Preinforme 3 Lab MAT023 S2 CC

Valores de α,β,γ

```
α := 4
β := 4
γ := 7
```

Ejercicio 1.

Considere la siguiente ecuación diferencial de primer orden:

$$\alpha x^2 - \gamma\, xy + y^2 - y'(\, xy - \beta x^2 - \alpha y^2)$$

a. Encuentre explícitamente la solución del la ecuación presentada.

b.. Presente una gráfica de la solución de la ecuación para valores arbitrarios de la constante de integración (fijados por usted).

Solución:

Primero normalizaremos la edo y la signamos a una función de y , x y las constantes del lab.

$$\left(\alpha x^2 - \gamma x y + y^2\right) - y' \left(x y - \beta x^2 - \alpha y^2\right) = 0$$

Por la forma de la Edo se detecta que es homogénea y que realizando el cambio de variable y = xz(x), esta se transformará en una Edo de variables separables.

$$F[y\_] := \frac{\alpha x^2 - \gamma x y + y^2}{\left(x y - \beta x^2 - \alpha y^2\right)} - D[y, x]$$

```
Solve[F[x z[x]] == 0, {z'[x]}]
```

$$\left\{\left\{z'[x] \to \frac{-4 + 3 z[x] - 4 z[x]^3}{x \left(4 - z[x] + 4 z[x]^2\right)}\right\}\right\}$$

Resulta algo feo pero de variable separable.

```
Edo := First[First[Solve[F[x z[x]] == 0, {z'[x]}]][[1]]] ==
  Last[First[Solve[F[x z[x]] == 0, {z'[x]}]][[1]]]
```

```
DSolve[Edo, z, x]
```

Resolvemos la edo.

$$\text{First[DSolve[Edo, z[x], x]][[2]][[1]]}\; e^{-(\text{First[DSolve[Edo,z[x],x]][[1]]})} - x$$

$$-x+e^{-\frac{1}{3}\text{RootSum}\left[4-3\,\#1+4\,\#1^3\&,\ \frac{4\,\text{Log}[-\#1+z[x]]-\text{Log}[-\#1+z[x]]\,\#1+4\,\text{Log}[-\#1+z[x]]\,\#1^2}{-1+4\,\#1^2}\&\right]}\,C[1]$$

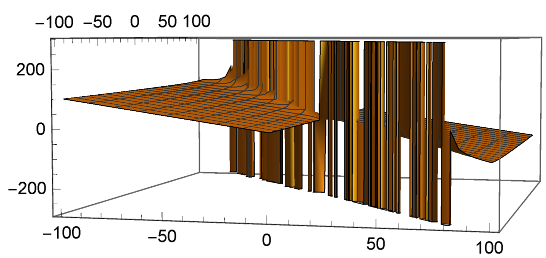
Nos devolvemos a la variable original.

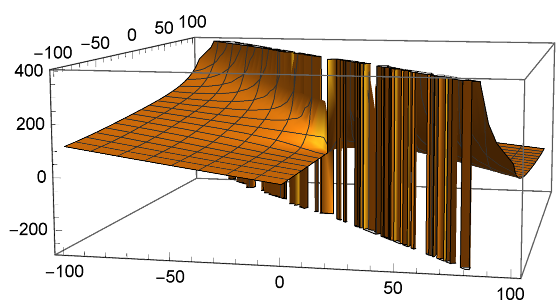
```
z[x] := y / x
```

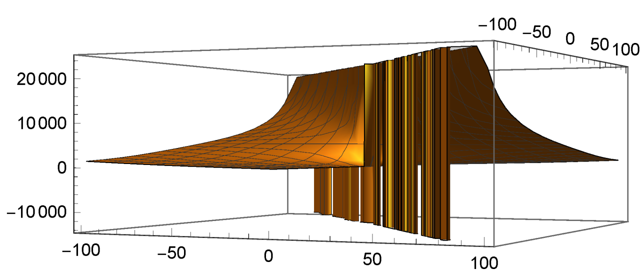
$$-x+e^{-\frac{1}{3}\text{RootSum}\left[4-3\,\#1+4\,\#1^3\&,\ \frac{4\,\text{Log}[-\#1+z[x]]-\text{Log}[-\#1+z[x]]\,\#1+4\,\text{Log}[-\#1+z[x]]\,\#1^2}{-1+4\,\#1^2}\&\right]//N}\,C[1]$$

```
c1 := 1
c2 := 10
c3 := 1000
```

```
Plot3D[-x +
  e^(-0.3333333333333333` ((0.40060067582662473`-1.1577299553257219` i) Log[(-0.6230083252929541`-0.6437531515674265` i)+
   c1, {x, -100, 100}, {y, -100, 100}]
Plot3D[-x +
  e^(-0.3333333333333333` ((0.40060067582662473`-1.1577299553257219` i) Log[(-0.6230083252929541`-0.6437531515674265` i)+
   c2, {x, -100, 100}, {y, -100, 100}]
Plot3D[-x +
  e^(-0.3333333333333333` ((0.40060067582662473`-1.1577299553257219` i) Log[(-0.6230083252929541`-0.6437531515674265` i)+
   c3, {x, -100, 100}, {y, -100, 100}]
```







Ejercicio 2

El isótopo radioactivo del Torio 234 se desintegra a una rapidéz proporcional a la cantidad existente en ese
instánte de tiempo. Si máx {100α, 100β, 100γ} miligramos de este material se reducen a mín {80α, 80β, 80γ}
miligramos en un semana, ¿Cuánto Torio se tendrá a al cabo de 3 semanas? ¿Cuánto tiempo tiene que trans-
currir para que la cantidad de Torio se reduzca a la mitad?

Solución :

Analizando el problema detectamos las siguientes ecuaciones

$\frac{dT}{dt}$ = -k T(t) (edo de variable separable)

T(0)=máx {100α, 100β, 100γ}

T(t=1 semana) = mín {80α, 80β, 80γ}

```
T[0] := Max[100 α, 100 β, 100 γ]
```

```
T[1] := Min[80 α, 80 β, 80 γ]
```

H[t] = T[t] , de otro modo no funcionaba

```
H[t_] := T[0] ⅇ^(-t k)
```

```
k := Last[
  Refine[Log[T[0] / T[0] ⅇ^(-d)] == Log[T[1] / T[0]], Assumptions → d > 0] // FullSimplify]
```

a. ¿Cuánto Torio se tendrá a al cabo de 3 semanas?

```
H[3] // N
```

```
66.8735
```

R: 66.8735 miligramos

b. ¿Cuánto tiempo tiene que transcurrir para que la cantidad de Torio se reduzca a la mitad?

```
Solve[T[0]/2 == H[t], t]
```

$$\left\{\left\{t \to \frac{-\text{Log}\left[\frac{7}{2}\right] + \text{Log}[7]}{-2\,\text{Log}[4] + \text{Log}[5] + \text{Log}[7]}\right\}\right\} \text{ // N}$$

```
{{t → 0.885518}}
```

R: Debe transcurrir 0.88 semanas, que son 6 días y 4 horas app.

Ejercicio 3

Calcule la solucion general de la siguiente ecuación diferencial:

$$y^{(6)}+ \alpha y^{(4)}+ 3\,y^{(3)}- \beta y^{(2)}+ 2\,y^{(1)}- 5y = x^{\frac{\gamma}{2}+1}\mathrm{Ln}[x]$$

para x ∈ $\mathbb{R}^+$.

Solución:

Detectamos al mirar la edo que es una de orden superior no homogenea, por lo que para resolverla debemos
buscar la solución homogenea (mediante polinomio asociado) y luego aplicar variación de parámetros, puesto que no existe anulador para la parte
no homogénea

```
D[Y[x], {x, 6}] + α D[Y[x], {x, 4}] + 3 D[Y[x], {x, 3}] -
  β D[Y[x], {x, 2}] + 2 D[Y[x], {x, 1}] - 5 y[x] == x^(γ/2) Log[x]
```

```
-5 y[x] + 2 Y′[x] - 4 Y″[x] + 3 Y^(3)[x] + 4 Y^(4)[x] + Y^(6)[x] == x^(7/2) Log[x]
```

```
L[l_] := -5 + 2 l - 4 l^2 + 3 l^3 + 4 l^4 + l^6
```

```
Solve[-5 + 2 l - 4 l^2 + 3 l^3 + 4 l^4 + l^6 == 0, l] // N
```

```
{{l → -1.42068}, {l → 0.956845}, {l → -0.0168415 - 0.872517 i},
 {l → -0.0168415 + 0.872517 i}, {l → 0.248761 - 2.18354 i}, {l → 0.248761 + 2.18354 i}}
```

```
(* Con una horrible aproximación el polinomio que se exive abajo*)
```

```
(l + 1.42) (l - 0.95) (l + 0.016 + 0.87 i)
 (l + 0.016 - 0.87 i) (l - 0.24 + 2.18 i) (l - 0.24 - 2.18 i)
```

Que nos da una solución homogenea como le sigue:

```
In[1]:= Yh := d1 e^(-1.42 x) + d2 e^(0.95 x) + d3 Sin[0.87 x] e^(-0.016 x) +
  d4 Cos[0.87 x] e^(-0.016 x) + d5 Sin[2.18 x] e^(0.24 x) + d6 Cos[2.18 x] e^(0.24 x)
```

Haciendo variación de parámetros para aobtener la particular. Esto implica calcular el wronskiano y luego las constantes del sistema

In[2]:= W := Det[

$$\begin{pmatrix} e^{-1.42\,x} & e^{0.95\,x} & \text{Sin}[0.87\,x]\,e^{-0.016\,x} & \text{Cos}[0.87\,x]\,e^{\text{-}} \\ D\left[e^{-1.42\,x}, x\right] & D\left[e^{0.95\,x}, x\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, x\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0} \right. \\ D\left[e^{-1.42\,x}, \{x, 2\}\right] & D\left[e^{0.95\,x}, \{x, 2\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 2\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.01} \right. \\ D\left[e^{-1.42\,x}, \{x, 3\}\right] & D\left[e^{0.95\,x}, \{x, 3\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 3\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.01} \right. \\ D\left[e^{-1.42\,x}, \{x, 4\}\right] & D\left[e^{0.95\,x}, \{x, 4\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 4\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.01} \right. \\ D\left[e^{-1.42\,x}, \{x, 5\}\right] & D\left[e^{0.95\,x}, \{x, 5\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 5\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.01} \right. \end{pmatrix}$$

]

In[3]:= g1 := $\int \frac{1}{W}$ Det[

$$\begin{pmatrix} 0 & e^{0.95\,x} & \text{Sin}[0.87\,x]\,e^{-0.016\,x} & \text{Cos}[0.87\,x]\,e^{-0.016} \\ 0 & D\left[e^{0.95\,x}, x\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, x\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.016} \right. \\ 0 & D\left[e^{0.95\,x}, \{x, 2\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 2\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.016\,x}, \right. \\ 0 & D\left[e^{0.95\,x}, \{x, 3\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 3\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.016\,x}, \right. \\ 0 & D\left[e^{0.95\,x}, \{x, 4\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 4\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.016\,x}, \right. \\ x^{7/2}\,\text{Log}[x] & D\left[e^{0.95\,x}, \{x, 5\}\right] & D\left[\text{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 5\}\right] & D\left[\text{Cos}[0.87\,x]\,e^{-0.016\,x}, \right. \end{pmatrix}$$

] dx

In[4]:=
$$g2 := \int \frac{1}{W} \mathrm{Det}\Big[\begin{pmatrix} e^{-1.42\,x} & 0 & \mathrm{Sin}[0.87\,x]\,e^{-0.016\,x} & \mathrm{Cos}[0.87\,x]\,e^{-0.0} \\ D[e^{-1.42\,x}, x] & 0 & D[\mathrm{Sin}[0.87\,x]\,e^{-0.016\,x}, x] & D[\mathrm{Cos}[0.87\,x]\,e^{-0.01} \\ D[e^{-1.42\,x}, \{x, 2\}] & 0 & D[\mathrm{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 2\}] & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \\ D[e^{-1.42\,x}, \{x, 3\}] & 0 & D[\mathrm{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 3\}] & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \\ D[e^{-1.42\,x}, \{x, 4\}] & 0 & D[\mathrm{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 4\}] & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \\ D[e^{-1.42\,x}, \{x, 5\}] & x^{7/2}\,\mathrm{Log}[x] & D[\mathrm{Sin}[0.87\,x]\,e^{-0.016\,x}, \{x, 5\}] & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \end{pmatrix}\Big] dx$$

In[5]:=
$$g3 := \int \frac{1}{W} \mathrm{Det}\Big[\begin{pmatrix} e^{-1.42\,x} & e^{0.95\,x} & 0 & \mathrm{Cos}[0.87\,x]\,e^{-0.016\,x} & \\ D[e^{-1.42\,x}, x] & D[e^{0.95\,x}, x] & 0 & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, x] & D[\\ D[e^{-1.42\,x}, \{x, 2\}] & D[e^{0.95\,x}, \{x, 2\}] & 0 & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \{x, 2\}] & D[\mathrm{Si} \\ D[e^{-1.42\,x}, \{x, 3\}] & D[e^{0.95\,x}, \{x, 3\}] & 0 & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \{x, 3\}] & D[\mathrm{Si} \\ D[e^{-1.42\,x}, \{x, 4\}] & D[e^{0.95\,x}, \{x, 4\}] & 0 & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \{x, 4\}] & D[\mathrm{Si} \\ D[e^{-1.42\,x}, \{x, 5\}] & D[e^{0.95\,x}, \{x, 5\}] & x^{7/2}\,\mathrm{Log}[x] & D[\mathrm{Cos}[0.87\,x]\,e^{-0.016\,x}, \{x, 5\}] & D[\mathrm{Si} \end{pmatrix}\Big] dx$$

In[6]:=

$$g4 := \int \frac{1}{W} \mathrm{Det}\Bigg[\begin{pmatrix} e^{-1.42\,x} & e^{0.95\,x} & \mathrm{Sin}[0.87\,x]\, e^{-0.016\,x} & 0 & \\ D[e^{-1.42\,x}, x] & D[e^{0.95\,x}, x] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, x] & 0 & D\vert \\ D[e^{-1.42\,x}, \{x, 2\}] & D[e^{0.95\,x}, \{x, 2\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 2\}] & 0 & D[\mathrm{Si} \\ D[e^{-1.42\,x}, \{x, 3\}] & D[e^{0.95\,x}, \{x, 3\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 3\}] & 0 & D[\mathrm{Si} \\ D[e^{-1.42\,x}, \{x, 4\}] & D[e^{0.95\,x}, \{x, 4\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 4\}] & 0 & D[\mathrm{Si} \\ D[e^{-1.42\,x}, \{x, 5\}] & D[e^{0.95\,x}, \{x, 5\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 5\}] & x^{7/2}\,\mathrm{Log}[x] & D[\mathrm{Si} \end{pmatrix}\Bigg]\, dx$$

In[7]:=

$$g5 := \int \frac{1}{W} \mathrm{Det}\Bigg[\begin{pmatrix} e^{-1.42\,x} & e^{0.95\,x} & \mathrm{Sin}[0.87\,x]\, e^{-0.016\,x} & \mathrm{Cos}[0.87\,x] \\ D[e^{-1.42\,x}, x] & D[e^{0.95\,x}, x] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, x] & D[\mathrm{Cos}[0.87\,x] \\ D[e^{-1.42\,x}, \{x, 2\}] & D[e^{0.95\,x}, \{x, 2\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 2\}] & D[\mathrm{Cos}[0.87\,x]\, e^{-0} \\ D[e^{-1.42\,x}, \{x, 3\}] & D[e^{0.95\,x}, \{x, 3\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 3\}] & D[\mathrm{Cos}[0.87\,x]\, e^{-0} \\ D[e^{-1.42\,x}, \{x, 4\}] & D[e^{0.95\,x}, \{x, 4\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 4\}] & D[\mathrm{Cos}[0.87\,x]\, e^{-0} \\ D[e^{-1.42\,x}, \{x, 5\}] & D[e^{0.95\,x}, \{x, 5\}] & D[\mathrm{Sin}[0.87\,x]\, e^{-0.016\,x}, \{x, 5\}] & D[\mathrm{Cos}[0.87\,x]\, e^{-0} \end{pmatrix}\Bigg]\, dx$$

In[8]:= $$g6 := \int \frac{1}{W} \mathrm{Det}\left[\begin{pmatrix} e^{-1.42x} & e^{0.95x} & \mathrm{Sin}[0.87x]\, e^{-0.016x} & \mathrm{Cos}[0.87x] \\ D[e^{-1.42x}, x] & D[e^{0.95x}, x] & D[\mathrm{Sin}[0.87x]\, e^{-0.016x}, x] & D[\mathrm{Cos}[0.87x] \\ D[e^{-1.42x}, \{x, 2\}] & D[e^{0.95x}, \{x, 2\}] & D[\mathrm{Sin}[0.87x]\, e^{-0.016x}, \{x, 2\}] & D[\mathrm{Cos}[0.87x]\, e^{-0} \\ D[e^{-1.42x}, \{x, 3\}] & D[e^{0.95x}, \{x, 3\}] & D[\mathrm{Sin}[0.87x]\, e^{-0.016x}, \{x, 3\}] & D[\mathrm{Cos}[0.87x]\, e^{-0} \\ D[e^{-1.42x}, \{x, 4\}] & D[e^{0.95x}, \{x, 4\}] & D[\mathrm{Sin}[0.87x]\, e^{-0.016x}, \{x, 4\}] & D[\mathrm{Cos}[0.87x]\, e^{-0} \\ D[e^{-1.42x}, \{x, 5\}] & D[e^{0.95x}, \{x, 5\}] & D[\mathrm{Sin}[0.87x]\, e^{-0.016x}, \{x, 5\}] & D[\mathrm{Cos}[0.87x]\, e^{-0} \end{pmatrix}\right] dx$$

g1 // N

$$-0.0205999 \left(-0.0493827\, x^{9/2}\, \mathrm{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, 1.42\, x] + \mathrm{Log}[x] \left(2.40075\, \mathrm{Erfi}\left[1.19164 \sqrt{x}\right] + \sqrt{x} \left(-3.22809 + 3.05593\, x - 1.73577\, x^2 + 0.704225\, x^3\right) (\mathrm{Cosh}[1.42\, x] + \mathrm{Sinh}[1.42\, x])\right)\right)$$

g2 // N

$$0.0474957\, (\mathrm{Cosh}[0.95\, x] - 1.\, \mathrm{Sinh}[0.95\, x]) \left(-0.0493827\, x^{9/2}\, \mathrm{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, -0.95\, x] (\mathrm{Cosh}[0.95\, x] + \mathrm{Sinh}[0.95\, x]) + \mathrm{Log}[x] \left(\sqrt{x} \left(-16.1141 - 10.2056\, x - 3.87812\, x^2 - 1.05263\, x^3\right) + 14.6517\, \mathrm{Erf}\left[0.974679 \sqrt{x}\right] (\mathrm{Cosh}[0.95\, x] + \mathrm{Sinh}[0.95\, x])\right)\right)$$

g3 // N

$$-0.0474957\, (\mathrm{Cosh}[0.95\, x] - 1.\, \mathrm{Sinh}[0.95\, x]) \left(-0.0493827\, x^{9/2}\, \mathrm{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, -0.95\, x] (\mathrm{Cosh}[0.95\, x] + \mathrm{Sinh}[0.95\, x]) + \mathrm{Log}[x] \left(\sqrt{x} \left(-16.1141 - 10.2056\, x - 3.87812\, x^2 - 1.05263\, x^3\right) + 14.6517\, \mathrm{Erf}\left[0.974679 \sqrt{x}\right] (\mathrm{Cosh}[0.95\, x] + \mathrm{Sinh}[0.95\, x])\right)\right)$$

g4 // N

$$\frac{1}{\sqrt{x}} 2.71828^{(0.-0.87 i) x} \Big((0.000917871 - 0.00310233 i)\, 2.71828^{(0.+0.87 i) x} x^5 \text{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, (0.016 - 0.87 i) x] + (0.000917871 + 0.00310233 i)\, 2.71828^{(0.+0.87 i) x} x^5 \text{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, (0.016 + 0.87 i) x] + \Big(2.71828^{0.016 x} x \big((0.318688 - 1.46566 i) + (0.846682 + 0.200473 i) x - (0.0751832 - 0.293362 i) x^2 - (0.0725778 + 0.0200295 i) x^3 + 2.71828^{(0.+1.74 i) x} \big((0.318688 + 1.46566 i) + (0.846682 - 0.200473 i) x - (0.0751832 + 0.293362 i) x^2 - (0.0725778 - 0.0200295 i) x^3\big)\big) - (1.49846 + 0.297074 i)\, 2.71828^{(0.+0.87 i) x} \sqrt{(0.016 - 0.87 i) x}\; \text{Erfi}\Big[\sqrt{(0.016 - 0.87 i) x}\Big] - (1.49846 - 0.297074 i)\, 2.71828^{(0.+0.87 i) x} \sqrt{(0.016 + 0.87 i) x}\; \text{Erfi}\Big[\sqrt{(0.016 + 0.87 i) x}\Big]\Big) \text{Log}[x]\Big)$$

g5 // N

$$\frac{1}{\sqrt{x}} 2.71828^{(-0.24-2.18 i) x} \Big((-0.000361042 - 0.000253778 i)\, 2.71828^{(0.24+2.18 i) x} x^5 \text{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, (-0.24 - 2.18 i) x] - (0.000361042 - 0.000253778 i)\, 2.71828^{(0.24+2.18 i) x} x^5 \text{HypergeometricPFQ}[\{4.5, 4.5\}, \{5.5, 5.5\}, (-0.24 + 2.18 i) x] + \Big(x \big((-0.00251692 - 0.00440074 i) + (0.00599304 - 0.00436204 i) x + (0.00437903 + 0.00480718 i) x^2 - (0.00269391 - 0.00305714 i) x^3 + 2.71828^{(0.+4.36 i) x} \big((-0.00251692 + 0.00440074 i) + (0.00599304 + 0.00436204 i) x + (0.00437903 - 0.00480718 i) x^2 - (0.00269391 + 0.00305714 i) x^3\big)\big) - (0.00187889 - 0.000816341 i)\, 2.71828^{(0.24+2.18 i) x} \sqrt{(-0.24 - 2.18 i) x}\; \text{Erfi}\Big[\sqrt{(-0.24 - 2.18 i) x}\Big] - (0.00187889 + 0.000816341 i)\, 2.71828^{(0.24+2.18 i) x} \sqrt{(-0.24 + 2.18 i) x}\; \text{Erfi}\Big[\sqrt{(-0.24 + 2.18 i) x}\Big]\Big) \text{Log}[x]\Big)$$

In[9]:= **Yp :=**

$g1\, e^{-1.42 x} + g2\, e^{0.95 x} + g3 \,\text{Sin}[0.87 x]\, e^{-0.016 x} + g4 \,\text{Cos}[0.87 x]\, e^{-0.016 x} + g5 \,\text{Sin}[2.18 x]\, e^{0.24}$

In[10]:= **J[x_] = Yh + Yp**