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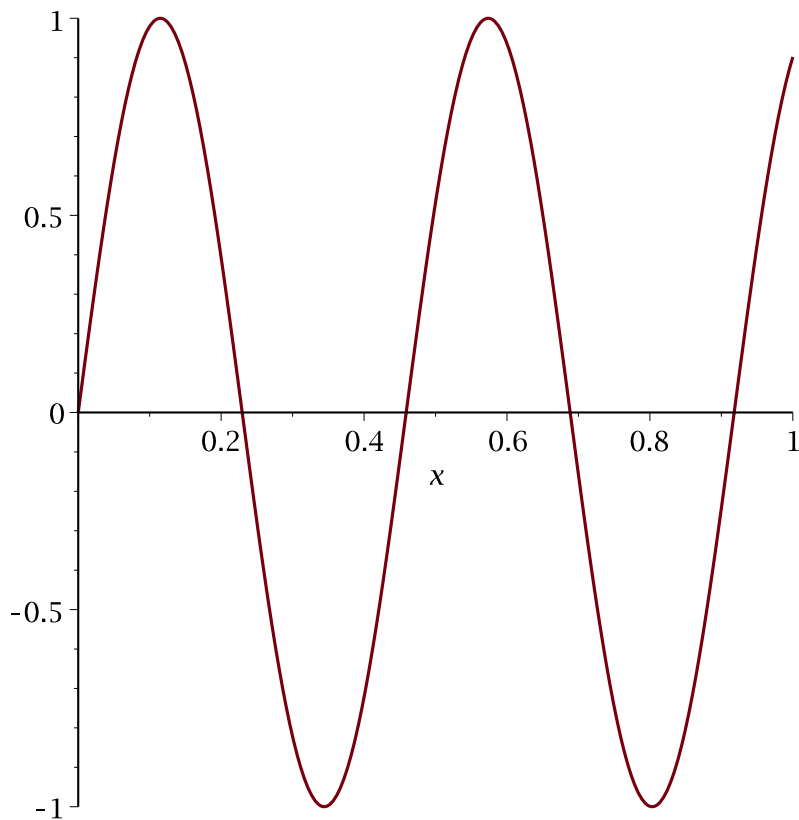
> with(plots):
>
#animate solutions of the wave equation  $u_{tt}=c^2u_{xx}$ , with one end (0)
fixed, the other free
# See the handout Sect04.4Handout3.pdf on the class website

> L:=1; c:=1; NumSol:=10; #NumSol is how many terms of the sum to
include (about 20 is OK)
                                L:= 1
                                c:= 1
                                NumSol:= 10
> f:=x->sin(2.3**Pi*x);          #Initial position
g:=x->0;                          #This is  $u_t(x,0)$  or initial velocity
                                f:= x→sin(2.3 $\pi$  x)
                                g:= x→0
> plot(f(x),x=0..L);

```

(1)

(2)



```

> a:=n->(2/L)*int(f(x)*sin((2*n-1)*Pi*x/(2*L)),x=0..L);

```

```
A:=[seq(evalf(a(n)),n=1..NumSol)];
```

$$a := n \rightarrow \frac{2 \left( \int_0^L f(x) \sin\left(\frac{1}{2} \frac{(2n-1)\pi x}{L}\right) dx \right)}{L}$$

```
A:= [-0.06402328052, 0.07167285128, -0.09417777626, 0.1780273555,
      0.9514550752, -0.1065394803, 0.05157724264, -0.03219820288,
      0.02252561418, -0.01683580699]
```

```
> b:=n->(4/((2*n-1)*Pi*c))*int(g(x)*sin((2*n-1)*Pi*x/(2*L)),x=0..L);
B:=[seq(evalf(b(n)),n=1..NumSol)];
```

$$b := n \rightarrow \frac{4 \left( \int_0^L g(x) \sin\left(\frac{1}{2} \frac{(2n-1)\pi x}{L}\right) dx \right)}{(2n-1)\pi c}$$

```
B:= [0., 0., 0., 0., 0., 0., 0., 0., 0.]
```

```
> U:=sum(A[n]*sin((2*n-1)*Pi*x/(2*L))*cos((2*n-1)*Pi*c*t/(2*L)),n=1..
      NumSol)+sum(B[n]*sin((2*n-1)*Pi*x/(2*L))*sin((2*n-1)*Pi*c*t/(2*L)),n=1..
      .NumSol);
```

```
U:= -0.06402328052 sin\left(\frac{1}{2} \pi x\right) cos\left(\frac{1}{2} \pi t\right)
      + 0.07167285128 sin\left(\frac{3}{2} \pi x\right) cos\left(\frac{3}{2} \pi t\right)
      - 0.09417777626 sin\left(\frac{5}{2} \pi x\right) cos\left(\frac{5}{2} \pi t\right)
      + 0.1780273555 sin\left(\frac{7}{2} \pi x\right) cos\left(\frac{7}{2} \pi t\right)
      + 0.9514550752 sin\left(\frac{9}{2} \pi x\right) cos\left(\frac{9}{2} \pi t\right)
      - 0.1065394803 sin\left(\frac{11}{2} \pi x\right) cos\left(\frac{11}{2} \pi t\right)
      + 0.05157724264 sin\left(\frac{13}{2} \pi x\right) cos\left(\frac{13}{2} \pi t\right)
      - 0.03219820288 sin\left(\frac{15}{2} \pi x\right) cos\left(\frac{15}{2} \pi t\right)
      + 0.02252561418 sin\left(\frac{17}{2} \pi x\right) cos\left(\frac{17}{2} \pi t\right)
      - 0.01683580699 sin\left(\frac{19}{2} \pi x\right) cos\left(\frac{19}{2} \pi t\right)
```

```
> #The animated solution!
animate(plot,[U,x=0..L],t=0..2,frames=100);
```

