In[1]:=
```
(*opzioni per i grafici*)
```

In[2]:=
```
SetOptions[
  {
   Plot,
   ListPlot
  },
  TicksStyle -> Directive[
    Hue[5 / 6],
    8
   ],
  FrameStyle -> Directive[
    Hue[5 / 6],
    7
   ]
 ];
```

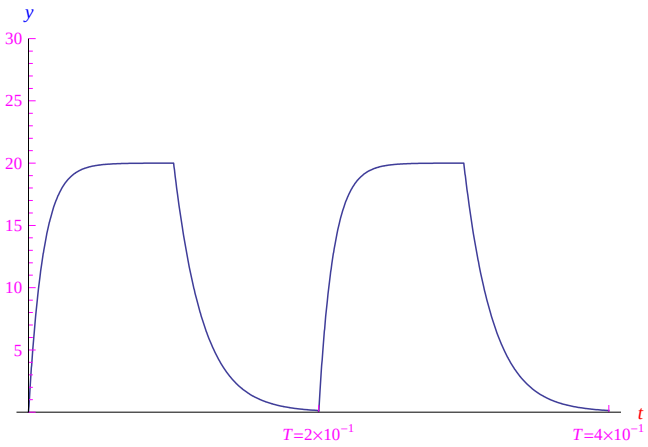
In[3]:=
```
T = 2 * 10^-1;
```

In[4]:=
```
(*segnale*)
```

In[5]:=
```
y[t_] := Which[
  t ≥ 0 && t ≤ T/2, 20 * (1 - Exp[-10^2 t]),
  t ≥ T/2 && t ≤ T, 20 * Exp[-50 * (t - 10^-1)],
  t ≥ T && t ≤ 3/2 T, 20 * (1 - Exp[-10^2 (t - T)]),
  t ≥ 3/2 T && t ≤ 2 T, 20 * Exp[-50 * ((t - T) - 10^-1)]
 ]
```

In[6]:=
```
ploty = Plot[
  y[t],
  {t, 0, 2 T},
  PlotStyle → Thickness[0.00255],
  PlotRange → {0, 30},
  AxesLabel →
   {
    Style["t", Small, Red],
    Style["y", Small, Blue]
   },
  Ticks →
   {
    {
     {2 * 10^-1, "T=2×10^-1"}, {4 * 10^-1, "T=4×10^-1"}
    }
   }
 ]
```

Out[6]=



In[7]:=
```
Ymedio = 1/T * Integrate[
   y[t],
   {t, 0, T}
  ]
```

Out[7]= $\frac{1 - 2\,e^{5} + 11\,e^{10}}{e^{10}}$

In[8]:=
```
Ymedio // N
```

Out[8]= 10.9866

In[9]:=
```
Yefficace = Sqrt[1/T (∫_0^T y[t]^2 dt)]
```

Out[9]= $\frac{\sqrt{10\left(-1 + 2\,e^{10} + 19\,e^{20}\right)}}{e^{10}}$

In[10]:=
```
Yefficace // N
```

Out[10]= 13.7841

In[11]:=
```
(*partizione di [0,T]*)
```

In[12]:=
```
T // N
```

Out[12]=
```
0.2
```

In[13]:=
```
lista[n_] := lista[n] = Table[
     Random[Real, {0, T}],
     {k, 0, n - 1}
    ] // Sort;
```

In[14]:=
```
points0 = lista[7]
```

Out[14]=
```
{0.0242294, 0.0553994, 0.0594916, 0.0676557, 0.0935963, 0.121067, 0.194578}
```

In[15]:=
```
(*aggiungo gli estremi*)
```

In[16]:=
```
points = Append[Prepend[points0, 0], T]
```

Out[16]=
$$\left\{0, 0.0242294, 0.0553994, 0.0594916, 0.0676557, 0.0935963, 0.121067, 0.194578, \frac{1}{5}\right\}$$

In[17]:=
```
(*enumerazione dei punti dell'asse dei tempi*)
```

In[18]:=
```
t[k_] := points0[[k]]
```

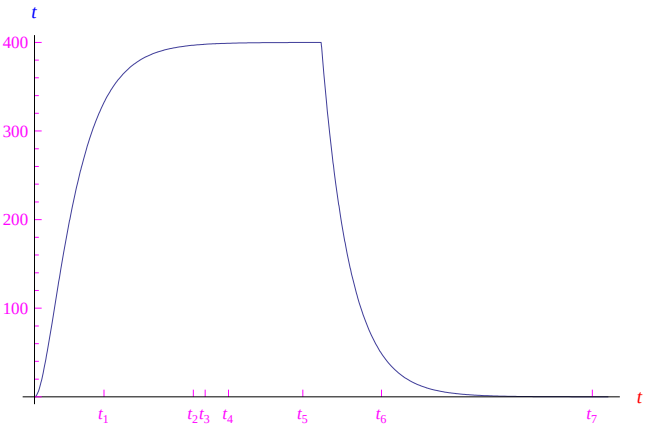
In[19]:=
```
tt[k_] := points[[k]]
```

In[20]:=
```
(*posizionamento dei punti*)
```

In[21]:=
```
f[t_] := y[t]^2
```

In[22]:=
```
graficopartizione0 = Plot[
  f[t],
  {t, 0, T},
  AxesLabel →
   {
    Style["t", Small, Red],
    Style["t", Small, Blue]
   },
  Ticks →
   {
    {
     0, {t[1], "t₁"}, {t[2], "t₂"}, {t[3], "t₃"}, {t[4], "t₄"}, {t[5], "t₅"}, {t[6], "t₆"},
     {t[7], "t₇"}
    }
   }
 ]
```

Out[22]=



In[23]:=
```
(*costruisco i punti arbitrari in [tk,tk+1]*)
```

In[24]:=
```
τ[k_] := τ[k] = RandomReal[{tt[k], tt[k + 1]}]
```

In[25]:=
```
tt[3]
```

Out[25]= 0.0553994

In[26]:=
```
τ[4]
```

Out[26]= 0.0646088

In[27]:=
```
f[τ[1]]
```

Out[27]= 235.719

In[28]:=
```
f[τ[1]] * (tt[2] - tt[1]) + f[τ[3]] * (tt[3] - tt[2])
```

Out[28]= 18.1084

In[29]:=
```
(*calcolo la somma di  Riemann relativa a f(t)*)
```

In[30]:=
```
σ = Sum[
  f[τ[k]] * (tt[k + 1] - tt[k]),
  {k, 2, 4}
 ]
```

Out[30]= 17.2478

In[31]:=
```
lista1[n_] := lista1[n] = Append[Prepend[lista[n], 0], T]
```

In[32]:=
```
Clear[t, tt, ξ, σ]
```

In[33]:=
```
tt[k_, n_] := lista1[n][[k]]
```

In[34]:=
```
tt[10, 200]
```

Out[34]= 0.0115509

In[35]:=
```
ξ[k_, n_] := ξ[k, n] = RandomReal[{tt[k, n], tt[k + 1, n]}];
```

In[36]:=
```
f[ξ[10, 200]]
```

Out[36]= 199.161

In[37]:=
```
f[ξ[10, 200]] (tt[11, 200] - tt[10, 200])
```

Out[37]= 0.231289

In[38]:=
```
σ[n_] := Sum[
  f[ξ[k, n]] * (tt[k + 1, n] - tt[k, n]),
  {k, 1, n + 1}
 ]
```

In[39]:=
```
σ[20]
```

Out[39]= 36.4718

In[40]:=
```
Yeff[n_] := √(1/T σ[n])
```

In[41]:=
```
Yeff[20]
```

Out[41]= 13.504

In[42]:=
```
Yefftable = TableForm[
  Table[
   {n, Yeff[n]},
   {n, 1, 50}
  ],
  TableHeadings → {
    None,
    {
     StyleForm["n", FontWeight → Bold],
     StyleForm["Y_eff", FontWeight → Bold]
    }
   }
 ]
```

Out[42]//TableForm=

n	Y_{eff}
1	14.3859
2	15.6675
3	13.5751
4	15.0157
5	8.66391
6	13.6324
7	12.9533
8	14.7133
9	13.1896
10	13.9523
11	12.533
12	12.7718
13	13.1052
14	13.7428
15	13.7022
16	12.7185
17	14.3328
18	14.7556
19	14.2585
20	13.504
21	13.7382
22	13.9634
23	13.0252
24	13.4369
25	13.9152
26	13.8697
27	13.4894
28	13.6672
29	13.8379
30	14.052
31	13.2229
32	13.2489
33	13.8943
34	13.3911
35	13.7877
36	13.87
37	14.3817
38	14.1763
39	13.9138
40	14.0801
41	13.6613
42	14.1509
43	14.0548
44	13.8075
45	13.4791
46	13.8521
47	13.9328
48	13.7214
49	13.8213
50	13.6913

In[43]:=
```
Yefficace
```

Out[43]=
$$\frac{\sqrt{10\left(-1+2\,e^{10}+19\,e^{20}\right)}}{e^{10}}$$

In[52]:=
```
somme1 = Table[{n, σ[n]}, {n, 1, 550}];
```

In[53]:=
```
graficosomme1 = ListPlot[
   somme1,
   PlotStyle → {
     Red,
     PointSize[0.006],
     Joined → False,
     PlotRange → All
    }
  ];
```

In[55]:=
```
Yefficace
```

Out[55]=
$$\frac{\sqrt{10\left(-1+2\,e^{10}+19\,e^{20}\right)}}{e^{10}}$$

In[56]:=
```
efficace = Show[
  graficosomme1,
  Plot[Yefficace // N, {x, 0, 550}],
  AxesLabel →
   {"n", "Yeff"},
  Ticks →
   {
    Automatic,
    {
     {Yefficace, "Yeff"}
    }
   }
 ]
```

Out[56]=