```
> restart
> H := f -> - diff(f, x$2)
```
$$H := f \to -\left(\frac{\partial^2}{\partial x^2} f\right) \tag{1}$$
```
> eq := H(φ(x)) = k^2·φ(x)
```
$$eq := -\frac{d^2}{dx^2}\, \varphi(x) = k^2\, \varphi(x) \tag{2}$$
```
>
> dsolve((2))
```
$$\varphi(x) = \_C1 \sin(k\, x) + \_C2 \cos(k\, x) \tag{3}$$
```
> ics := φ(-L/2) = 0, φ(L/2) = 0
```
$$ics := \varphi\left(-\frac{L}{2}\right) = 0, \varphi\left(\frac{L}{2}\right) = 0 \tag{4}$$
```
> subs(ics, subs~([x = -L/2, x = L/2], (3)))
```
$$\left[0 = \_C1 \sin\left(-\frac{k\, L}{2}\right) + \_C2 \cos\left(-\frac{k\, L}{2}\right), 0 = \_C1 \sin\left(\frac{k\, L}{2}\right) + \_C2 \cos\left(\frac{k\, L}{2}\right)\right] \tag{5}$$
```
> zip~(`=`, indets((5), 'suffixed(_C, integer)'), [A, B])
```
$$[\_C1 = A, \_C2 = B] \tag{6}$$
```
> subs((6), (3))
```
$$\varphi(x) = A \sin(k\, x) + B \cos(k\, x) \tag{7}$$
```
> subs((6), (5))
```
$$\left[0 = -A \sin\left(\frac{k\, L}{2}\right) + B \cos\left(\frac{k\, L}{2}\right), 0 = A \sin\left(\frac{k\, L}{2}\right) + B \cos\left(\frac{k\, L}{2}\right)\right] \tag{8}$$
```
> # solve((8), {B, E, A})
> solve((8), {B, k, A}, allsolutions, explicit )
```
$$\left\{A = A, B = 0, k = \frac{2\, \pi\, \_Z1\sim}{L}\right\}, \{A = 0, B = 0, k = k\} \tag{9}$$
```
> simplify(solve((8), {A, B}, 'parametric' = 'full'))
```
$$\begin{cases} \begin{cases} [\{A = A, B = B\}] & \sin\left(\frac{k\, L}{2}\right) = 0 \\ [\{A = 0, B = B\}] & \text{otherwise} \end{cases} & \cos\left(\frac{k\, L}{2}\right) = 0 \\ [\{A = A, B = 0\}] & \sin\left(\frac{k\, L}{2}\right) = 0 \\ [\{A = 0, B = 0\}] & \cos\left(\frac{k\, L}{2}\right) \neq 0 \wedge \sin\left(\frac{k\, L}{2}\right) \neq 0 \end{cases} \tag{10}$$
```
> solve(op(1, ??), {k}, allsolutions)
```
$$\left\{k = \frac{\pi\, (1 + 2\, \_Z16\sim)}{L}\right\} \tag{11}$$

> $solve(op(3, \mathbf{??}), \{k\}, allsolutions)$

$$\left\{k = \frac{2\,\pi\,\_Z17\sim}{L}\right\} \tag{12}$$

the values of two formulas (8) can be obtained by two different methods,but the result (9) is different from (10).