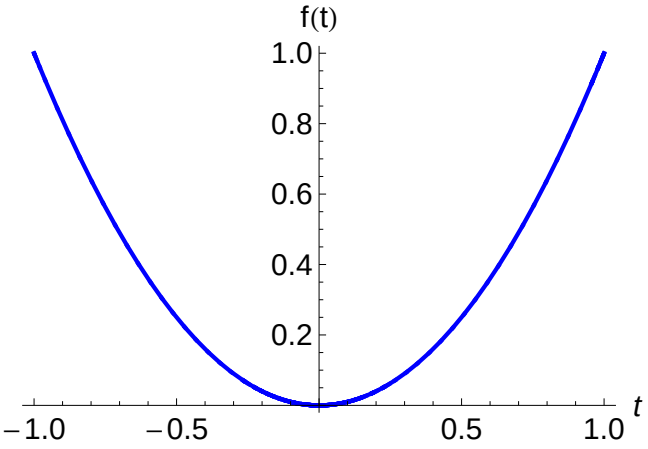
```
ClearAll[s, t]
InverseLaplaceTransform[(s - 5) / (s^2 + 9), s, t]
```

$$\frac{1}{3}\left(3\cos[3t] - 5\sin[3t]\right)$$

3 o

i)

```
fgr = Plot[t^2, {t, -1, 1}, PlotStyle → Thick,
  ColorFunction -> Function[Blue],
  AxesLabel → {t, "f(t)"},
  BaseStyle → {FontFamily → "Arial", FontSize → 14}]
```




```
ClearAll[n]
T = 2;
a0 = (4 / 2) * Integrate[t^2, {t, 0, 1}];
Print["a0 = ", a0]
(4 / 2) * Integrate[t^2 * Cos[(2 * n * Pi * t) / T], t]
an = (4 / 2) * Integrate[t^2 * Cos[(2 * n * Pi * t) / T],
      {t, 0, 1}] /. {Cos[n Pi] → (-1)^n, Sin[n Pi] → 0};
Print["an = ", an]
```

$$a_0 = \frac{2}{3}$$

$$\frac{2\left(2\,n\,\pi\,t\,\text{Cos}[n\,\pi\,t] + \left(-2 + n^2\,\pi^2\,t^2\right)\text{Sin}[n\,\pi\,t]\right)}{n^3\,\pi^3}$$

$$a_n = \frac{4\,(-1)^n}{n^2\,\pi^2}$$

```
ii)
y = InterpolatingPolynomial[
    {{1.0, 2.0}, {1.2, 2.5}, {1.4, 3.0}}, x];
Print["P2(x) = ", Expand[y]]
```

$$P_2(x) = -0.5 + 2.5\,x + 0.\,x^2$$