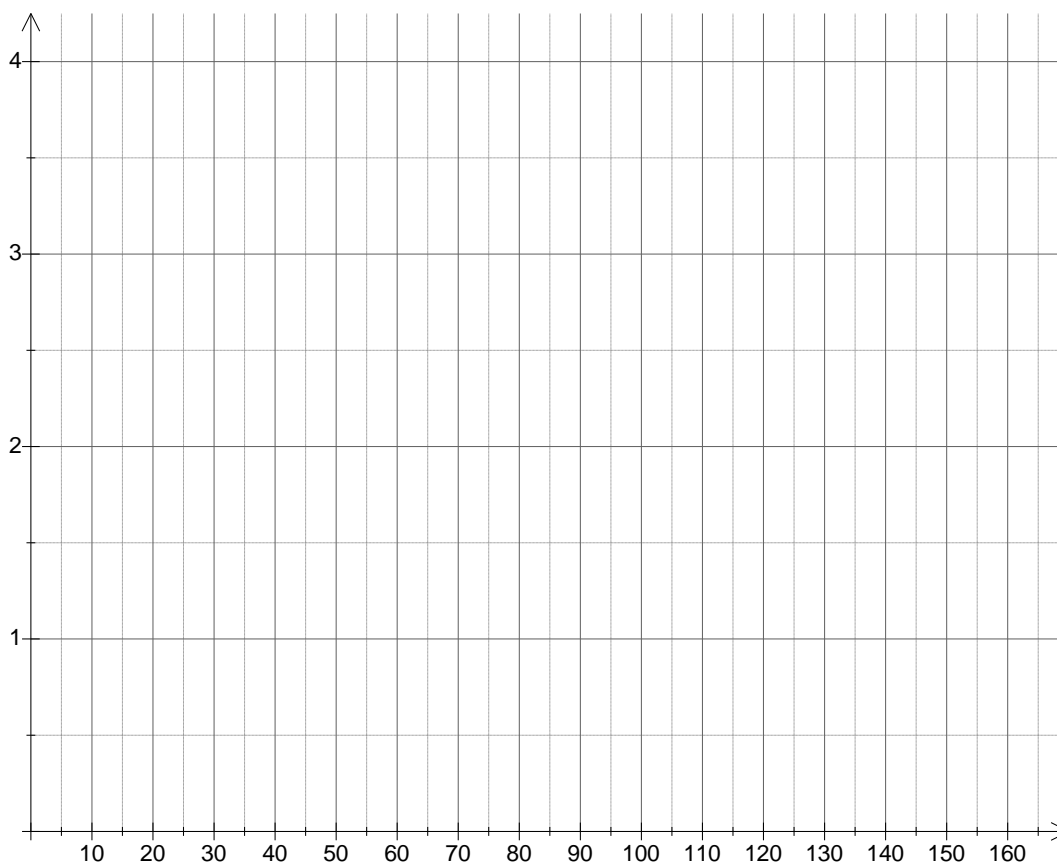# FURTHER MATHEMATICS

SAC 1 REVISION – TRANSFORMATIONS

The time spent studying in preparation for a SAC and the efficiency rating during the SAC for a number of students has been recorded in the table below:

Time	0.25	0.5	0.75	5.0	10	20	40	70	160
Efficiency rating	0.67	0.5	0.96	1.5	1.8	2.5	2.6	2.9	3.1

a) Construct a scatterplot on the axes below. Don't forget to label the axes.

b) Calculate the coefficient of determination (to the nearest whole percentage) and interpret your results in terms of the variables **efficiency rating** and **time**.

_____

c) Use your calculator to determine the equation of the least squares regression line. (make sure you write it in terms of the given variables) State coefficients correct to three decimal places.

_____

d) Use the model found in **partc)** to draw this line on the scatterplot.

To determine if a linear model is appropriate a residual plot is constructed.

e) Use the following axes to construct a residual plot for the least squares model.

residual

1

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160   year

-1
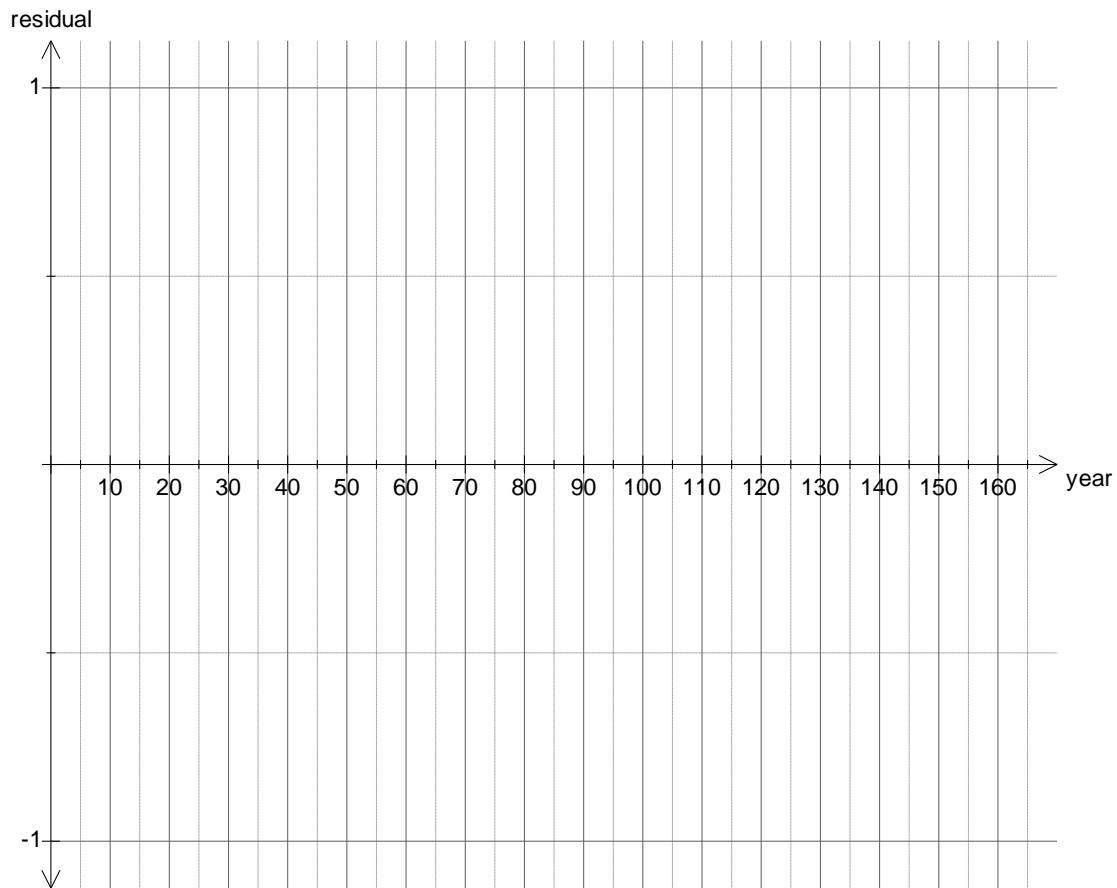
f) Explain why this residual plot supports the suggestion that this model is **not** linear.
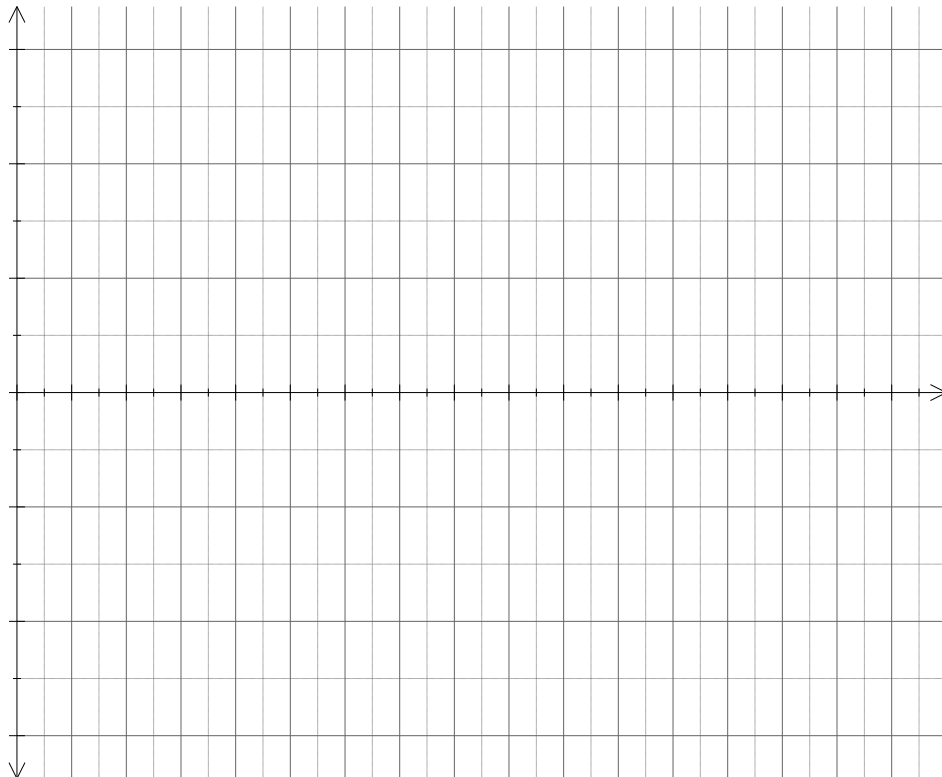
_____

1 mark

2. To transform this data a number of transformations are possible. To determine whether these will be successful, you are required to complete a y^2 transformation and a $\log_{10}(x)$ transformation. Give all results to three decimal places. Suitable grids have been supplied below:
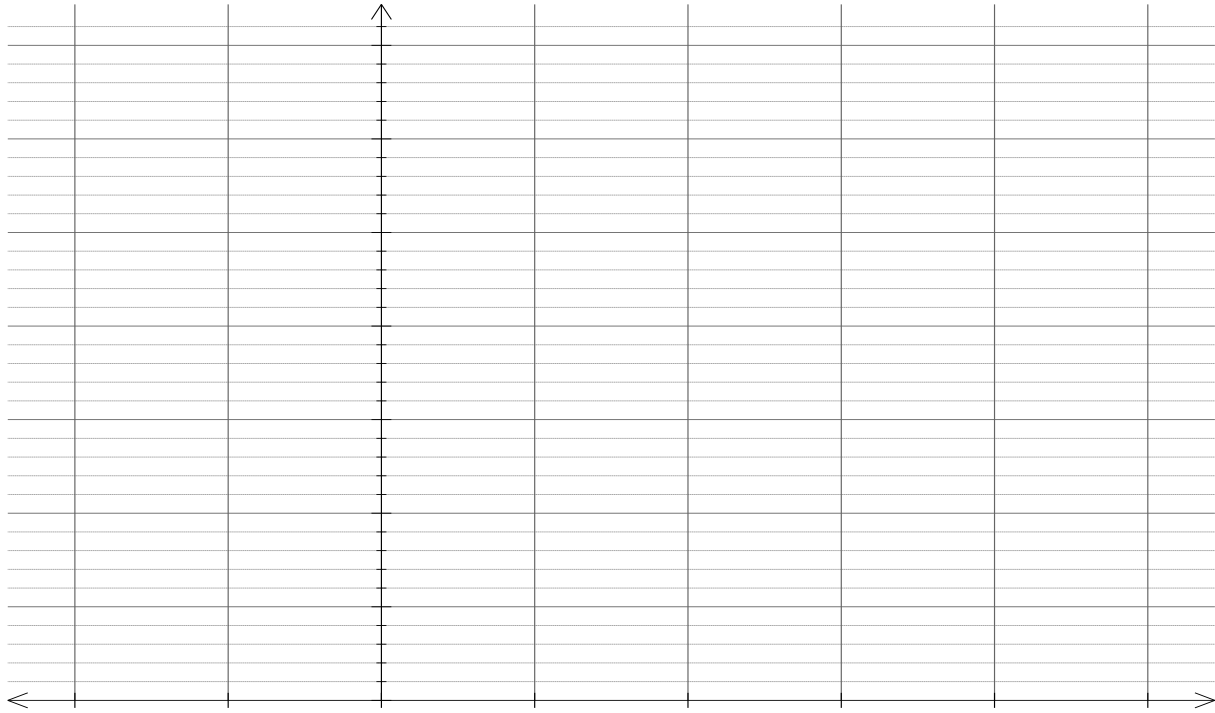
a) *efficiency rating*^{2} **transformation**
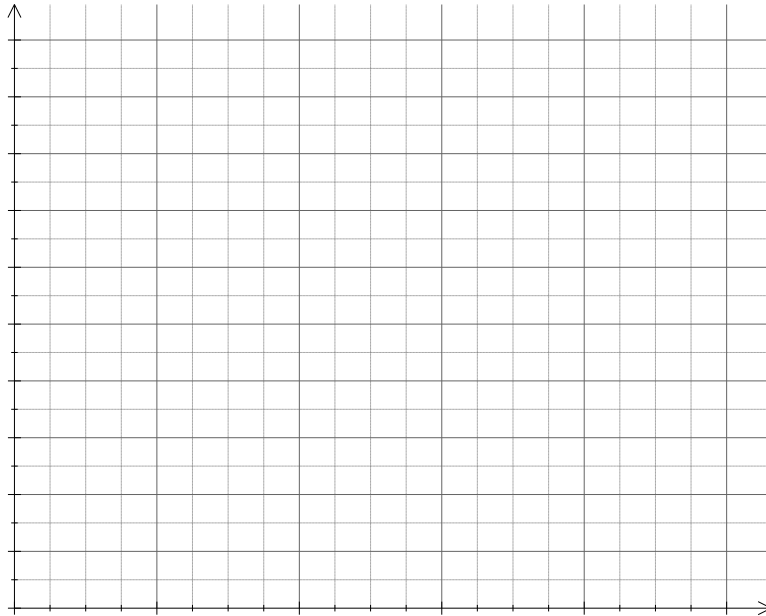
$$efficiency\ rating^2 = \underline{\hspace{2cm}} + \underline{\hspace{2cm}} \times time$$
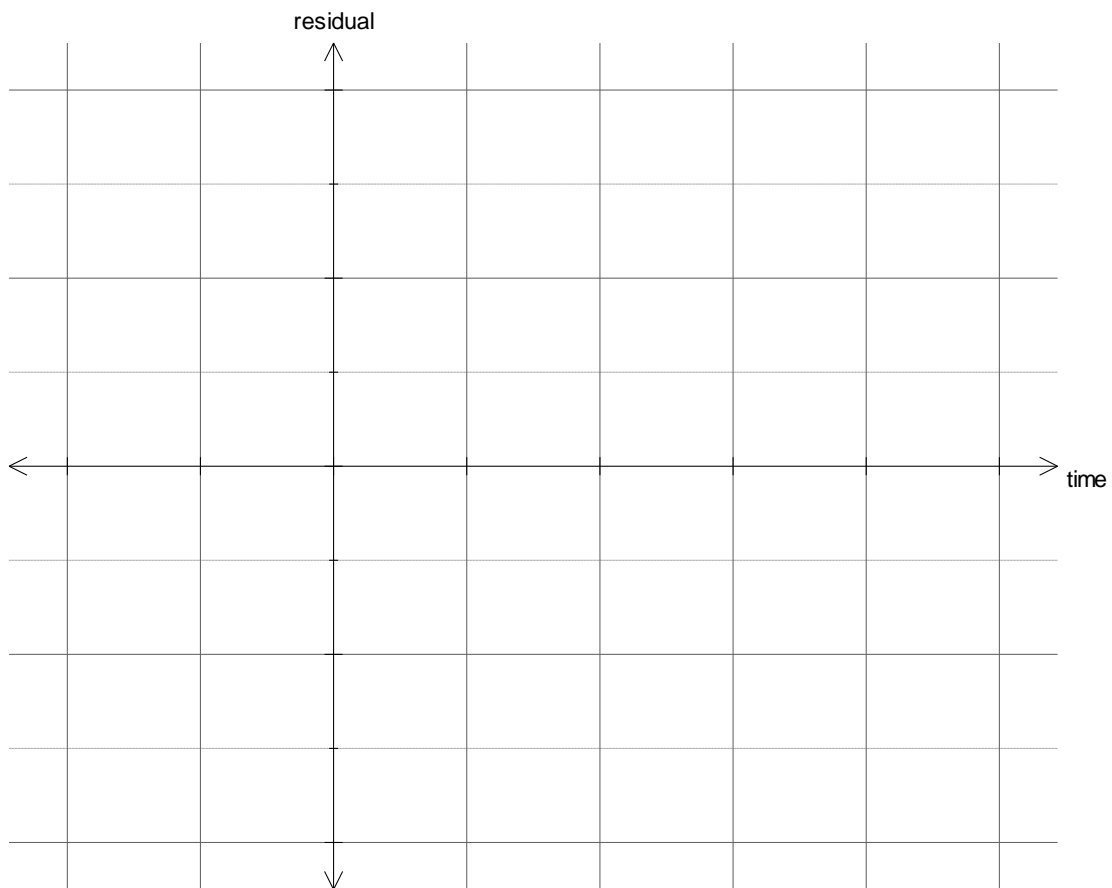
$$r^2 =$$

b) $\log_{10}(time)$ **transformation**

$$efficiency\ rating = \underline{\hspace{1.5cm}} + \underline{\hspace{1.5cm}} \times \log(time)$$

$$r^2 =$$

residual

time

c)   Using the results obtained above choose the best model to predict population from year:

| Original Linear Model | (y) squared | log(x) transformation |

d)   Explain your choice made in part c) using appropriate results from **parts a) and b).**

_____

_____

_____

_____

<div align="right">2 marks</div>

e)   Using the preferred model, predict the efficiency rating, correct to 1 decimal place, (showing all

working) of a student who does:

(i)   10 hours of study _____

_____

(ii)   Explain whether you believe this would be a reliable prediction, stating a clear reason.

_____

_____

<div align="right">2 + 1 = 3 marks</div>