# TP 9 de physique

## Questions préliminaires

2. — Script :

```
def subdivision1(tmax:float, n:int) -> list:
  Dt = tmax/n  # Pas de temps
  return [k*Dt for k in range(n+1)]
print(subdivision1(1., 5))
```

Renvoie : `[0.0, 0.2, 0.4, 0.6, 0.8, 1.0]`

— Script :

```
def subdivision2(tmax:float, Dt:float) ->  list:
  n = int(tmax/Dt)
  return [k*Dt for k in range(n+1)]
print(subdivision2(0.3, 0.07))
```

Renvoie : `[0.0, 0.07, 0.14, 0.21000000000000002, 0.28]`
(Ignorez l'erreur de python)

3.
```
def resolution(e, U:float, tau:float, tmax:float, Dt:float) -> (list, list):
  t = subdivision2(tmax, Dt)
  u = [U]
  uk = U
  r = Dt/tau
  for k in range(len(t)-1):
    uk = uk + r * (e(t[k])-uk)
    u.append(uk)
  return (t, u)

t, u = resolution(lambda t:0., 3., 1., 5., 0.1)
print(t, u)
```

Renvoie : `([0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8,`

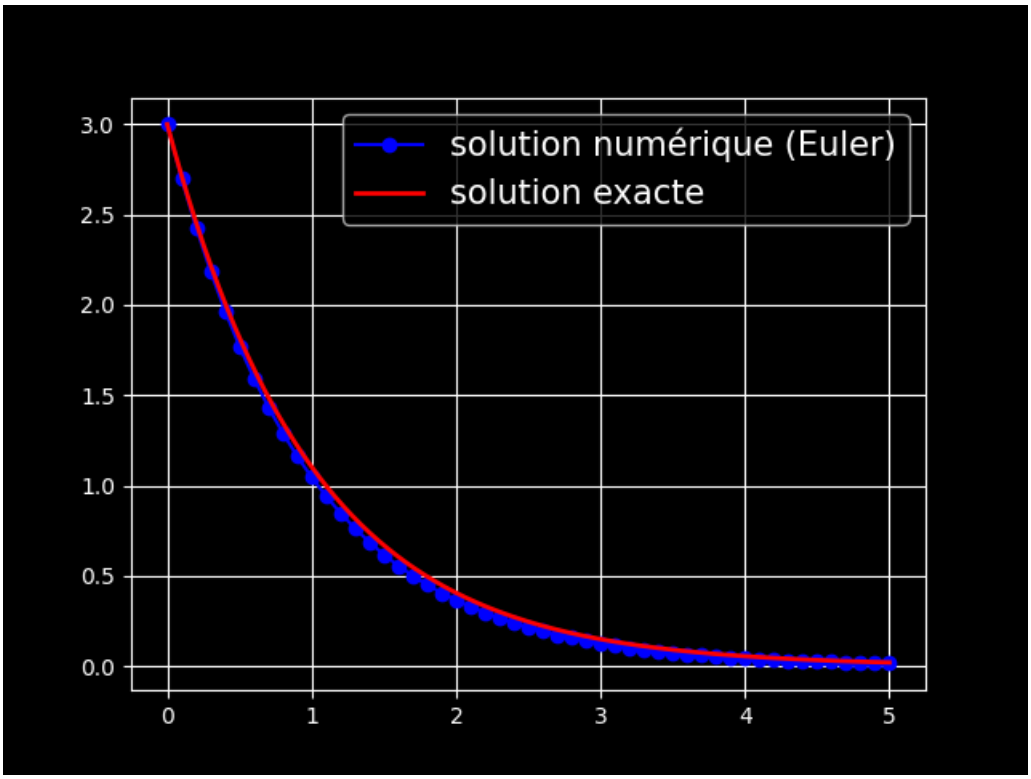
```
4.9, 5.0], [3.0, 2.7, 2.43, 2.187, 1.9683, 1.77147, 1.594323,
1.4348907, 1.29140163, 1.162261467, 1.046035 3203, 0.94143178827,
0.847288609443, 0.7625597484987, 0.68630377364883, 0.617673396283947,
0.5559060566555524, 0.5003154509899972, 0.4502839058909975, 0.40525551530189774,
0.36472996377170797, 0.3282569673945372, 0.29543127065508346,
0.26588814358957513, 0.2392993292306176, 0.21536939630755586,
0.19383245667680027, 0.17444921100912025, 0.15700428990820822,
0.1413038609173874, 0.12717347482564864, 0.11445612734308377,
0.10301051460877539, 0.09270946314789785, 0.08343851683310807,
0.07509466514979726, 0.06758519863481753, 0.060826678771335775,
0.054744010894202194, 0.049269609804781976, 0.044342648824303776,
0.0399083839418734, 0.03591754554768606, 0.03232579099291745,
0.029093211893625705, 0.026183890704263135, 0.023565501633836822,
0.02120895147045314, 0.019088056323407824, 0.01717925069106704,
0.015461325621960335])
```

(Les erreurs de python ont été corrigées)

4.
```python
def e_nulle(t):
  return 0

def u_exacte(t):
  return 3.*np.exp(-t/1.)

t_dense = np.linspace(0., 5., 10000)
plt.style.use('dark_background')
plt.clf()
plt.grid()
plt.plot(t, u, 'bo-', label="solution numérique (Euler)")
plt.plot(t_dense, u_exacte(t_dense), 'r', lw=2, label="solution exacte")
plt.legend(fontsize=15)
plt.savefig("p_tp_9")
```

Renvoie : 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