CSC 260, Spring 1999 - Solution to assignment 3

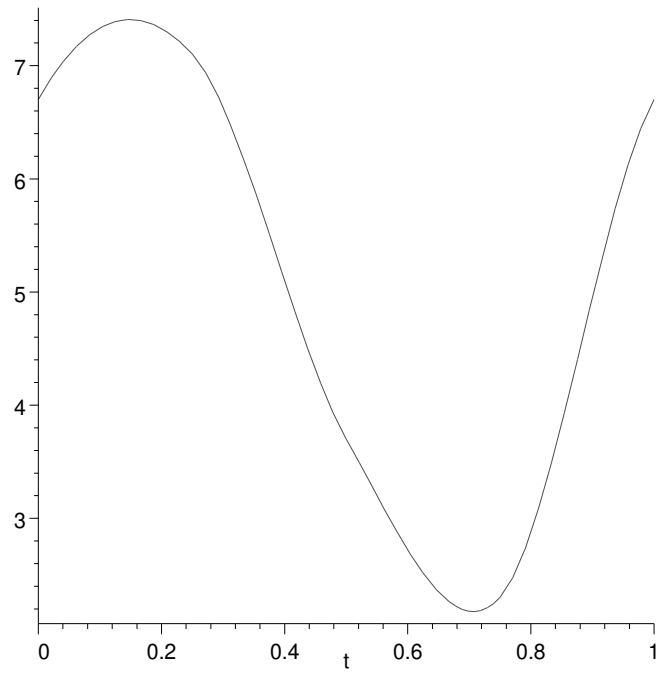
```
> read `/u/radford/bisection.mp`;
> read `/u/radford/intrect.mp`;
> read `/u/radford/circspline.mp`;
> Digits := 5:
```

QUESTION 1:

```
> use:=circspline([7.1,3.7,2.3,6.7],t);
```

$$use := \begin{cases} 6.7000 + 9.6000\,t - 33.600\,t^2 + 6.4000\,t^3 & t \le \frac{1}{4} \\ .90000 + 67.200\,t - 216.\,t^2 + 185.60\,t^3 & t \le \frac{1}{2} \\ -10.300 + 96.\,t - 196.80\,t^2 + 121.60\,t^3 & t \le \frac{3}{4} \\ 200.30 - 710.40\,t + 830.40\,t^2 - 313.60\,t^3 & t \le 1 \end{cases}$$

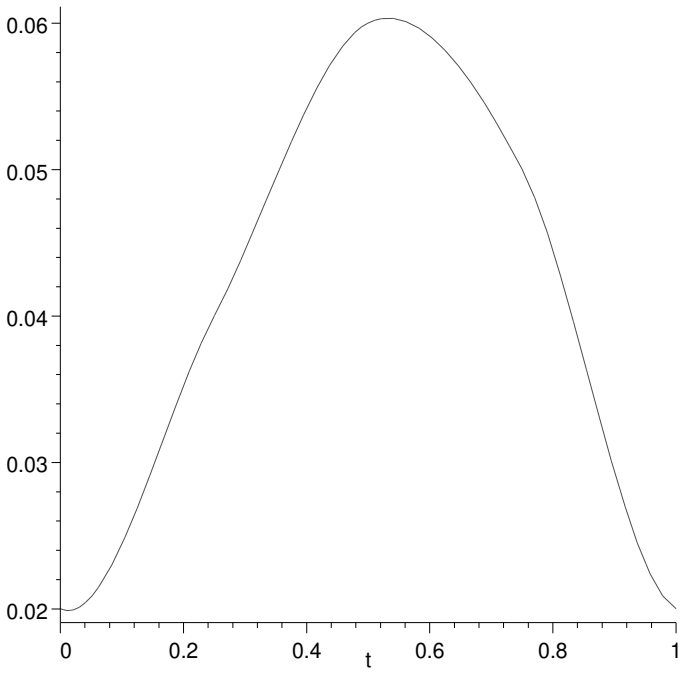
```
> plot(use,t=0..1);
```




```
> sun:=circspline([0.04,0.06,0.05,0.02],t);
```

$$sun := \begin{cases} .020000 - .020000\,t + .80000\,t^2 - 1.6000\,t^3 & t \le \frac{1}{4} \\ .050000 - .22000\,t + .96000\,t^2 - .96000\,t^3 & t \le \frac{1}{2} \\ -.070000 + .58000\,t - .80000\,t^2 + .32000\,t^3 & t \le \frac{3}{4} \\ -1.2400 + 4.7800\,t - 5.7600\,t^2 + 2.2400\,t^3 & t \le 1 \end{cases}$$

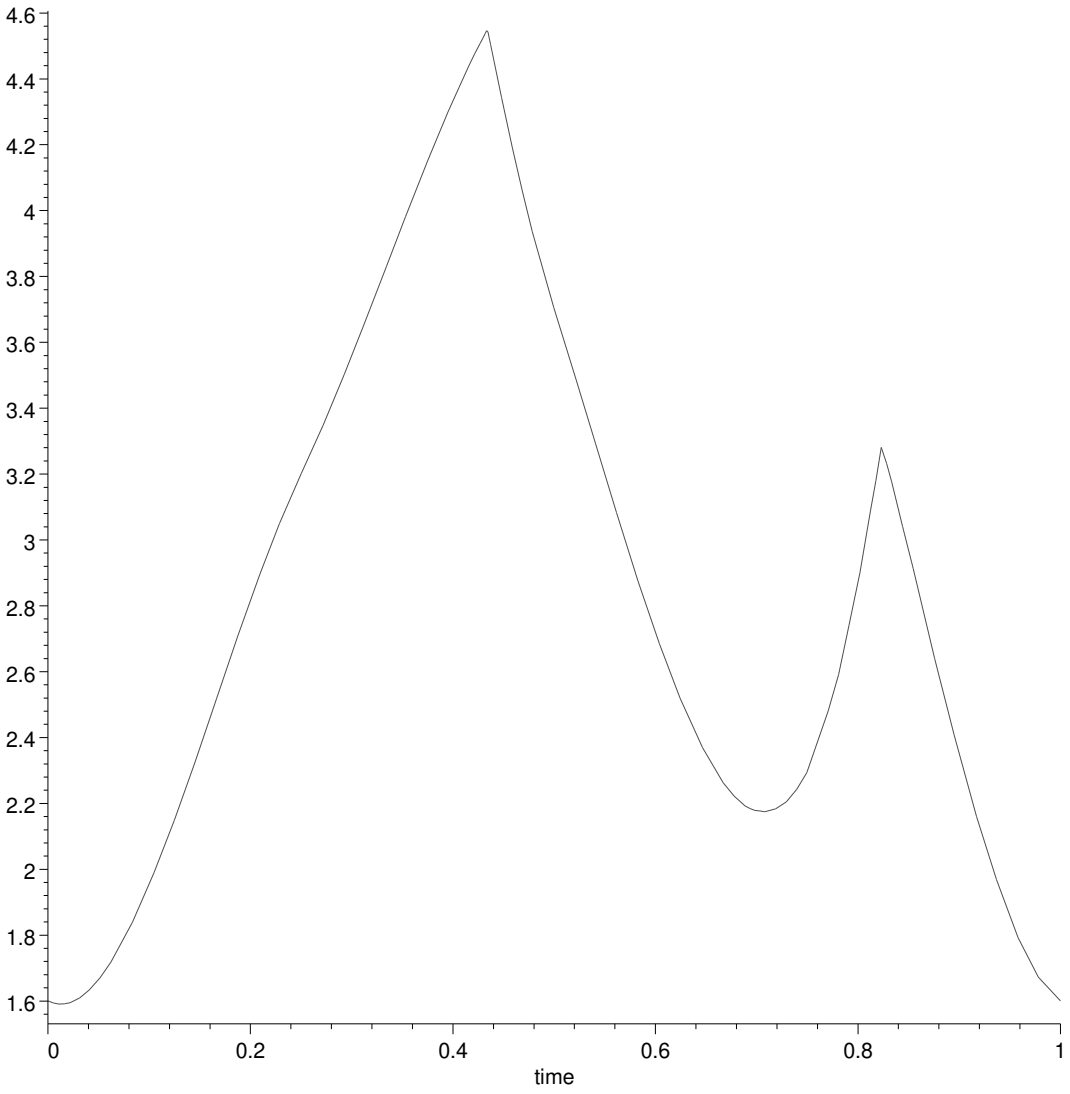
```
> plot(sun,t=0..1);
```



QUESTION 2:

```
> saving := proc (time,quantity)
   global use, sun, t;
   local u, s;
   u := evalf(subs(t=time,use));
   s := quantity * evalf(subs(t=time,sun));
   if s<u then s else u fi;
  end:

> plot('saving(time,80)',time=0..1);
```



QUESTION 3:

```
> total_saved := proc (quantity)
    local time;
    800000 * intrect('saving(time,quantity)',time,0..1,100);
  end:
```

```
> total_saved(80);
```

$$.22534\ 10^{7}$$

QUESTION 4:

```
> total_cost := proc (quantity) 16000.0*quantity end:
```

QUESTION 5:

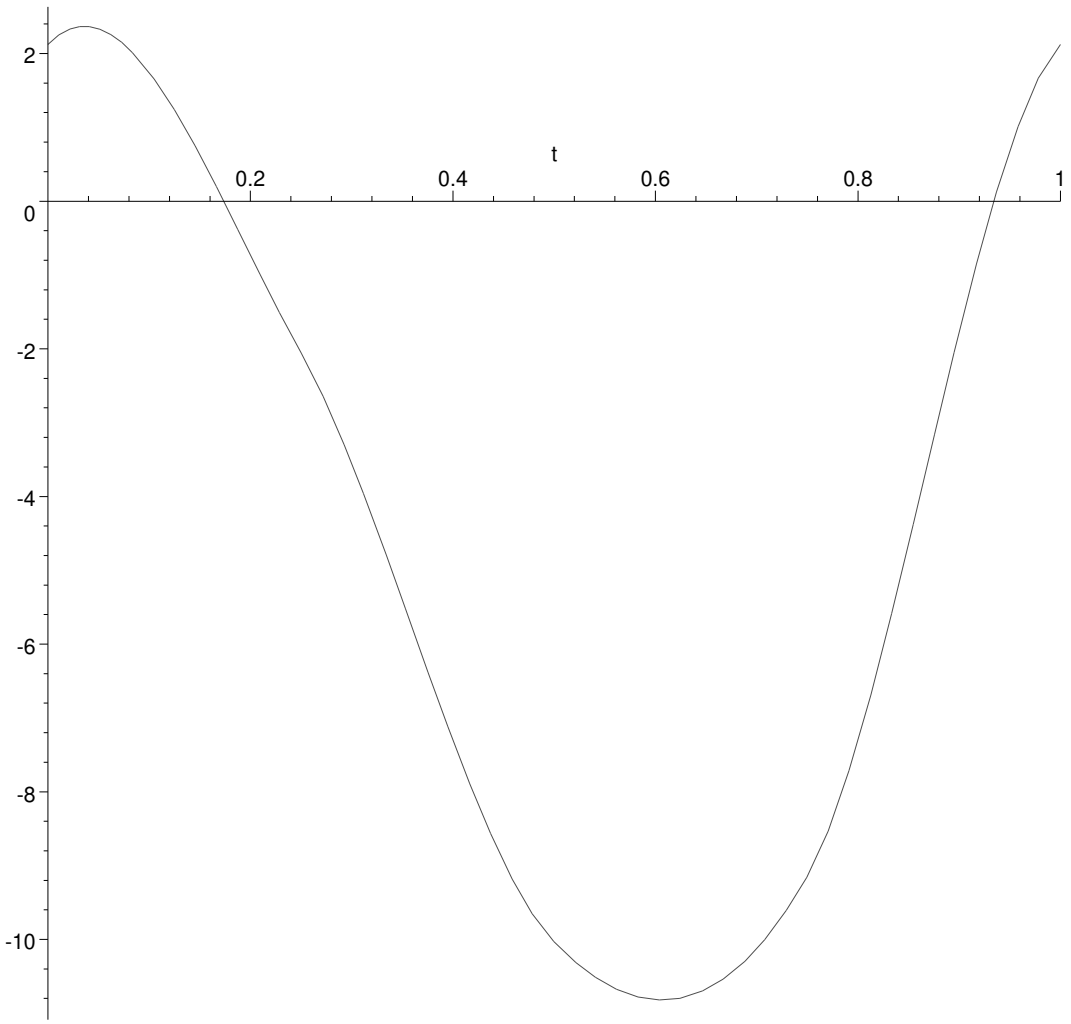
```
> bisection('total_saved(q)-total_cost(q)',q,1..500,0.1);
```

229.07

If the company can't buy a fractional number of panels, then the largest number that they can buy without losing money compared to buying none is 229.

QUESTION 6:

```
> plot(use-229*sun,t=0..1);
```



The panels appear to be fully used from time 0 to about 0.16 and from about time 0.95 to 1. We can find the time period more precisely using the bisection procedure (twice).

```
> bisection(use-229*sun,t,0.1..0.2,0.001);
                                    .17422
> bisection(use-229*sun,t,0.9..1,0.001);
                                    .93360
```

The panels are fully used from the start of the year (time 0) to time 0.174 and again from time 0.933 to the end of the year (time 1).