

```

In[22]:= cof := {{1, b1}, {a2, b2}, {a3, b3}, {a4, b4}, {a5, 0}}
v := {v1, v2, v3, v4, v5}
v1 := 0
v2 := 0.2
v3 := -0.15
v4 := 0.05
v5 := -0.3
eng := 0.1
densityFunction[f_] := f f*

pot[x_] := Piecewise[
  {{v1, x < 0}, {v2, 0 < x < 10}, {v3, 10 < x < 60}, {v4, 60 < x < 70}, {v5, 70 < x}}]

expform[zone_, x_] := Part[Part[cof, zone], 1] Exp[I k[zone] x] +
  Part[Part[cof, zone], 2] Exp[-I k[zone] x]
(*decform[zone_, x_] := Part[Part[cof, zone], 1] Exp[k[zone] x] +
  Part[Part[cof, zone], 2] Exp[-k[zone] x] *)

k[zone_] := Sqrt[(eng - Part[v, zone]) / 3.81]

result := Solve[{expform[1, 0] == expform[2, 0], expform[2, 10] == expform[3, 10],
  expform[3, 60] == expform[4, 60], expform[4, 70] == expform[5, 70],
  (D[expform[1, x], x] /. x -> 0) == (D[expform[2, x], x] /. x -> 0),
  (D[expform[2, x], x] /. x -> 10) == (D[expform[3, x], x] /. x -> 10),
  (D[expform[3, x], x] /. x -> 60) == (D[expform[4, x], x] /. x -> 60),
  (D[expform[4, x], x] /. x -> 70) == (D[expform[5, x], x] /. x -> 70)},
  {a2, a3, a4, a5, b1, b2, b3, b4}]

In[35]:= result
Out[35]= {{a2 -> 1.01189 - 0.936254 I, a3 -> -0.339944 - 0.0299639 I,
  a4 -> 0.314394 - 0.27522 I, a5 -> -0.206734 - 0.0700589 I, b1 -> 0.0756405 - 0.948148 I,
  b2 -> 0.0637464 - 0.0118942 I, b3 -> -0.139257 + 0.191827 I, b4 -> 0.184647 - 0.0756858 I}}

In[36]:= pot[x_] := Piecewise[
  {{v1, x < 0}, {v2, 0 < x < 10}, {v3, 10 < x < 60}, {v4, 60 < x < 70}, {v5, 70 < x}}]

In[37]:= phi[x_] :=
  Piecewise[{{expform[1, x], x < 0}, {expform[2, x], 0 < x < 10}, {expform[3, x],
    10 < x < 60}, {expform[4, x], 60 < x < 70}, {expform[5, x], 70 < x}}] /. result[[1]]

```

In[38]:= **phi[x]**

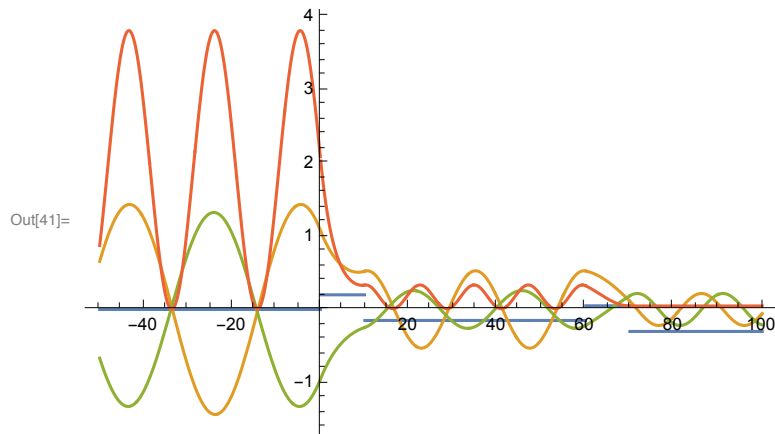
Out[38]:=

$$\begin{cases} (0.0756405 - 0.948148 i) e^{(0. - 0.162008 i) x} + e^{(0. + 0.162008 i) x} & x < 0 \\ (1.01189 - 0.936254 i) e^{(-0.162008 + 0. i) x} + (0.0637464 - 0.0118942 i) e^{(0.162008 + 0. i) x} & 0 < x < 10 \\ (-0.139257 + 0.191827 i) e^{(0. - 0.256158 i) x} - (0.339944 + 0.0299639 i) e^{(0. + 0.256158 i) x} & 10 < x < 60 \\ (0.184647 - 0.0756858 i) e^{(0. - 0.114557 i) x} + (0.314394 - 0.27522 i) e^{(0. + 0.114557 i) x} & 60 < x < 70 \\ (-0.206734 - 0.0700589 i) e^{(0. + 0.324017 i) x} & 70 < x \\ 0 & \text{True} \end{cases}$$

In[39]:= **phi[x_] :=**

$$\begin{cases} (0.07564053115514274 - 0.9481477822861708 i) e^{(0. - 0.1620083922520836 i) x} + e^{(0. + 0.1620083922520836 i) x} & x < 0 \\ (1.011894156720657 - 0.9362536255655141 i) e^{(-0.1620083922520836 + 0. i) x} + (0.06374637443448593 - 0.011894156720656872 i) e^{(0.1620083922520836 + 0. i) x} & 0 < x < 10 \\ (-0.13925669700842763 + 0.19182729306103152 i) e^{(0. - 0.25615775978927996 i) x} - (0.33994367720730584 + 0.029963930414182494 i) e^{(0. + 0.25615775978927996 i) x} & 10 < x < 60 \\ (0.18464696336405292 - 0.07568578303468572 i) e^{(0. - 0.11455723277057846 i) x} + (0.3143935292274079 - 0.27521996508185753 i) e^{(0. + 0.11455723277057846 i) x} & 60 < x < 70 \\ (-0.20673386895736978 - 0.07005893177967341 i) e^{(0. + 0.3240167845041672 i) x} & 70 < x \\ 0 & \text{True} \end{cases}$$

In[41]:= **Plot[{pot[x], Re[phi[x]], Im[phi[x]], densityFunction[phi[x]]}, {x, -50, 100}, PlotRange -> Full]**



In[52]:= **phi[100]**

Out[52]= $-0.0557587 - 0.211041 i$

```
In[53]:= Plot[{pot[x] 15, Re[phi[x]], Im[phi[x]], densityFunction[phi[x]]},  
             {x, -50, 100}, PlotRange -> Full]
```

