Schwingungsdauer in eindimensionalem Potential (m=1)

In[1]:=
```
V[x_] = x^2 Exp[-x];
```

In[2]:=
```
Solve[V'[x] == 0, x]
```

Out[2]=
$$\{\{x \to 0\}, \{x \to 2\}\}$$

```
Series[V[x], {x, 0, 3}]
```

$$x^2 - x^3 + O[x]^4$$

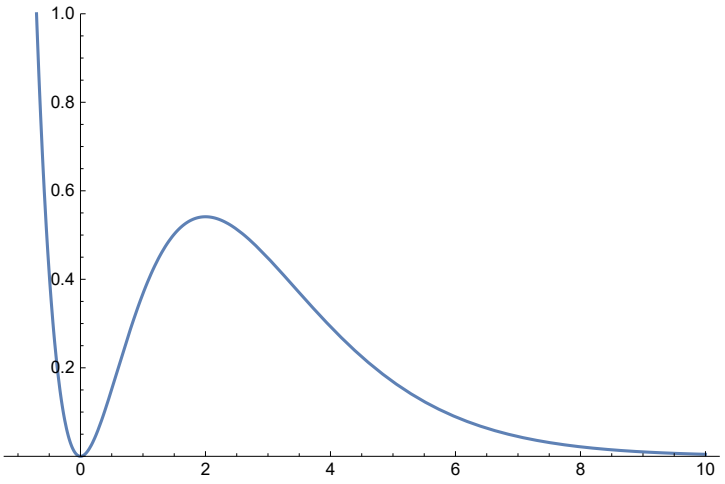
```
Series[V[x], {x, 2, 2}]
```

$$\frac{4}{e^2} - \frac{(x-2)^2}{e^2} + O[x-2]^3$$

In[8]:=
```
m = 1; d = 2; c = -1; Em = V[2]; α = 2/E^2;
```

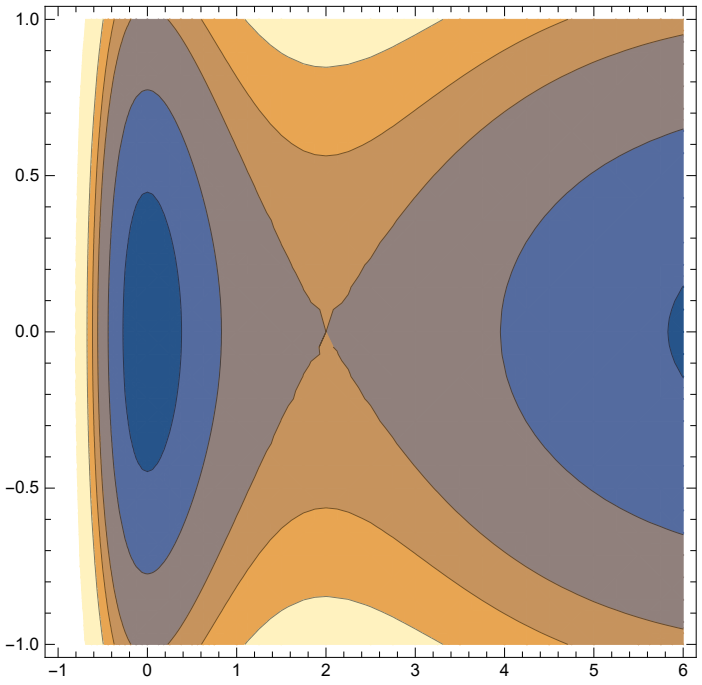
In[3]:=
```
Plot[V[x], {x, -1, 10}, PlotRange → {0, 1}]
```

Out[3]=



In[17]:=
```
ContourPlot[V[x] + p^2 / 2, {x, -1, 6}, {p, -1, 1}, Contours → {.1, .3, V[2], .7, .9}]
```

Out[17]=



In[6]:=
```
xuR[e_] := x /. FindRoot[V[x] == e, {x, 1}]
xuL[e_] := x /. FindRoot[V[x] == e, {x, -1}]
```

In[10]:=
$$T1[e\_] := \text{NIntegrate}\left[\frac{1}{\sqrt{\frac{2}{m}(e - V[x])}}, \{x, 0, xuR[e]\}\right]$$

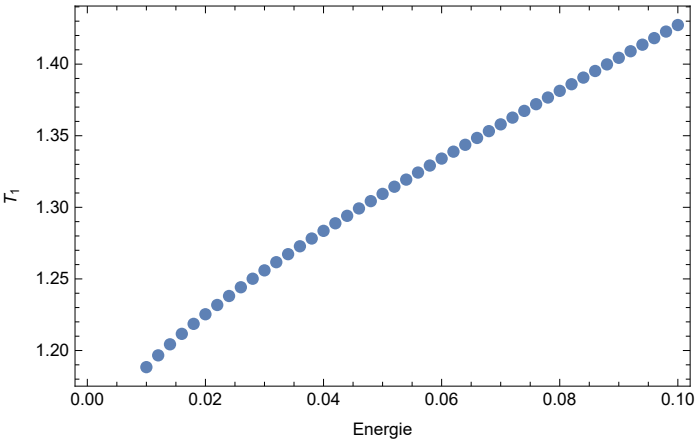
$$T2[e\_] := \text{NIntegrate}\left[\frac{1}{\sqrt{\frac{2}{m}(e - V[x])}}, \{x, xuL[e], 0\}\right]$$

$$\text{Integrate}\left[\frac{\left(1 - \text{Sin}[p]^3\right)}{1 - \text{Sin}[p]^2}, \{p, 0, \text{Pi}/2\}\right]$$

2

In[13]:=
```
Show[ListPlot[Table[{e, Re[T1[e]]}, {e, 0.01, .1, .002}], PlotStyle → PointSize[.02]],
 Frame → True, FrameLabel → {Energie, T1}]
```

Out[13]=

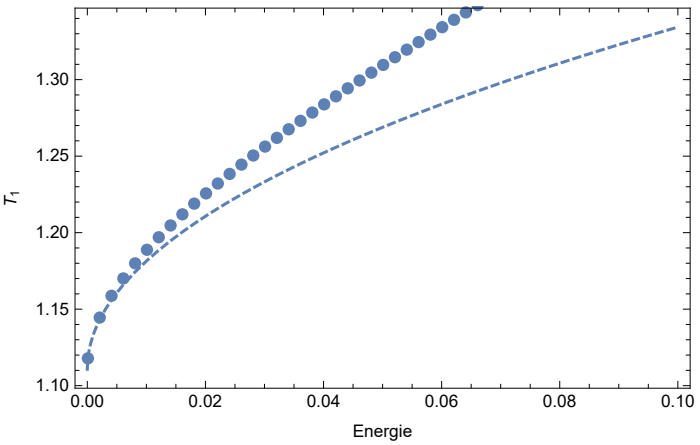


In[15]:=
```
√(m/d) (Pi/2.)
```

Out[15]=
```
1.11072
```

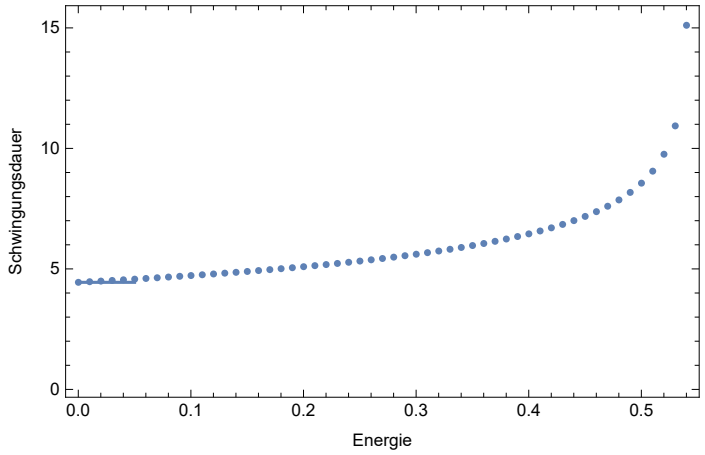
In[12]:=
```
Show[Plot[√(m/d) (Pi/2) (1 - 2/Pi √(2 e/d) 1/c), {e, 0, .1}, PlotStyle → Dashing[.01]],
 ListPlot[Table[{e, Re[T1[e]]}, {e, 0.0001, .1, .002}], PlotStyle → PointSize[.02]],
 Frame → True, FrameLabel → {Energie, T1}]
```

Out[12]=



In[16]:=
```
Show[ListPlot[Table[{e, 2 Re[T1[e] + T2[e]]}, {e, 0.0001, Em, .01}]],
 Plot[√(m/d) 2 Pi, {x, 0, .05}], Frame → True,
 FrameLabel → {Energie, Schwingungsdauer}, PlotRange → All]
```

Out[16]=




```
Show[ListPlot[Table[{e, 2 Re[T1[e] + T2[e]]}, {e, 0.0001, Em, .004}],
  PlotStyle → PointSize[.01], PlotRange → All],
 Plot[√(m/d) 2 Pi, {x, 0, .1}, PlotStyle → Red],
 Plot[3.4 + 2 × 1/2 √(m/α) Log[(Em)/(Em - E)], {E, .4, Em - .00001}, PlotStyle → Red, PlotRange → All],
 Frame → True, FrameLabel → {Energie, Schwingungsdauer}]
```