Exercises

Q2: Integrate the expression f(x) = sin(x) e^{-x}, and then take its derivative.

Clear the variables:

In[•]:=
```
Clear[f, F, PrimeF]
```

Define the function:

In[•]:=
```
f[x_] := Sin[x] × Exp[-x]
```

Integrate the function:

In[•]:=
```
F[x_] := Integrate[f[t], {t, 0, x}]
```

Derivate it:

In[•]:=
```
PrimeF[w_] = FullSimplify[D[F[w], w]]
```

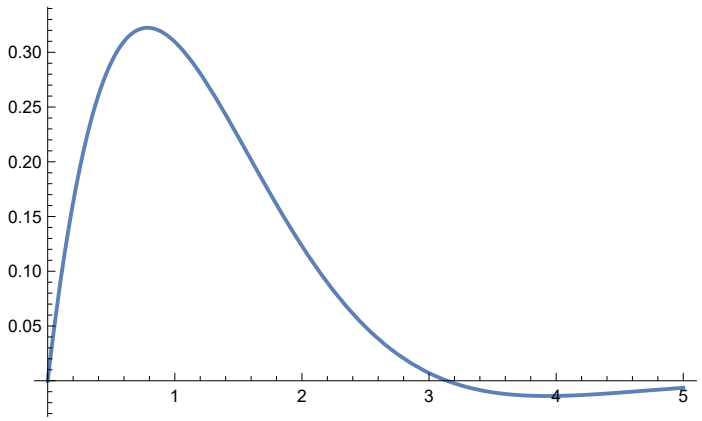
Out[•]=

$$e^{-w} \text{Sin}[w]$$

Plot it:

In[•]:=
```
Plot[PrimeF[x], {x, 0, 5}]
```

Out[•]=



Q3: Solve the equation x ln(x) - 3 x + 10 = 6, both symbolically and numerically.

In[•]:=
```
SolSym := Solve[Reduce[x Log[x] - 3 x + 10 == 6, x]]
```

Solutions:

In[•]:=
```
SolSym[[1, 1, 2]]
SolSym[[2, 1, 2]]
```

Out[•]=
$$e^{3+\text{ProductLog}\left[-\frac{4}{e^3}\right]}$$

Out[•]=
$$e^{3+\text{ProductLog}\left[-1,-\frac{4}{e^3}\right]}$$

Numerical solutions:

In[•]:=
```
Sol := NSolve[Reduce[x Log[x] - 3 x + 10 == 6, x]]

SolX1 = Sol[[1, 1, 2]]
SolX2 = Sol[[2, 1, 2]]
```

Out[•]=
```
15.5229
```

Out[•]=
```
1.56883
```

Q4: Solve the following initial-value problem using both DSolve and NDSolve. Compare your answers by plotting them.

y''(x) - x y(x) = 0
y(0) = 1
y'(0) = - $3^{1/3}$ Gamma(2/3) / Gamma(1/3)

In[•]:=
```
Clear[y, gammaFactor, solAnalitica, solNumerica]

eq := y''[x] - x y[x] == 0;

gammaFactor := (3^(1 / 3) Gamma[2 / 3]) / Gamma[1 / 3]

solAnalitica = DSolve[{eq, y[0] == 1, y'[0] == -gammaFactor}, y[x], x]

solNumerica = NDSolve[{eq, y[0] == 1, y'[0] == -gammaFactor}, y, {x, -10, 100}]

Plot[{y[x] /. solAnalitica[[1]]}, {x, -5, 5}]

Plot[Evaluate[y[x] /. solNumerica], {x, -5, 5}]
```

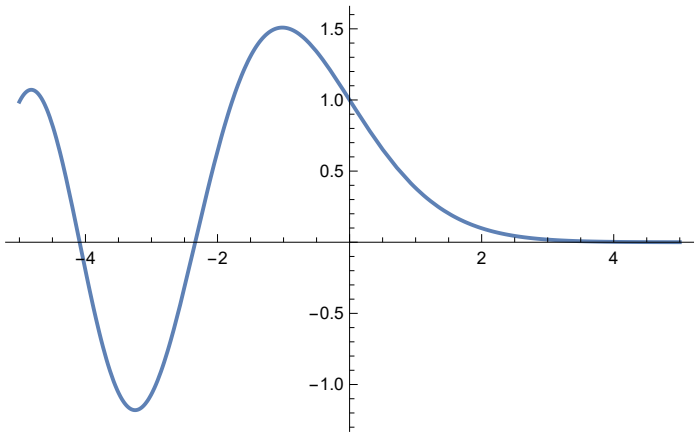
Out[•]=

$$\left\{\left\{y[x] \to 3^{2/3}\, \text{AiryAi}[x] \times \text{Gamma}\left[\frac{2}{3}\right]\right\}\right\}$$

Out[•]=

$$\left\{\left\{y \to \text{InterpolatingFunction}\left[\text{Domain: } \{\{-10., 100.\}\} \text{ Output: scalar}\right]\right\}\right\}$$

Out[•]=



Out[•]=