
Задача 1

Уравнение Шредингера для осциллятора имеет вид

$$-\frac{\psi''[x]}{2} + \frac{x^2}{2} \psi[x] = E \psi[x]$$

Найти 3 минимальных уровня энергии E_n ($n = 0, 1, 2$) и нарисовать соответствующие им волновые функции $\psi_n[x]$.

Решение

Уровни энергии положительны, $k > 0$.

```
In[8]:= x1 = 1;
```

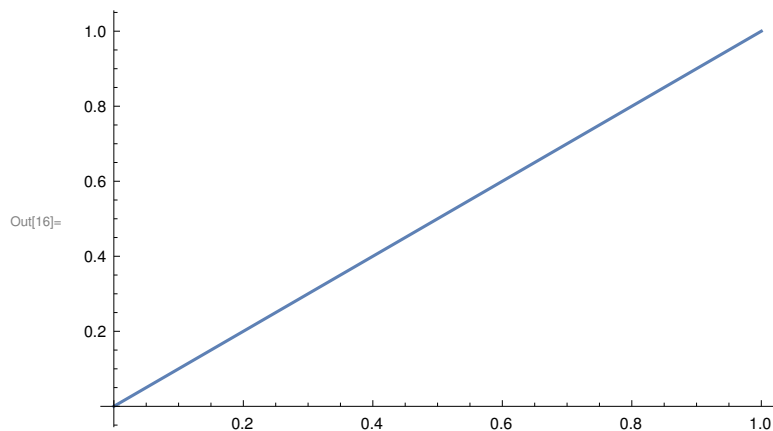
```
In[14]:= EE = 1.49;
```

```
solution = NDSolve[{y'[x] == -k * y[x], y[0] == 0, y'[0] == 1},  
  y, {x, 0, x1}][[1]];
```

```
Plot[y[x] /. solution, {x, 0, x1}]
```

```
*** NDSolve : The function value {1., -0.0000838121 k} is not a list of numbers with dimensions {2} at {x, y[x], y'[x]}  
= {0.0000838121, 0.0000838121, 1.}.
```

```
*** InterpolatingFunction : Input value {0.0000204286} lies outside the range of data in the interpolating function.  
Extrapolation will be used.
```



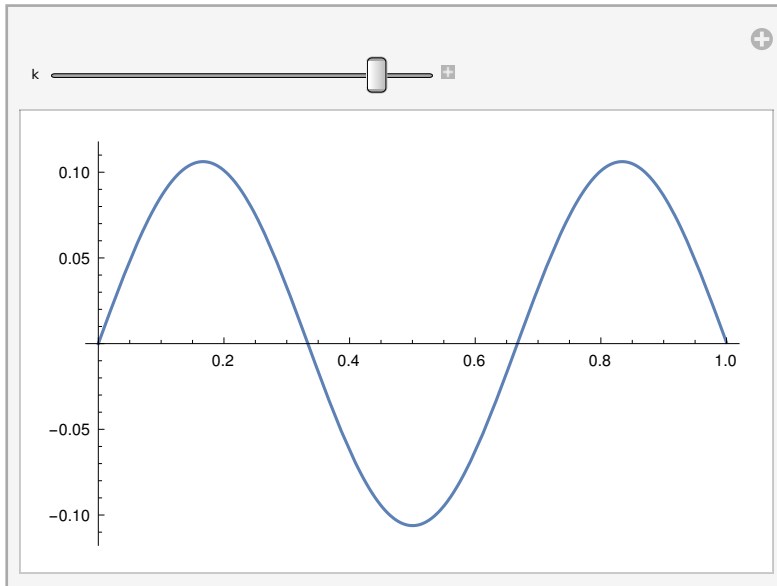
```
x1 = 1;
```

```

In[23]:= Manipulate[
  solution = NDSolve[{y'[x] == -k * y[x], y[0] == 0, y'[0] == 1},
    y, {x, 0, x1}][[1]];
  Plot[y[x] /. solution, {x, 0, x1}],
  {k, 0, 100}
]

```

Out[23]=

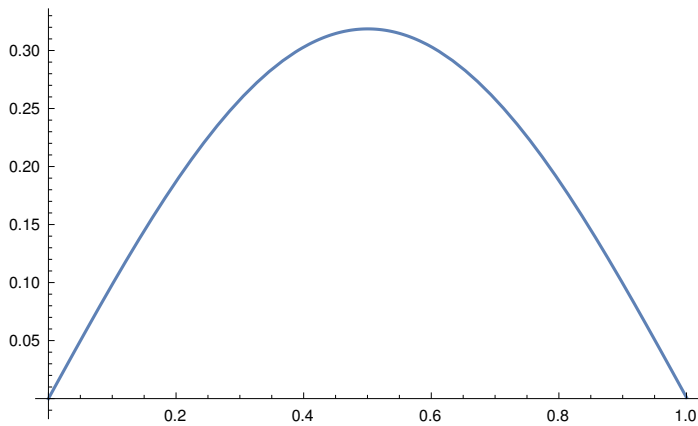


```

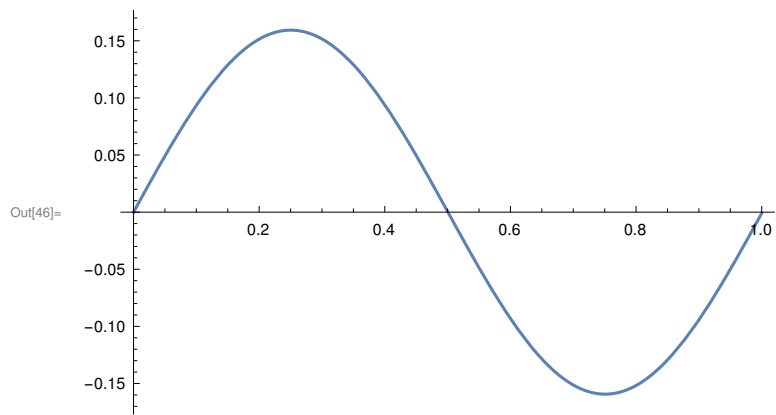
In[42]:= k = 9.85;
solution = NDSolve[{y'[x] == -k * y[x], y[0] == 0, y'[0] == 1},
  y, {x, 0, x1}][[1]];
Plot[y[x] /. solution, {x, 0, x1}]

```

Out[44]=



```
In[45]:= k = 33;  
Plot[y[x] /. solution, {x, 0, x1}]
```



```
In[47]:= k = 90;  
Plot[y[x] /. solution, {x, 0, x1}]
```

