Theoretical power production

define latitude of the solar pannels and declination of the sun

```
lat = 42 + 17/60
```

```
lat = 42.2833
```

```
dec = 23.45
```

```
dec = 23.4500
```

convert from degrees to radians

```
lat = (lat * pi) / 180
```

```
lat = 0.7380
```

```
dec = deg2rad(dec)
```

```
dec = 0.4093
```

Determine the amount of solar irradiance on the solar panels: $S_{panel} = S_{inc} \sin(\alpha)$,

where $S_{inc} = 1.4883 \times 0.7^{\sin(\alpha)^{-0.678}}$ and α is the elevation of the sun given by

$\sin(\alpha) = \sin(\delta) sin(\phi) + \cos(\delta) \cos(\phi) cos(15(LST - 12))$

δ is declination and ϕ is latitude

```
t = 5.5:0.25:20
```

```
t = 1×59
    5.5000    5.7500    6.0000    6.2500    6.5000    6.7500    7.0000    7.2500 ···
```

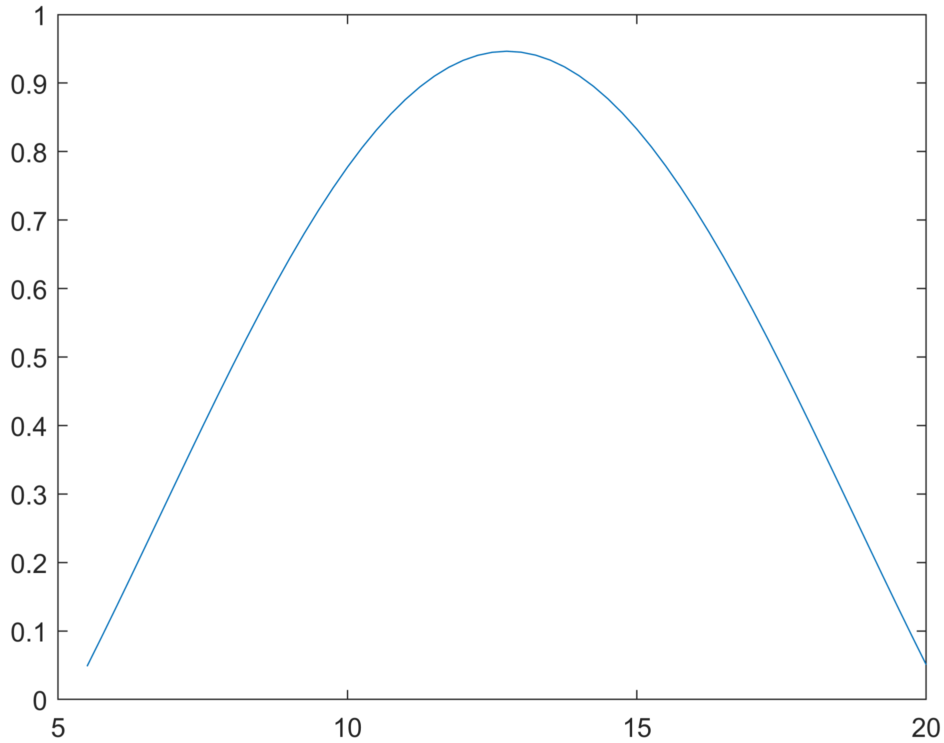
```
LTS = t - 1 + 14.6/60
```

```
LTS = 1×59
    4.7433    4.9933    5.2433    5.4933    5.7433    5.9933    6.2433    6.4933 ···
```

```
sumangle = sin(dec)*sin(lat) + cos(dec)*cos(lat)*cosd(15*(LTS-12))
```

```
sumangle = 1×59
    0.0484    0.0909    0.1342    0.1780    0.2222    0.2666    0.3109    0.3552 ···
```

```
plot(t,sumangle)
```




```
S_inc = 1.4883 * 0.7.^(sumangle.^-0.678);
```

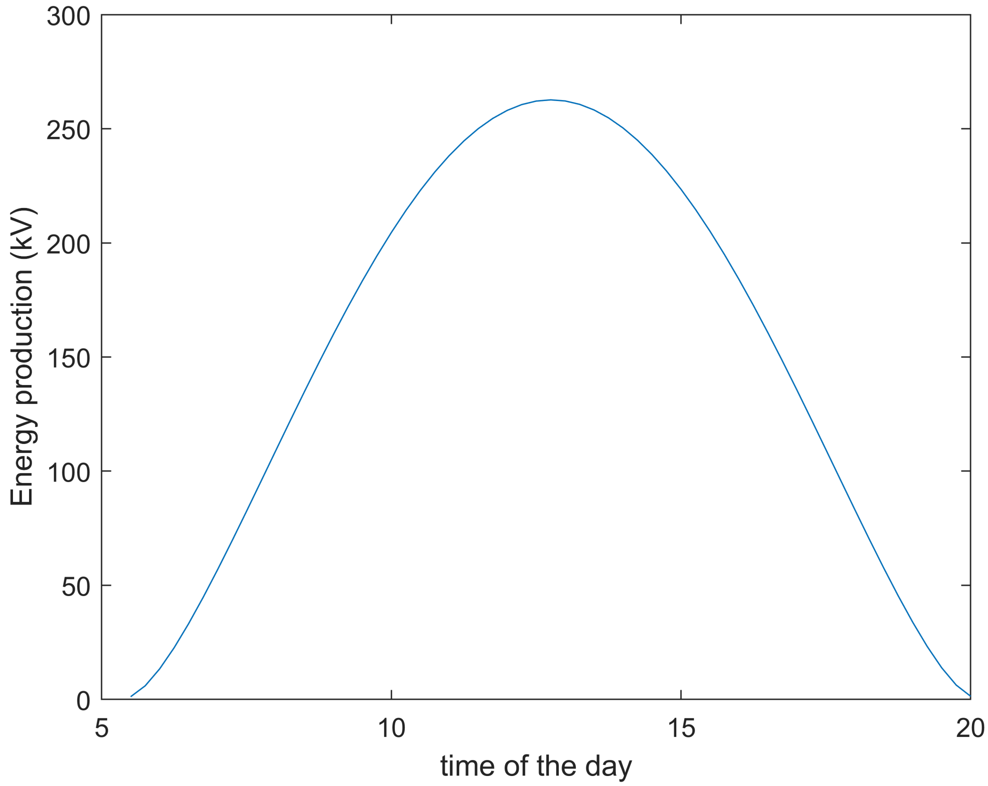
Calculate the final theoretical production for the entire solar panel array

```
production_theory = 270*S_inc.*sumangle
```

```
production_theory = 1×59
    1.2109    5.9649   13.3975   22.6549   33.2037   44.6887   56.8525   69.4954 ⋯
```

```
plot(t, production_theory)

xlabel("time of the day")
ylabel("Energy production (kV)")
```


Energy production (kV)
time of the day
0
50
100
150
200
250
300
5
10
15
20