Probleem 1: As $T(t)$ die temperatuur van tert na t minute is, dan gee Newton se afkoel wet vir ons dat

$$\frac{dT}{dt} = -k(T-20) \quad \Rightarrow \quad T(t) = C\,e^{-kt} + 20$$

Dit word vir ons gegee dat $T(0) = 180$ en $T(5) = 100$. Gebruik hierdie informasie om te bereken dat

$$C = 160 \quad k = \frac{\ln 2}{5}.$$

Dan het ons

$$T(t) = 160\,e^{-\frac{\ln 2}{5}t} + 20.$$

(a) $T(20) = 160\,e^{-\frac{\ln 2}{5}20} + 20 = 30 \Rightarrow$ temperatuur na 20 minute is 30^oC.

(b) Los op vir t in

$$25 = 160\,e^{-\frac{\ln 2}{5}t} + 20$$

om te kry $t = 25$, dus na 25 minute kan ons die te eet!

Probleem 2:

Belegging A na 30 jaar: $P(1+r)^{30}$
Belegging B na 30 jaar: Pe^{30r}

Dus moet ons vir r oplos in

$$2P(1+r)^{30} = Pe^{30r} \quad \text{oftewel} \quad 2(1+r)^{30} = e^{30r}.$$

```
>> r=fsolve(inline('2*(1+r)^30-exp(30*r)'),1)

Optimization terminated successfully:
 Norm of the current step is less than OPTIONS.TolX

r =  0.2306
```

Dus die rentekoers is 23%.

Probleem 3:

(a) Ons wil vir a en b oplos in $y = ax + b$ indien ons die eerste 6 punte van die gegewe data instel. Hierdie is 'n oorbepaalde stelsel $A \begin{bmatrix} a \\ b \end{bmatrix} = \mathbf{y}$ met

$$A = \begin{bmatrix} 13 & 1 \\ 15 & 1 \\ 16 & 1 \\ 21 & 1 \\ 22 & 1 \\ 23 & 1 \\ 25 & 1 \end{bmatrix} \quad \text{en} \quad \mathbf{y} = \begin{bmatrix} 11 \\ 10 \\ 11 \\ 12 \\ 12 \\ 13 \\ 13 \end{bmatrix}.$$

Die kleinste kwadraat oplossing is dus die oplossing $\begin{bmatrix} a \\ b \end{bmatrix}$ tot

$$A^T A \begin{bmatrix} a \\ b \end{bmatrix} = A^T \mathbf{y}$$

met

$$A^T A = \begin{bmatrix} 2104 & 110 \\ 110 & 6 \end{bmatrix} \quad \text{en} \quad A^T \mathbf{y} = \begin{bmatrix} 1284 \\ 69 \end{bmatrix}.$$

Dus

$$\begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 0.21755725190840 \\ 7.51145038167940 \end{bmatrix}.$$

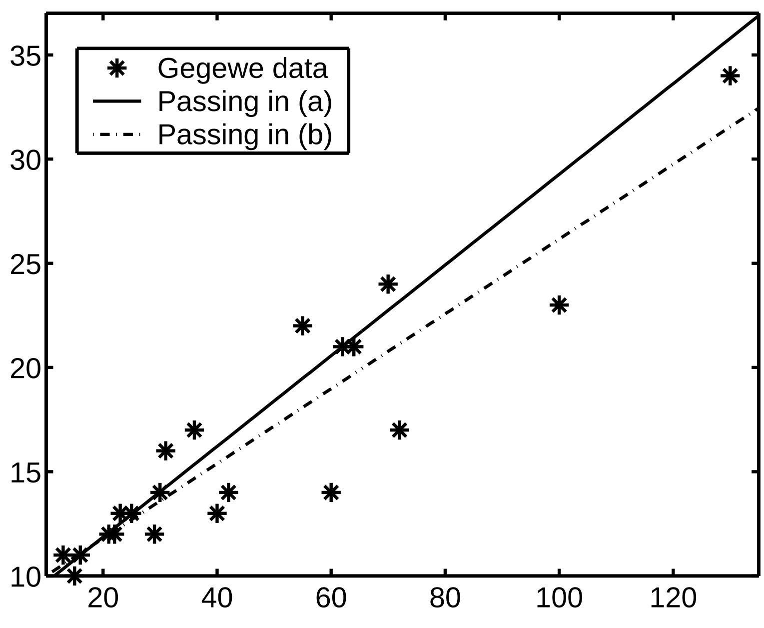
(b)
```
>> A=[x ones(size(x))]
>> temp=A\y

temp =

   0.17952242289174
   8.20840779597586
```

Dus $a = 0.17952242289174$ en $b = 8.20840779597586$.

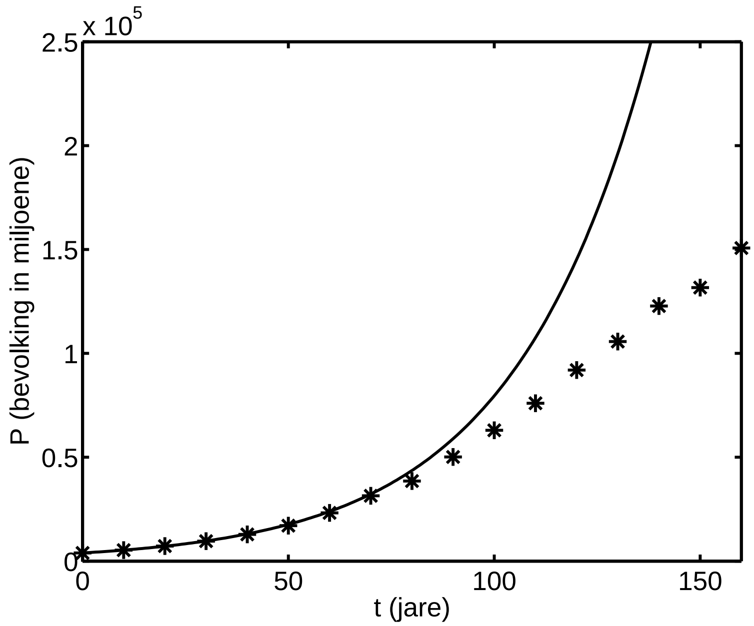
(c)



Probleem 4:

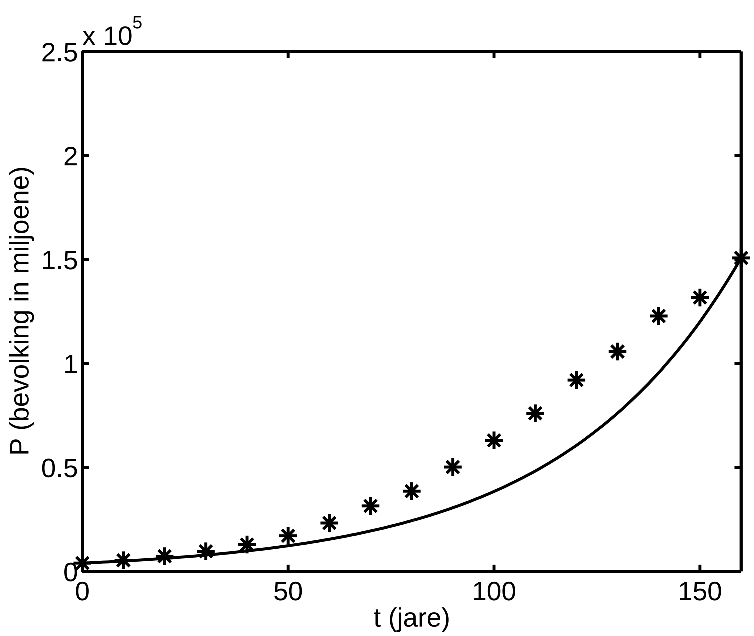
(a) $P(0) = 3929 \quad \Rightarrow \quad 3929 = P_0$

$$P(10) = 5308 \qquad \Rightarrow \qquad 5302 = 3929e^{k(10)}$$
$$\Rightarrow \qquad k = 0.03008301758936 = 3.008 \times 10^{-2}$$



(b) $P(0) = 3929 \quad \Rightarrow \quad 3929 = P_0$

$$P(160) = 150697 \qquad \Rightarrow \qquad 150697 = 3929e^{k(160)}$$
$$\Rightarrow \qquad k = 0.02279303911099 = 2.279 \times 10^{-2}$$



(c)

$$
\begin{aligned}
P = P_0 e^{kt} \qquad & \Rightarrow \qquad \ln \frac{P}{P_0} = k\,t \\
& \Rightarrow \qquad \ln P - \ln P_0 = k\,t \\
& \Rightarrow \qquad k\,t + \ln P_0 = \ln P
\end{aligned}
$$

As ons al die gegewe waardes van t en P hier instel kry ons 'n oorbepaalde stelsel, dus moet ons 'n kleinste kwadrate passing maak om k en $\ln P_0$ te bereken:

```
>> A=[x-1790 ones(size(x))];
>> b=log(y);
>> A\b

ans =  0.02338826223021
       8.51874448217748
```

Dus $k = 0.02338826223021 = 2.339 \times 10^{-2}$ en

$$\ln P_0 = 8.51874448217748 \quad \Rightarrow \quad P_0 = 5.007762473175991 \times 10^3$$