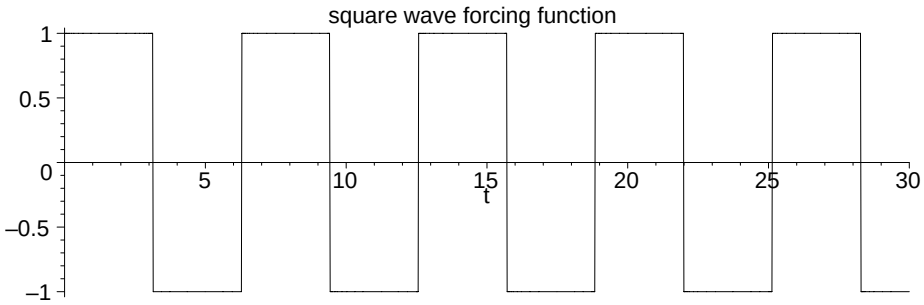
Math 2250-3
Monday December 1, 2003
Guess the resonance game

```
> with(plots):with(inttrans):
```

```
> f:=t->-1+2*sum((-1)^n*Heaviside(t-n*Pi),n=0..10);
```

$$f := t \to -1 + 2\left(\sum_{n=0}^{10} (-1)^n \,\text{Heaviside}(t - n\,\pi)\right)$$

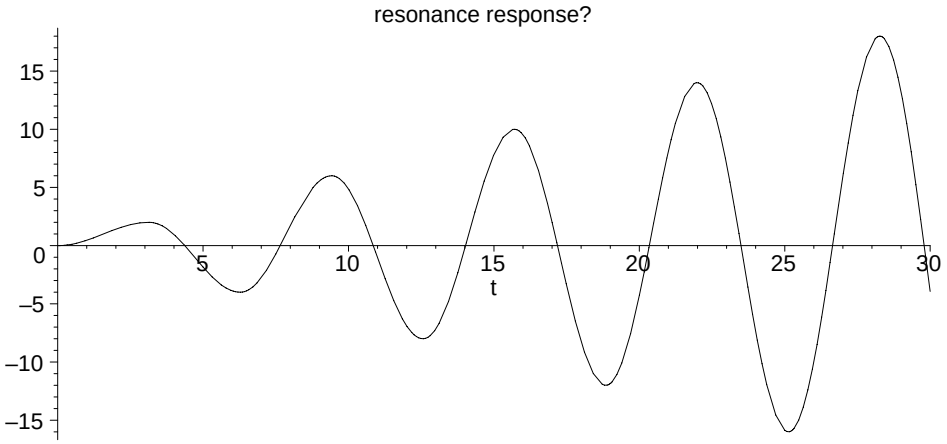
```
> plot(f(t),t=0..30,color=black,title='square wave forcing
  function');
```




```
> x:=t->int(sin(t-tau)*f(tau),tau=0..t);
```

$$x := t \to \int_0^t \sin(t - \tau)\, f(\tau)\, d\tau$$

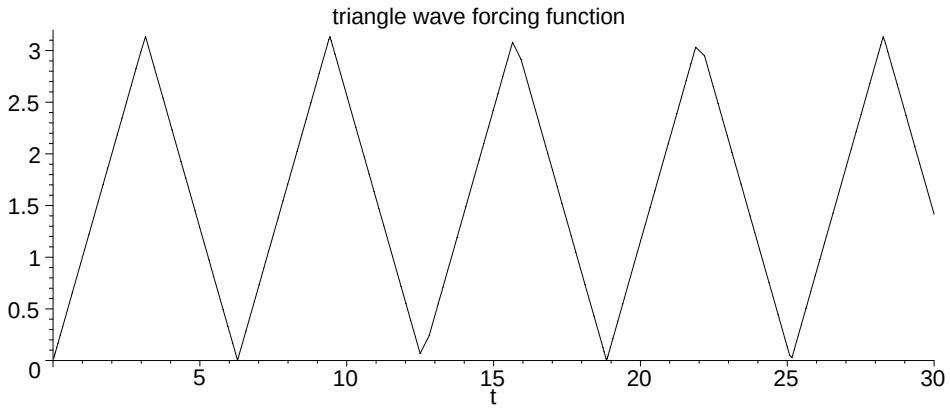
```
> plot(x(t),t=0..30,color=black,title='resonance response?');
```



```
> g:=t->int(f(u),u=0..t);
  #this should be a triangle wave...
```

$$g := t \to \int_0^t \mathrm{f}(u)\,du$$

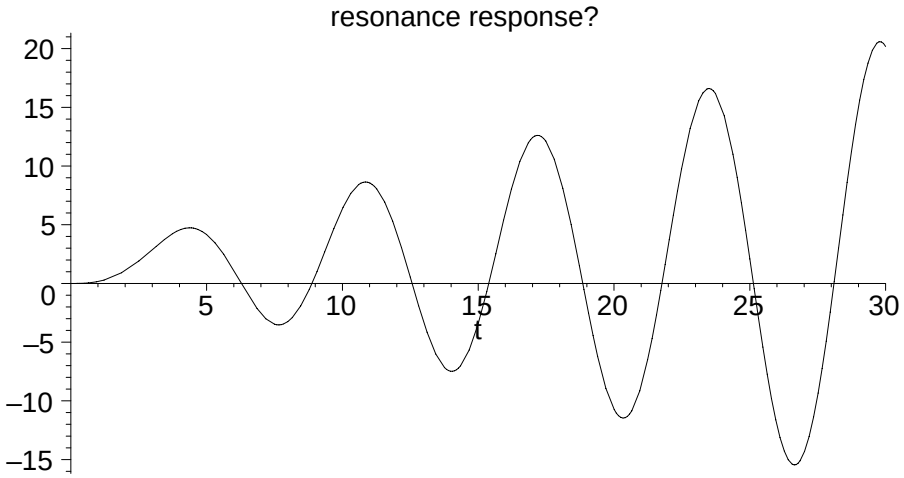
```
> plot(g(t),t=0..30,color=black, title='triangle wave forcing
  function');
```




```
> y:=t->int(sin(t-tau)*g(tau),tau=0..t);
```

$$y := t \to \int_0^t \sin(t-\tau)\,\mathrm{g}(\tau)\,d\tau$$

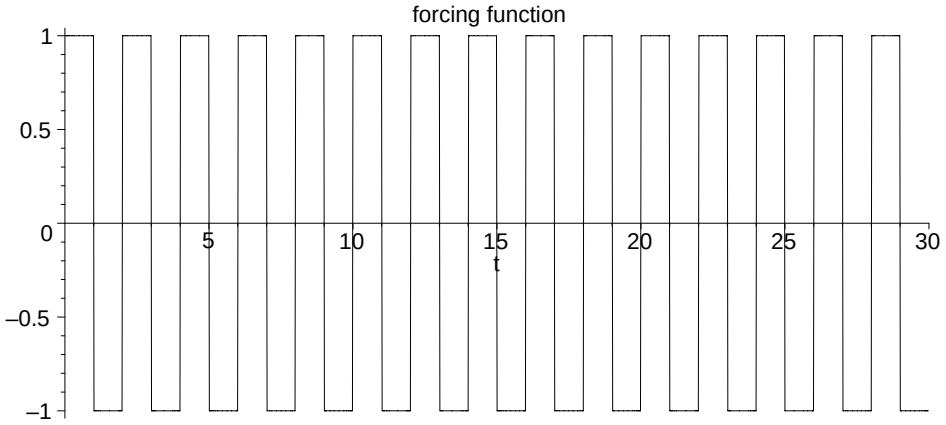
```
> plot(y(t),t=0..30,color=black, title='resonance response?');
```



```
> h:=t->-1+2*sum((-1)^n*Heaviside(t-n),n=0..30);
```

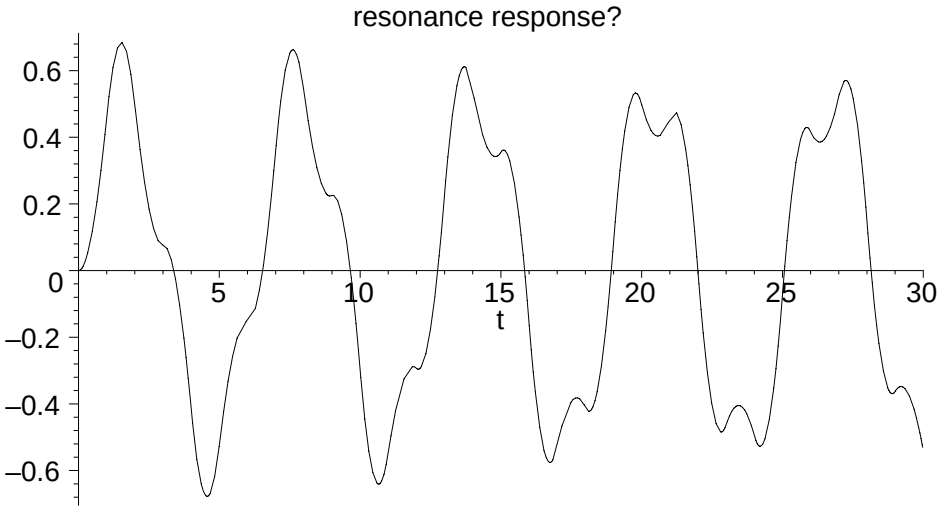
$$h := t \to -1 + 2\left(\sum_{n=0}^{30} (-1)^n \,\mathrm{Heaviside}(t-n)\right)$$

```
> plot(h(t),t=0..30,color=black, title='forcing function');
```




```
> z:=t->int(sin(t-tau)*h(tau),tau=0..t);
  plot(z(t),t=0..30,color=black,title='resonance response?');
```

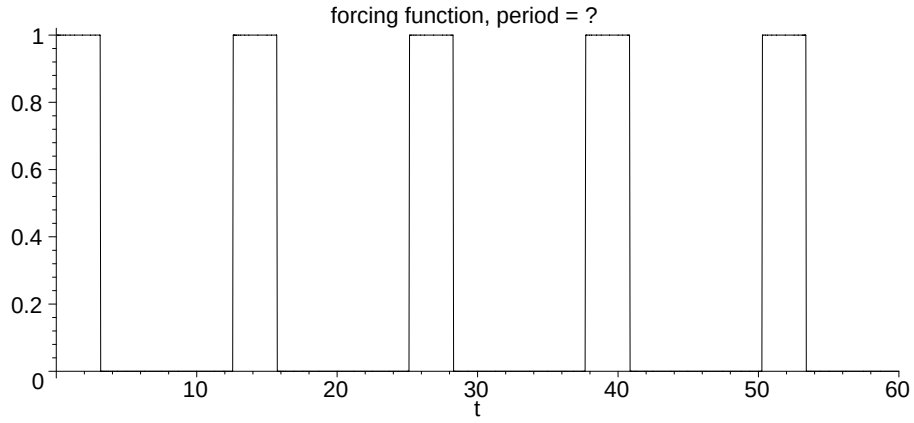
$$z := t \to \int_0^t \sin(t-\tau)\,\mathrm{h}(\tau)\,d\tau$$



```
> k:=t->sum(Heaviside(t-4*Pi*n)-Heaviside(t-4*Pi*n-Pi),
    n=0..5);
```

$$k := t \to \sum_{n=0}^{5} (\text{Heaviside}(t - 4\,n\,\pi) - \text{Heaviside}(t - 4\,n\,\pi - \pi))$$

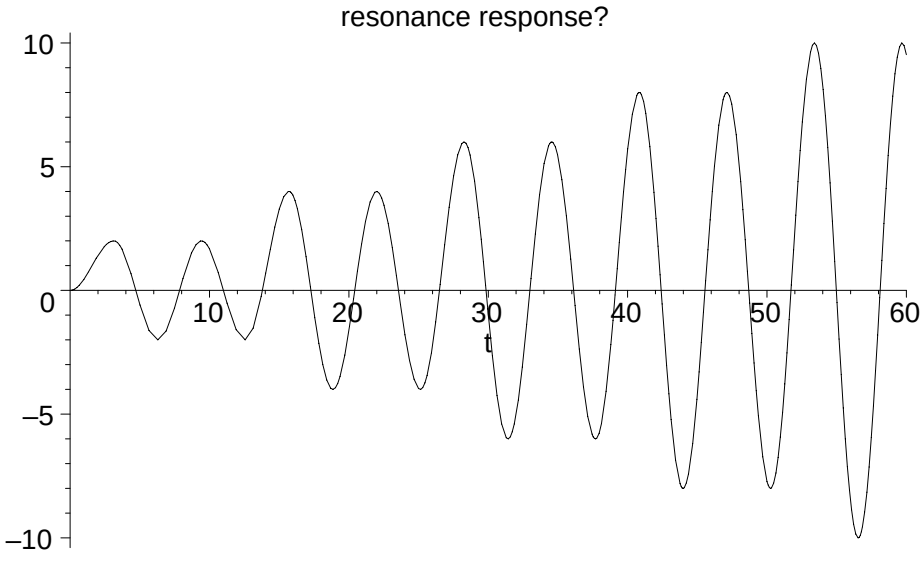
```
> plot(k(t),t=0..60,color=black,title='forcing function, period =
  ?');
>
```




```
> w:=t->int(sin(t-tau)*k(tau),tau=0..t);
```

$$w := t \to \int_0^t \sin(t - \tau)\,\mathrm{k}(\tau)\,d\tau$$

```
> plot(w(t),t=0..60,color=black,title='resonance response?');
```



Hey, what happened?