```
> #twee onder 1 kap woningen (1121)
> xdata0=c(100,120,145)
> ydata0=c(1766.24249594603,1650.55700908023,1522.17241432737)
> xdata=xdata0
> ydata=ydata0
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
> #fit linear model
> fitlm <- lm(y ~  x, data=ds)
>
> # summarise
> summary(fitlm)

Call:
lm(formula = y ~ x, data = ds)

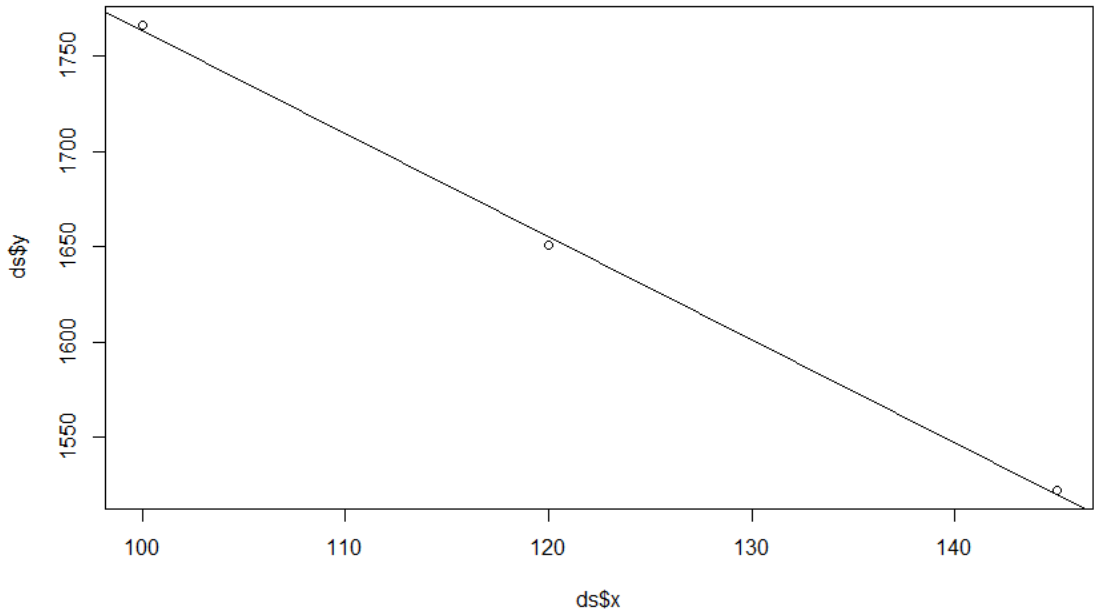
Residuals:
   1    2    3
2.659 -4.787  2.128

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 2304.7791    22.6720  101.66  0.00626 **
x             -5.4120     0.1842  -29.37  0.02167 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 5.875 on 1 degrees of freedom
Multiple R-squared:  0.9988,

Adjusted R-squared:  0.9977
F-statistic: 862.8 on 1 and 1 DF,  p-value: 0.02167

>
> sum(resid(fitlm)^2)
[1] 34.51303
> confint(fitlm)
                2.5 %    97.5 %
(Intercept) 2016.70454 2592.85369
x             -7.75305   -3.07087
>
> #draw line
> abline(fitlm)
```



> #tussen woningen laagbouw (1131)

```
> xdata1=c(30,50,60,75,95,115,150,200,250)
>
ydata1=c(2880.83586000454,2102.43191493536,1977.47412545155,1730.90138371064,1503.443
3811707,1398.0539014757,1224.95488241522,1164.02301284975,1044.20283822665)
> xdata=xdata1
> ydata=ydata1
>
> ds <- data.frame(y = ydata1, x = xdata1)
>
> # plot data
> plot(ds$x, ds$y)
>
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x ) + c, data = ds, start = list(a = 7.964287, b = - 0.005393, c=0))
>
> # summarise
> summary(fit)

Formula: y ~ exp(a + b * x) + c

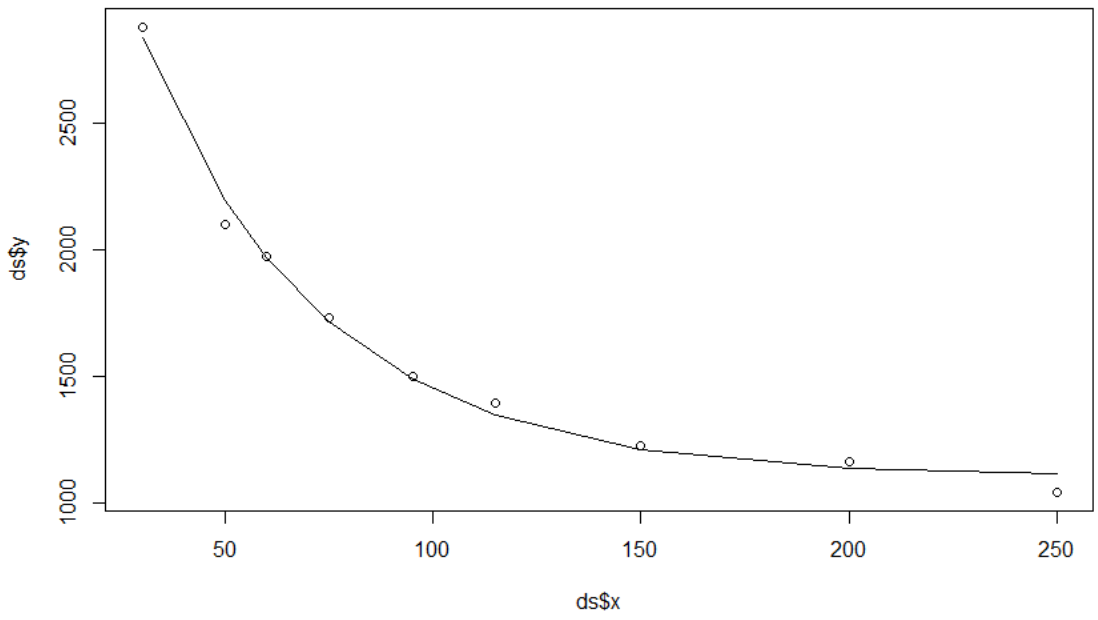
Parameters:
   Estimate Std. Error t value Pr(>|t|)
a  8.152e+00  6.538e-02  124.69 1.79e-11 ***
b -2.309e-02  1.865e-03  -12.38 1.69e-05 ***
c  1.103e+03  4.054e+01   27.21 1.63e-07 ***
```

```
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 56.92 on 6 degrees of freedom

Number of iterations to convergence: 9
Achieved convergence tolerance: 1.795e-06

>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>
>
> sum(resid(fit)^2)
[1] 19440.21
> confint(fit)
Waiting for profiling to be done...
        2.5%       97.5%
a   7.99199447    8.32746819
b  -0.02832603   -0.01857116
c 993.45640551 1200.29550160
>
```



```
> #Drive - in woningen (1138)
> xdata2=c(95,115,150,200,250)
>
ydata2=c(1677.99894850036,1549.59706222918,1426.18007188734,1262.7227272475,1126.9747
9161324)
> xdata=xdata2
> ydata=ydata2
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
> fit <- nls(y ~ exp(a + b * x ) + c, data = ds, start = list(a = 8.152e+00, b = -2.309e-02, c=1.103e+03))
> summary(fit)

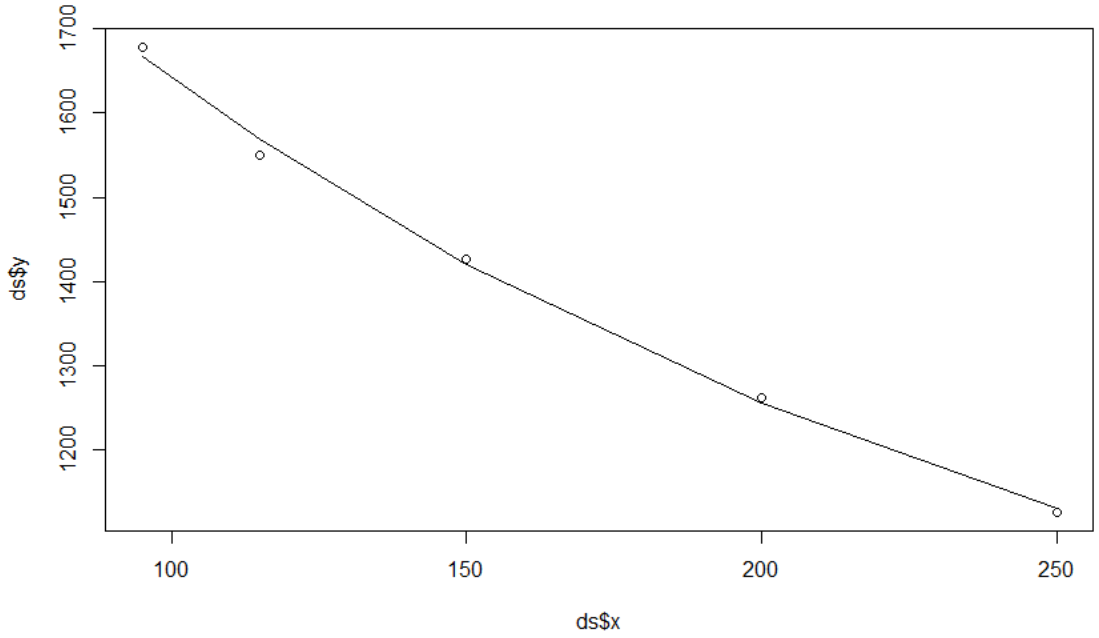
Formula: y ~ exp(a + b * x) + c

Parameters:
   Estimate Std. Error t value Pr(>|t|)
a   7.358224   0.047705 154.244  4.2e-05 ***
b  -0.005709   0.001883  -3.032   0.0937 .
c 754.696461 198.788504   3.796   0.0629 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 16.94 on 2 degrees of freedom

Number of iterations to convergence: 7
Achieved convergence tolerance: 1.595e-06

> sum(resid(fit)^2)
[1] 574.0722
> confint(fit)
Waiting for profiling to be done...
Error in prof$getProfile() : number of iterations exceeded maximum of 50
>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>
```



> #hoek woningen (1141)

```
> xdata3=c(30,50,60,75,95,115,150,200,250)
>
ydata3=c(3683.33152628289,2566.75521445294,2449.96017465901,2135.51816783706,1887.466
73909219,1750.11624183545,1507.6062255786,1420.91609715144,1267.52011779127)
>
>
> xdata=xdata3
> ydata=ydata3
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
>
>
##################################################################
#########
>
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x ) + c, data = ds, start = list(a = 8.442e+00, b = -2.430e-02, c=1.368e+03))
>
> # summarise
> summary(fit)

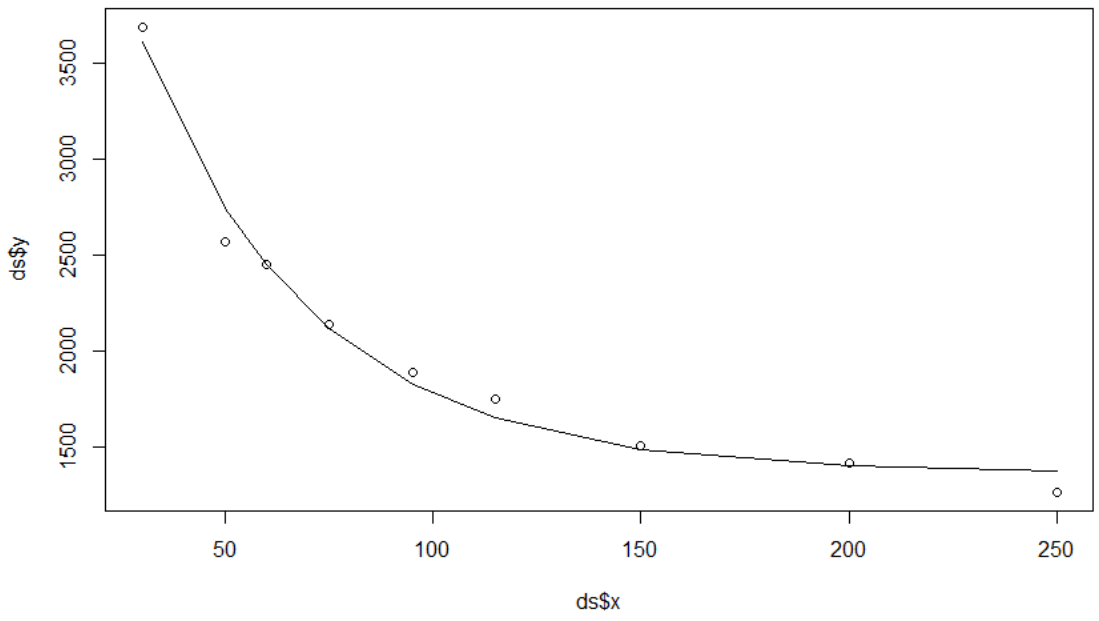
Formula: y ~ exp(a + b * x) + c
```

```
Parameters:
   Estimate Std. Error t value Pr(>|t|)
a  8.442e+00  9.530e-02  88.591 1.39e-10 ***
b -2.430e-02  2.721e-03  -8.931  0.00011 ***
c  1.368e+03  7.095e+01  19.281 1.26e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 103.3 on 6 degrees of freedom

Number of iterations to convergence: 1
Achieved convergence tolerance: 5.838e-06

> sum(resid(fit)^2)
[1] 63976.71
> confint(fit)
Waiting for profiling to be done...
        2.5%       97.5%
a    8.2072517    8.71230660
b   -0.0325452   -0.01770213
c 1167.0188380 1538.46889054
>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>
```



```
> #galerijflat (1181) -> magere fit maar te weinig punten voor exponentieel!!
> xdata4=c(50,70,90)
> ydata4=c(2255.55095308151,1975.52743353619,1762.03277853814)
>
>
> xdata=xdata4
> ydata=ydata4
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
> #fit linear model
> fitlm <- lm(y ~  x, data=ds)
>
> # summarise
> summary(fitlm)

Call:
lm(formula = y ~ x, data = ds)

Residuals:
   1    2    3
 11.09 -22.18  11.09

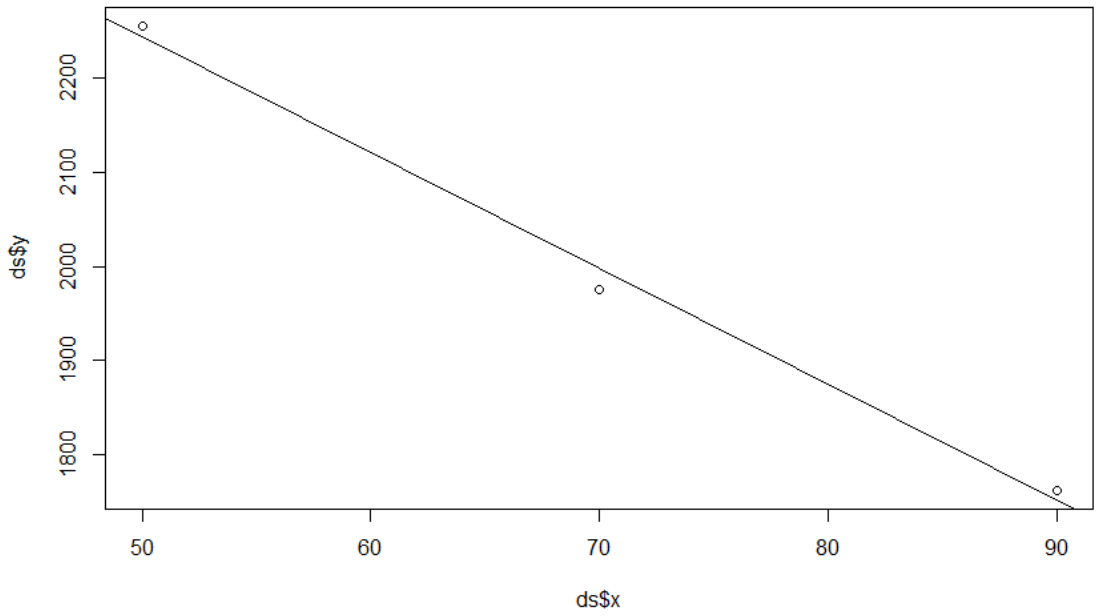
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 2861.3605    69.0231   41.45   0.0154 *
x            -12.3380     0.9603  -12.85   0.0494 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 27.16 on 1 degrees of freedom
Multiple R-squared:  0.994,

Adjusted R-squared:  0.988
F-statistic: 165.1 on 1 and 1 DF,  p-value: 0.04945

>
> sum(resid(fitlm)^2)
[1] 737.6816
> confint(fitlm)
                2.5 %      97.5 %
(Intercept) 1984.33837 3738.3826798
x            -24.53923   -0.1366758
>
> #draw line
```

> abline(fitlm)
>



> #appartement (1183) -> magere fit maar te weinig punten voor exponentieel!!

```
> xdata5=c(50,70,90)
> ydata5=c(2407.27529761209,2065.69570730164,1835.06004889074)
>
>
> xdata=xdata5
> ydata=ydata5
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
> #fit linear model
> fitlm <- lm(y ~  x, data=ds)
>
> # summarise
> summary(fitlm)

Call:
lm(formula = y ~ x, data = ds)

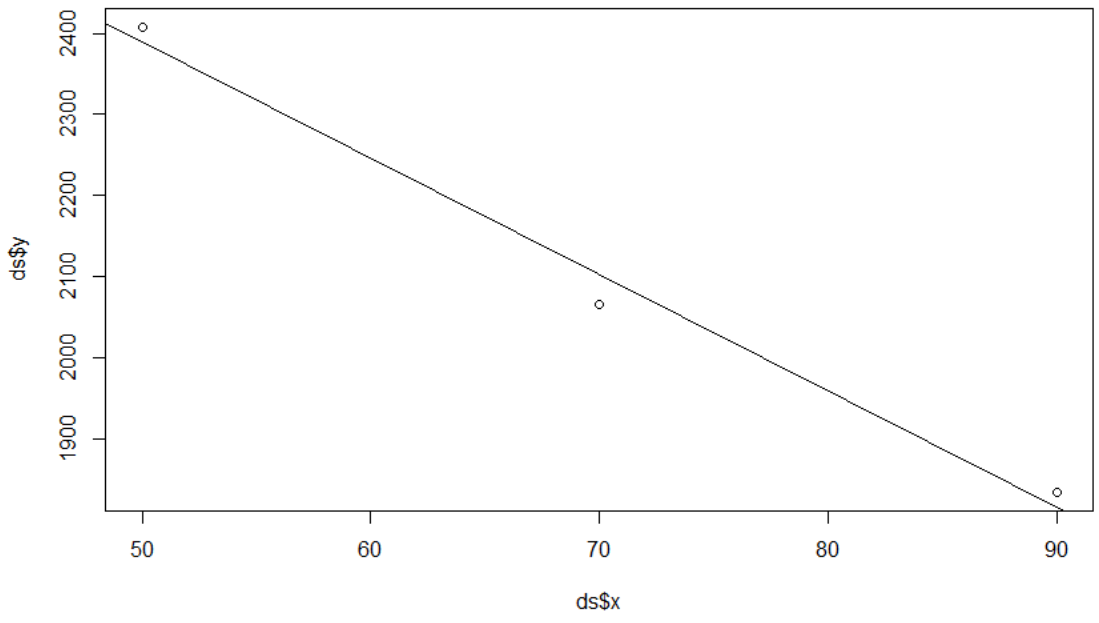
Residuals:
   1    2    3
18.49 -36.98  18.49
```

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 3104.054    115.103  26.968   0.0236 *
x           -14.305      1.601  -8.933   0.0710 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 45.29 on 1 degrees of freedom
Multiple R-squared:  0.9876,

Adjusted R-squared:  0.9752
F-statistic: 79.81 on 1 and 1 DF,  p-value: 0.07097

>
> sum(resid(fitlm)^2)
[1] 2051.426
> confint(fitlm)
                2.5 %     97.5 %
(Intercept) 1641.52632 4566.581083
x           -34.65231    6.041544
>
> #draw line
> abline(fitlm)
>
```



```
> #portiek flat (1184) -> magere fit maar te weinig punten voor exponentieel!!
> xdata6=c(50,70,90)
> ydata6=c(2558.99964214267,2155.86398106708,1908.08731924333)
>
>
> xdata=xdata6
> ydata=ydata6
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
> #fit linear model
> fitlm <- lm(y ~  x, data=ds)
>
> # summarise
> summary(fitlm)

Call:
lm(formula = y ~ x, data = ds)

Residuals:
   1    2    3
 25.89 -51.79  25.89

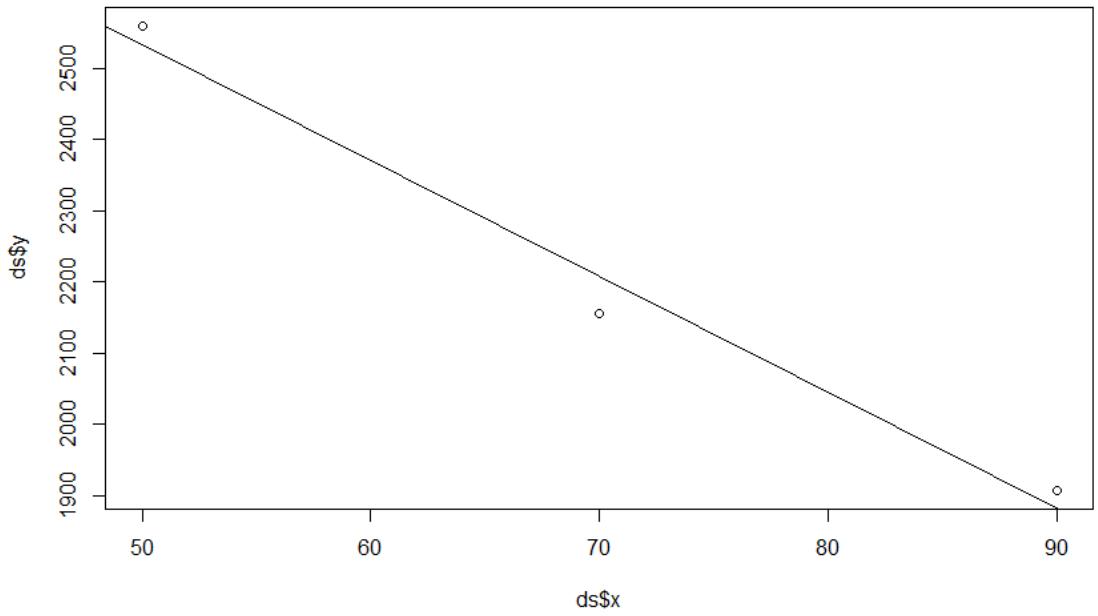
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 3346.747    161.184  20.764   0.0306 *
x           -16.273      2.242  -7.257   0.0872 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 63.43 on 1 degrees of freedom
Multiple R-squared:  0.9814,

Adjusted R-squared:  0.9627
F-statistic: 52.66 on 1 and 1 DF,  p-value: 0.08718

>
> sum(resid(fitlm)^2)
[1] 4022.736
> confint(fitlm)
                2.5 %    97.5 %
(Intercept) 1298.71427 5394.77949
x           -44.76538   12.21976
>
> #draw line
```

> abline(fitlm)
>



> #beneden woning (1187) + boven woning (1188)
> xdata7=c(29,40,50,70,90,120,150,181)
>
ydata7=c(3722.47817850273,2924.68139207738,2576.17566988308,2167.96308162919,1897.852
10105608,1663.19923424578,1505.72346595063,1506.03892078035)
>
>
> xdata=xdata7
> ydata=ydata7
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(dsx, dsy)
>>
##
#########
>
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x) + c, data = ds, start = list(a = 8.578e+00, b = -3.134e-02, c=1.512e+03))
>
> # summarise
> summary(fit)

Formula: y ~ exp(a + b * x) + c

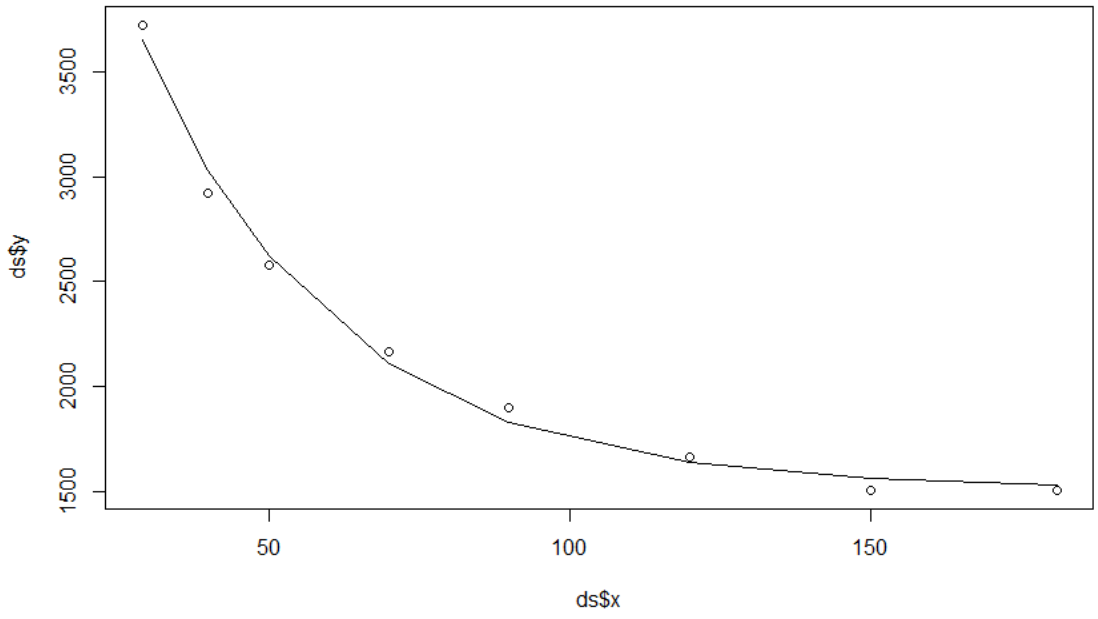
Parameters:
   Estimate Std. Error t value Pr(>|t|)
a 8.578e+00 9.777e-02 87.735 3.65e-09 ***
b -3.134e-02 3.171e-03 -9.882 0.000181 ***
c 1.512e+03 5.777e+01 26.179 1.52e-06 ***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 78.49 on 5 degrees of freedom

Number of iterations to convergence: 2
Achieved convergence tolerance: 7.255e-06

> sum(resid(fit)^2)
[1] 30804.81
> confint(fit)
Waiting for profiling to be done...
        2.5%   97.5%
a   8.33401470   8.87314251
b -0.04110468 -0.02335245
c 1340.18262000 1655.91012521
>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>



```
> #corridor flat (1189)
> xdata8=c(30,40,50,70,90,120,150,180)
>
ydata8=c(2872.84410626584,2362.84954726053,2142.01613694216,1921.85511328391,1746.130
5235191,1548.53914589613,1422.24065792901,1325.79208392684)
>
>
> xdata=xdata8
> ydata=ydata8
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
>
>
##################################################################
#########
>
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x ) + c, data = ds, start = list(a =  8.013e+00, b = -2.507e-02  , c=1.357e+03))
>
> # summarise
> summary(fit)

Formula: y ~ exp(a + b * x) + c

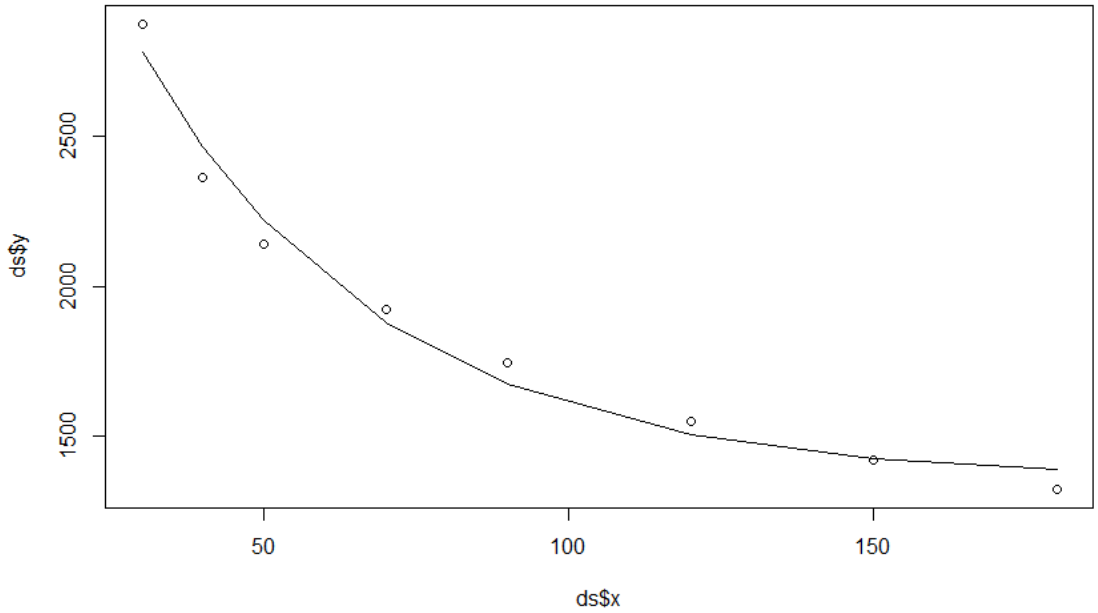
Parameters:
   Estimate Std. Error t value Pr(>|t|)
a  8.013e+00  1.404e-01   57.06 3.13e-08 ***
b -2.507e-02  4.712e-03   -5.32  0.00314 **
c  1.357e+03  8.026e+01   16.91 1.32e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 87.15 on 5 degrees of freedom

Number of iterations to convergence: 2
Achieved convergence tolerance: 7.101e-06

> sum(resid(fit)^2)
[1] 37975.74
> confint(fit)
Waiting for profiling to be done...
        2.5%       97.5%
a   7.68989583   8.51929141
b  -0.04201158  -0.01311524
```

c 1020.91962780 1543.74272121
>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>



> #studenten woningen (1384) + bejaarden woningen (1386)
> xdata9=c(30,40,50,70,90)
>
ydata9=c(2986.84410626584,2476.84954726053,2255.55095308151,1975.52743353619,1762.032
77853814)
>
>
> xdata=xdata9
> ydata=ydata9
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(dsx, dsy)
>
>
##
#########
>
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x) + c, data = ds, start = list(a =8.422e+00 , b = -4.245e-02 , c=1.696e+03))

>
> # summarise
> summary(fit)

Formula: y ~ exp(a + b * x) + c

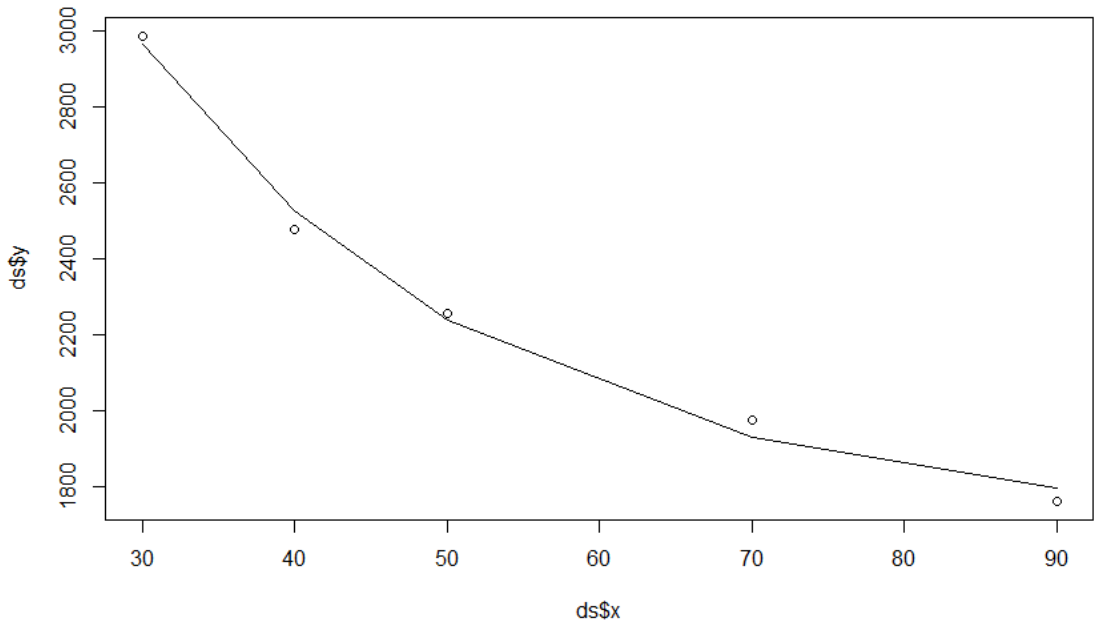
Parameters:
  Estimate Std. Error t value Pr(>|t|)
a 8.422e+00 2.174e-01 38.742 0.000666 ***
b -4.245e-02 8.538e-03 -4.973 0.038143 *
c 1.696e+03 9.759e+01 17.373 0.003297 **

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 57.06 on 2 degrees of freedom

Number of iterations to convergence: 2
Achieved convergence tolerance: 4.678e-06

> sum(resid(fit)^2)
[1] 6512.397
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))



```
> #karakteristiek historisch beneden (1981) + karakteristiek historisch boven (1982)
> xdata10=c(29,40,50,70,90,120,150,181)
>ydata10=c(3939.11563735234,3115.1094396276,2757.02437723376,2340.34108175688,2064.90
113481455,1825.33235869602,1664.38768262567,1664.89006216892)
> xdata=xdata10
> ydata=ydata10
>
> ds <- data.frame(y = ydata, x = xdata)
>
> # plot data
> plot(ds$x, ds$y)
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x ) + c, data = ds, start = list(a =8.290e+00 , b = -2.462e-02  , c=1.691e+03))
>
> # summarise
> summary(fit)

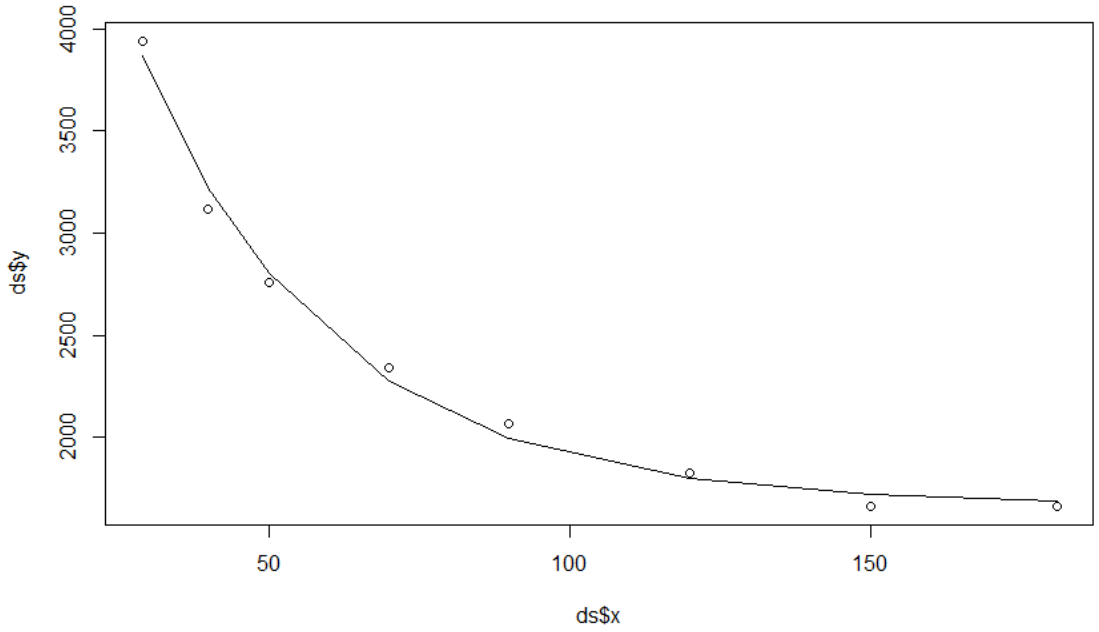
Formula: y ~ exp(a + b * x) + c

Parameters:
   Estimate Std. Error t value Pr(>|t|)
a  8.610e+00  9.988e-02  86.199 3.98e-09 ***
b -3.159e-02  3.236e-03  -9.762 0.000192 ***
c  1.673e+03  5.971e+01  28.024 1.08e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 81.66 on 5 degrees of freedom

Number of iterations to convergence: 6
Achieved convergence tolerance: 3.306e-06

> sum(resid(fit)^2)
[1] 33340.09
> #confint(fit)
>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>
```



> #karakteristiek historisch beneden wijk A (1987) + karakteristiek historisch boven wijk A (1988)

```
> xdata11=c(29,40,50,70,90,120,150,181)
>ydata11=c(4023.22863735234,3199.22243962759,2841.13737723376,2424.45408175688,2149.0
1413481455,1909.44535869602,1748.50068262567,1749.00306216892)
>
>
> xdata=xdata11
> ydata=ydata11
>
> ds <- data.frame(y = ydata, x = xdata)
> # plot data
> plot(ds$x, ds$y)
> # fit non-linear model
> fit <- nls(y ~ exp(a + b * x ) + c, data = ds, start = list(a =8.290e+00 , b = -2.462e-02  , c=1.691e+03))
>
> # summarise
> summary(fit)

Formula: y ~ exp(a + b * x) + c

Parameters:
   Estimate Std. Error t value Pr(>|t|)
a  8.610e+00  9.988e-02  86.199 3.98e-09 ***
b -3.159e-02  3.236e-03  -9.762 0.000192 ***
c  1.757e+03  5.971e+01  29.432 8.49e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Residual standard error: 81.66 on 5 degrees of freedom

Number of iterations to convergence: 6
Achieved convergence tolerance: 3.102e-06

```
> sum(resid(fit)^2)
[1] 33340.09
> #confint(fit)
>
> #draw curve fit
> new = data.frame(xdata = seq(min(xdata),max(xdata),len=200))
> lines(ds$x,predict(fit,newdata=new))
>
```

