```mathematica
In[67]:= (*constants*)
ACC = 10 000;
HWCap = 2.4*10^-3;(*nF*)
BIOCap = 0.24; (*nF*)
vShift = 1200;
vAlpha = 10;

In[72]:= (*invers calibration*)
invEl[V_] := 0.9804 * V + 8.4118;
invVthr[V_] := 1.002*V + 3.5571;
invIglPLUS[x_] := (-0.24 + Sqrt[0.0576 - 2.208*10^-4*(0.89 - x)]) / (1.104 * 10^-4) ;
invIglMINUS[x_] := (-0.24 - Sqrt[0.0576 - 2.206*10^-4*(0.89 - x)]) / (1.164 * 10^-4) ;
invIpl[x_] := 40/x + 0.016;
invIgladaptPLUS[x_] := (-0.26 + Sqrt[0.0676 + 1.972*10^-4*(0.66 + x)]) / (9.86 * 10^-5) ;
invIgladaptMINUS[x_] := (-0.26 - Sqrt[0.0676 + 1.972*10^-4*(0.66 + x)]) / (9.86 * 10^-5) ;
invIradaptPLUS[x_] :=
   (0.00032 + Sqrt[1.024*10^-7 - 1.76*10^-5 * (0.0005 + 1/x)])/(8.8*10^-6);
invIradaptMINUS[x_] := (0.00032 - Sqrt[1.024*10^-7 - 1.76*10^-5 * (0.0005 + 1/x)])/
   (8.8*10^-6);
invIfirePLUS[x_] := (45 + Sqrt[2025 + 0.56*(54.75 - x)])/0.28;
invIfireMINUS[x_] := (45 - Sqrt[2025 + 0.56*(54.75 - x)])/0.28;
invIrexpPLUS[x_] := (-66.3847 + Sqrt[4406.9265 + 36.9544 * (x + 94.2541)])/18.4772;
invIrexpMINUS[x_] := (-66.3847 - Sqrt[4406.9265 + 36.9544 * (x + 94.2541)])/18.4772;
invVexp[V_] := 2.6882*V - 269.597;
invVsyntcPLUS[x_] := (37 + Sqrt[1369 - 15.76*(x - 1382)])/7.88;
invVsyntcMINUS[x_] := (37 - Sqrt[1369 - 15.76*(x - 1382)])/7.88;

In[88]:= (*invers scaling*)
rescaleV[V_] := (V - vShift)/vAlpha;
rescaleCurrent[x_] := x * BIOCap / ( ACC * vAlpha * HWCap);
rescaleDeltaT[x_] := x /10;
rescaleConductance[x_] := x*BIOCap / (ACC * HWCap);
rescaleTau[x_] := x * ACC / 1000;

In[93]:= (*invers transformations*)
invtransEl[V_] := rescaleV[invEl[V]];
invtransVthr[V_] := rescaleV[invVthr[V]];
invtransIglPLUS[x_] := rescaleConductance[invIglPLUS[x]];
invtransIglMINUS[x_] := rescaleConductance[invIglMINUS[x]];
invtransIpl[x_] := rescaleTau[invIpl[x]];
invtransIgladaptPLUS[x_] := rescaleConductance[invIgladaptPLUS[x]];
invtransIgladaptMINUS[x_] := rescaleConductance[invIgladaptMINUS[x]];
invtransIradaptPLUS[x_] := rescaleTau[invIradaptPLUS[x]];
invtransIradaptMINUS[x_] := rescaleTau[invIradaptMINUS[x]];
invtransIfirePLUS[x_] := rescaleCurrent[invIfirePLUS[x]];
invtransIfireMINUS[x_] := rescaleCurrent[invIfireMINUS[x]];
invtransIrexpPLUS[x_] := rescaleDeltaT[invIrexpPLUS[x]];
invtransIrexpMINUS[x_] := rescaleDeltaT[invIrexpMINUS[x]];
invtransVexp[V_] := rescaleV[invVexp[V]];
invtransVsyntcPLUS[x_] := rescaleTau[invVsyntcPLUS[x]];
invtransVsyntcMINUS[x_] := rescaleTau[invVsyntcMINUS[x]];
```
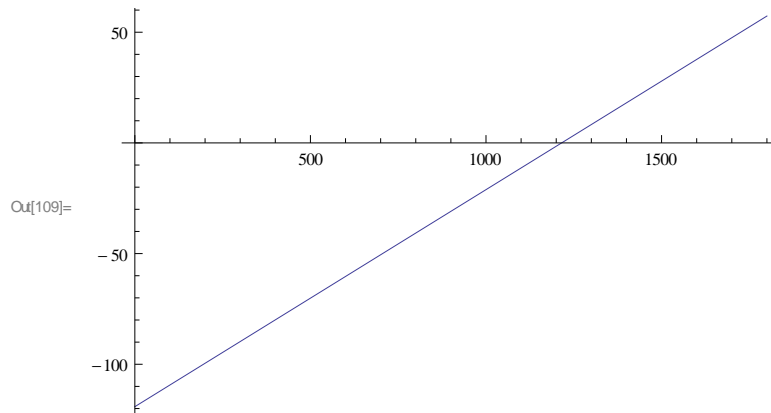
In[109]:= `(*Plots*)`
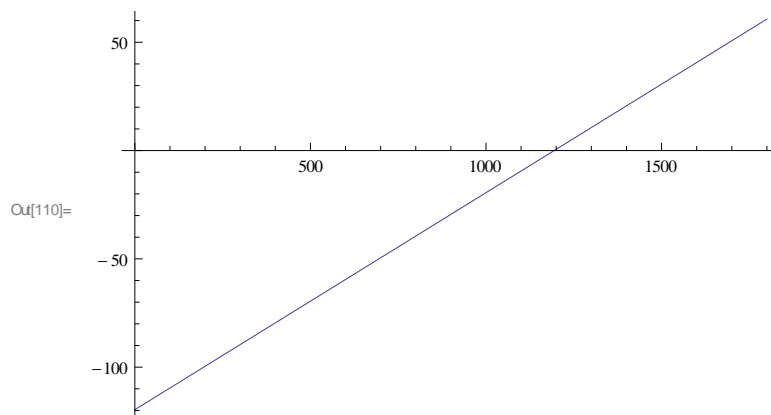`(*LIF dynamics*)`
`Plot[invtransEl[V],{V,0,1800}]`

Out[109]=

In[110]:= `Plot[invtransVthr[V],{V,0,1800}]`

Out[110]=
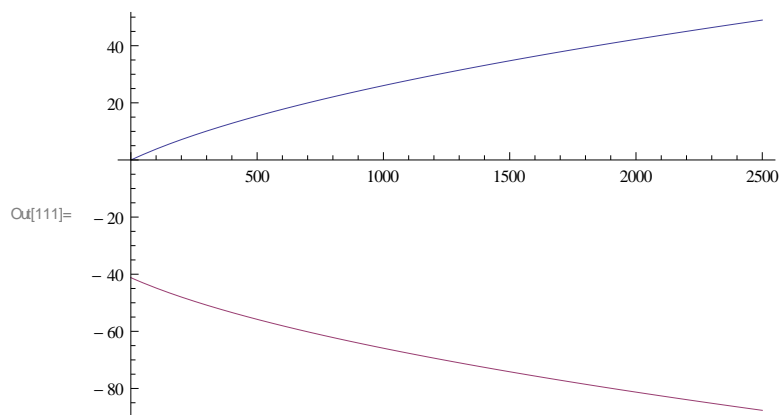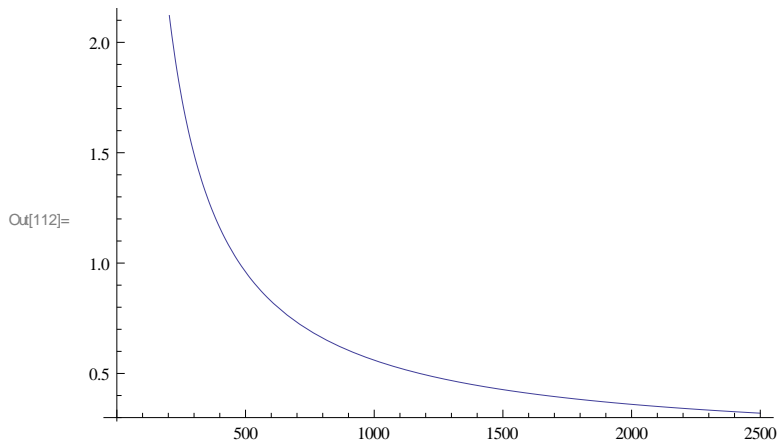

In[111]:= `Plot[{invtransIglPLUS[x],invtransIglMINUS[x]},{x,0,2500}] (*PLUS is the physical solution*)`

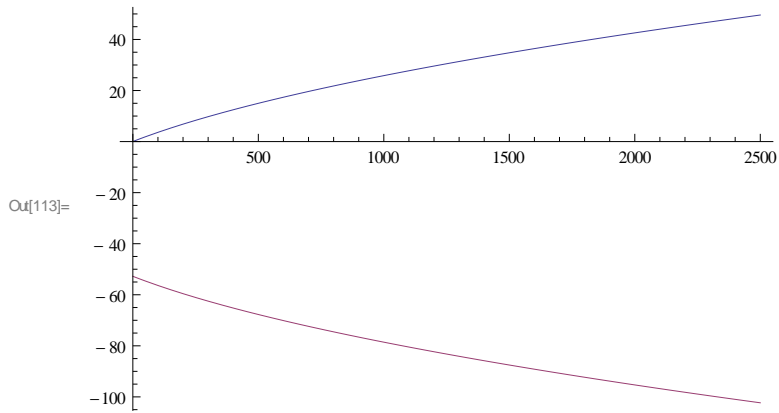Out[111]=

In[112]:= **Plot[invtransIpl[x], {x, 0, 2500}]**
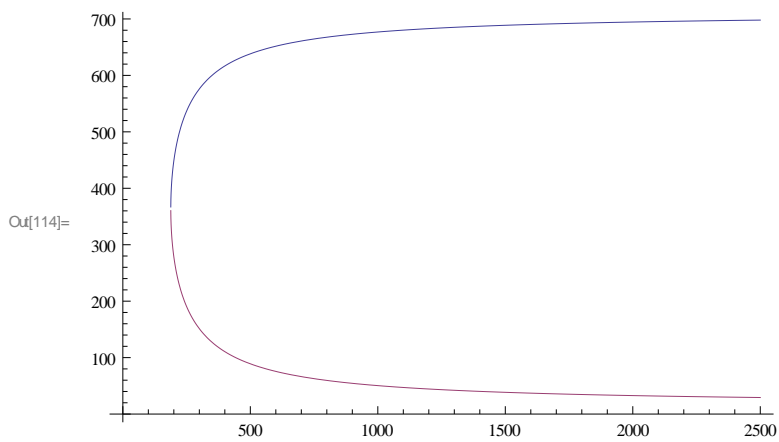
Out[112]=

In[113]:= **(*Adaptation term*)**
Plot[{invtransIgladaptPLUS[x], invtransIgladaptMINUS[x]}, {x, 0, 2500}]
(*PLUS is the physical solution*)

Out[113]=
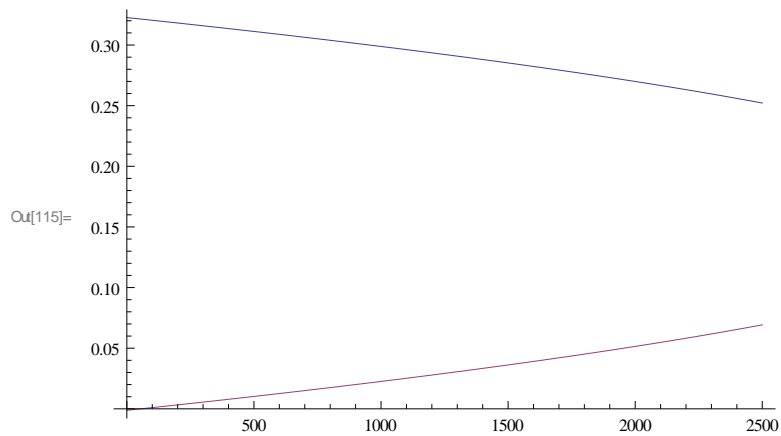
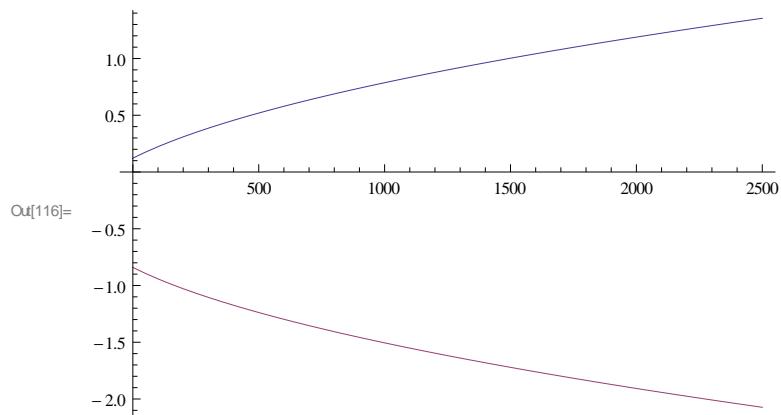In[114]:= **Plot[{invtransIradaptPLUS[x], invtransIradaptMINUS[x]}, {x, 0, 2500}]**
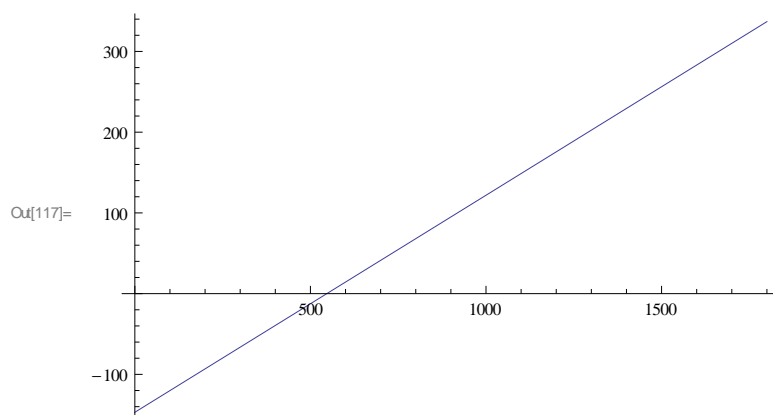**(*MINUS is the physical solution*)**

Out[114]=

In[115]:= **Plot[{invtransIfirePLUS[x], invtransIfireMINUS[x]}, {x, 0, 2500}]**
(* MINUS is the physical solution*)

Out[115]=

In[116]:= **(*Exponential term*)**
Plot[{invtransIrexpPLUS[x], invtransIrexpMINUS[x]}, {x, 0, 2500}]
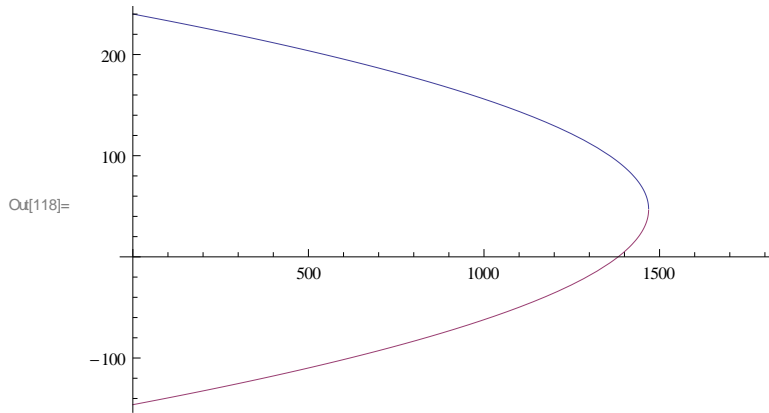**(*PLUS is the physical solution*)**

Out[116]=

In[117]:= **Plot[invtransVexp[V], {V, 0, 1800}] (*passt*)**

Out[117]=

In[118]:= `(*synaptic Input*)`
`Plot[{invtransVsyntcPLUS[x],invtransVsyntcMINUS[x]} , {x,0,1800}]`
 `(*MINUS is the physical solution*)`

Out[118]=

In[119]:= `(*data for test*)`
`dacmvolt[x_] := x * 1800/1023;`
`daccurr[x_] := x * 2500 / 1023;`

In[121]:= `invtransEl[dacmvolt[511]]`

Out[121]= `-31.0091`

In[122]:= `invtransIglPLUS[daccurr[511]]`

Out[122]= `30.5414`

In[123]:= `BIOCap / 30.5414 * 1000`

Out[123]= `7.85819`

In[124]:= `invtransIgladaptPLUS[daccurr[511]]`

Out[124]= `30.4612`

In[125]:= `invtransIradaptMINUS[daccurr[511]]`

Out[125]= `43.2176`

In[126]:= `invtransIrexpPLUS[daccurr[511]]`

Out[126]= `0.898815`

In[127]:= `invtransIfireMINUS[daccurr[511]]`

Out[127]= `0.0291836`

In[128]:= `invtransVsyntcMINUS[dacmvolt[800]]`

Out[128]= `7.52924`

In[129]:= `invtransVexp[dacmvolt[511]]`

Out[129]= `94.7418`

In[130]:= `invtransIpl[daccurr[511]]`

Out[130]= `0.480313`

In[131]:= `invtransVthr[dacmvolt[511]]`

Out[131]= `-29.5524`

In[132]:=

In[133]:=