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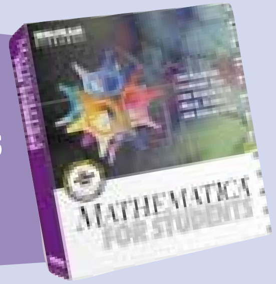

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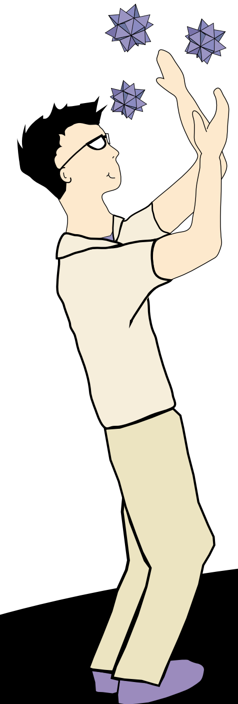

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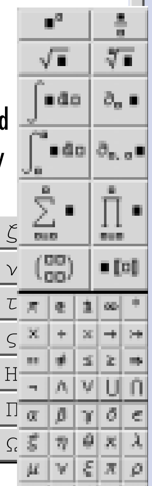

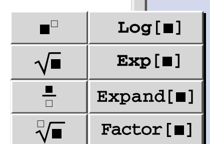

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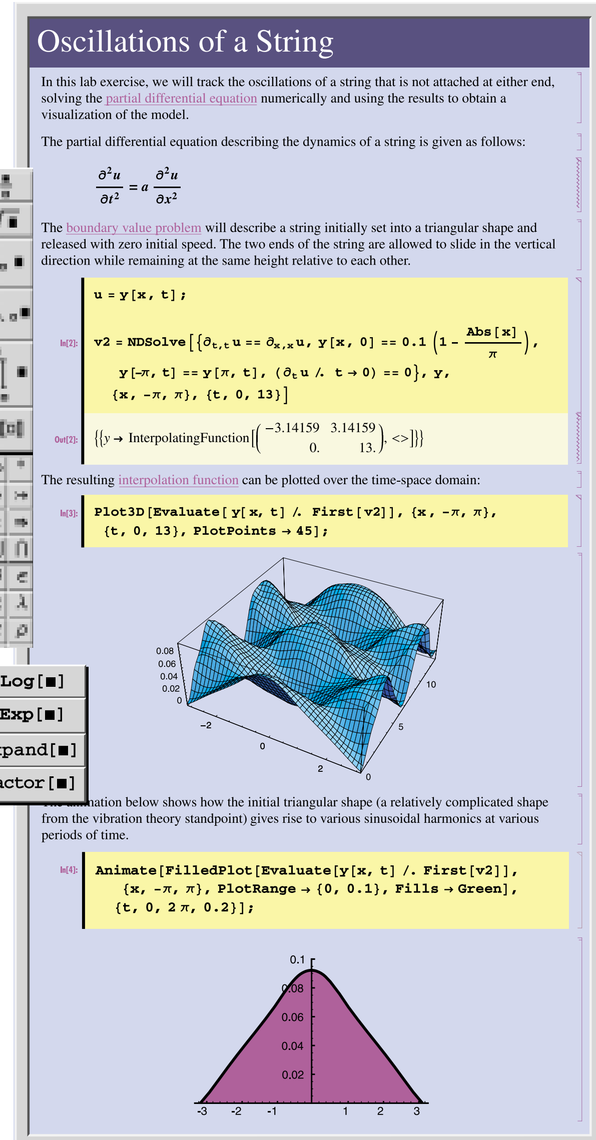


Oscillations of a String

In this lab exercise, we will track the oscillations of a string that is not attached at either end, solving the partial differential equation numerically and using the results to obtain a visualization of the model.

The partial differential equation describing the dynamics of a string is given as follows:

$$\frac{\partial^2 u}{\partial t^2} = a \frac{\partial^2 u}{\partial x^2}$$

The boundary value problem will describe a string initially set into a triangular shape and released with zero initial speed. The two ends of the string are allowed to slide in the vertical direction while remaining at the same height relative to each other.

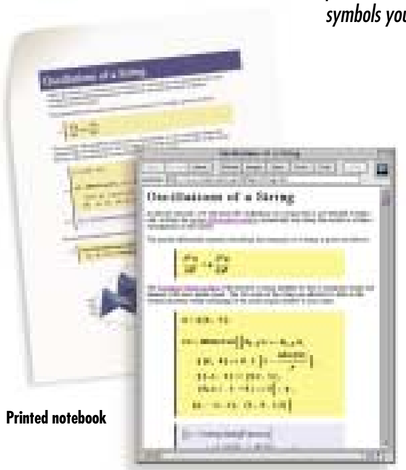
```
u = y[x, t];
In[2]:= v2 = NDSolve[{∂t,t u == ∂x,x u, y[x, 0] == 0.1 (1 - Abs[x]/π),
     y[-π, t] == y[π, t], (∂t u /. t → 0) == 0}, y,
   {x, -π, π}, {t, 0, 13}]
Out[2]= {{y → InterpolatingFunction[{{-3.14159, 3.14159}, {0., 13.}}, <>]}}
```

The resulting interpolation function can be plotted over the time-space domain:

```
In[3]:= Plot3D[Evaluate[y[x, t] /. First[v2]], {x, -π, π},
  {t, 0, 13}, PlotPoints → 45];
```

…nation below shows how the initial triangular shape (a relatively complicated shape from the vibration theory standpoint) gives rise to various sinusoidal harmonics at various periods of time.

```
In[4]:= Animate[FilledPlot[Evaluate[y[x, t] /. First[v2]],
    {x, -π, π}, PlotRange → {0, 0.1}, Fills → Green],
  {t, 0, 2 π, 0.2}];
```



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