4.4.10
Brannon and Boyce (baby 3rd ed.)

solution

In[1]:=
```
lambda = -2;
omega = 2 Sqrt[31];
```

In[3]:=
```
y[t_] = -(1 / (4 omega)) E^(lambda t) Sin[omega t]
```

Out[3]= $-\frac{e^{-2 t} \operatorname{Sin}\left[2 \sqrt{31}\, t\right]}{8 \sqrt{31}}$

In[7]:=
```
Simplify[y''[t] + 128 y[t] + 4 y'[t]]
```

Out[7]= 0

In[8]:=
```
y[0]
y'[0]
```

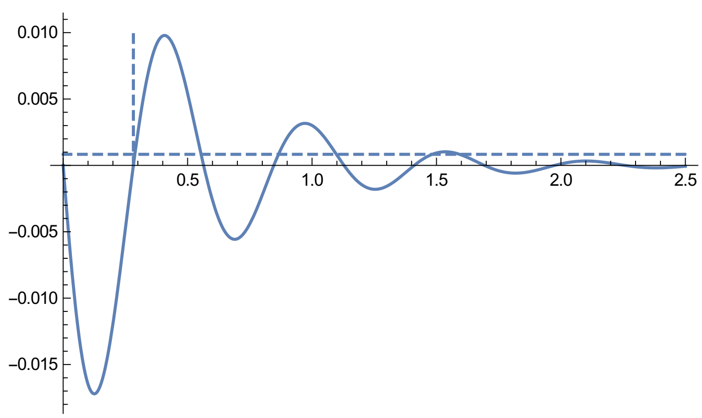
Out[8]= 0

Out[9]= $-\frac{1}{4}$

first pass through equilibrium

In[20]:=
```
basicplot = Show[Plot[y[t], {t, 0, 2.5}, PlotRange → All],
  ParametricPlot[{Pi / omega, t}, {t, 0, 0.01}, PlotStyle -> Dashed],
  Plot[0.01 / 12, {t, 0, 2.5}, PlotStyle → Dashed], PlotRange → All]
```

Out[20]=



small amplitude

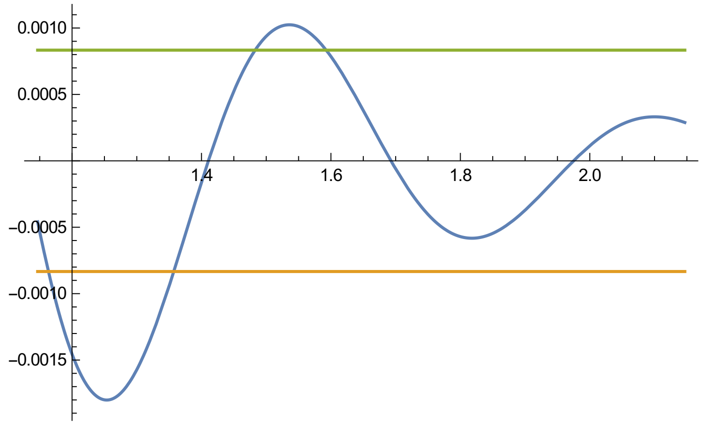
In[17]:=
```
rought = Log[150 / Sqrt[31]] / 2
N[rought]
```

Out[17]= $\frac{1}{2}\,\mathrm{Log}\left[\frac{150}{\sqrt{31}}\right]$

Out[18]= 1.64682

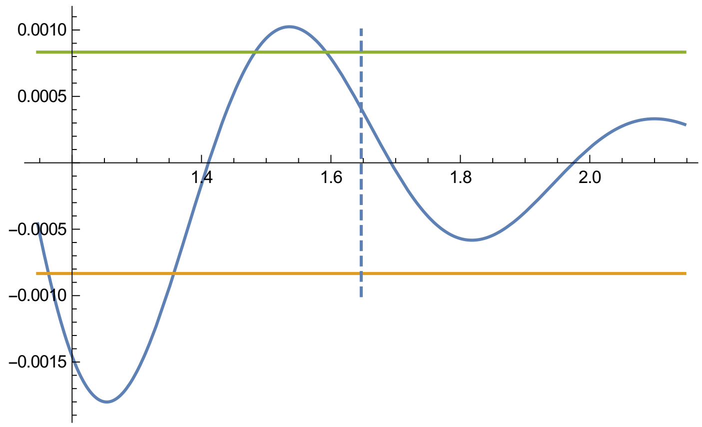
In[21]:=
```
farplot = Plot[{y[t], -0.01 / 12, 0.01 / 12}, {t, rought - 0.5, rought + 0.5}]
```

Out[21]=



In[23]:=
```
Show[farplot, ParametricPlot[{rought, t}, {t, -0.001, 0.001}, PlotStyle -> Dashed]]
```

Out[23]=



In[26]:=
```
exactt = FindRoot[y[tfind] == 0.01 / 12, {tfind, 1.62}][[1, 2]]
```

Out[26]= 1.59271

In[27]:=
```
Show[farplot, ParametricPlot[{exactt, t}, {t, -0.001, 0.001}, PlotStyle -> Dashed]]
```

Out[27]=