# Logarithm and Exponential As level Edexcel Maths Past Papers Questions

**01.**

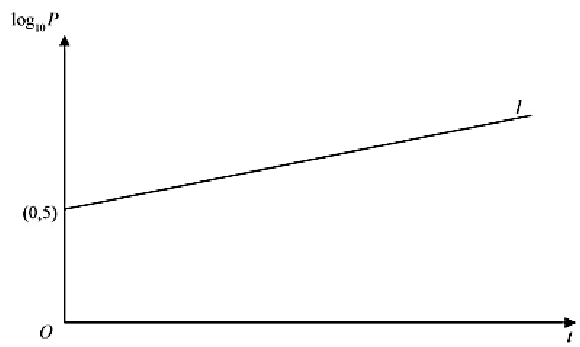


**Figure 2**

A town's population, $P$, is modelled by the equation $P = ab^t$ , where $a$ and $b$ are constants and $t$ is the number of years since the population was first recorded.

The line $l$ shown in Figure 2 illustrates the linear relationship between $t$ and $\log_{10} P$ for the population over a period of 100 years.

The line $l$ meets the vertical axis at (0, 5) as shown. The gradient of $l$ is $\frac{1}{200}$ .

(a) Write down an equation for $l$.

(2)

(b) Find the value of $a$ and the value of $b$.

(4)

(c) With reference to the model interpret

(i) the value of the constant $a$,

(ii) the value of the constant $b$

(2)

(d) Find

(i) the population predicted by the model when $t = 100$, giving your answer to the nearest hundred thousand,

(ii) the number of years it takes the population to reach 200 000, according to the model.

(3)

(e) State two reasons why this may not be a realistic population model.

(2)

**02.** .

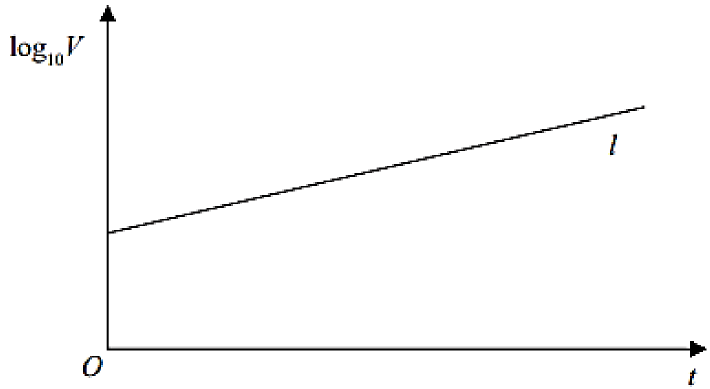


**Figure 3**

The value of a rare painting, £$V$, is modelled by the equation $V = pq^t$, where $p$ and $q$ are constants and $t$ is the number of years since the value of the painting was first recorded on 1st January 1980.

The line $l$ shown in Figure 3 illustrates the linear relationship between $t$ and $\log_{10} V$ since 1st January 1980.

The equation of line $l$ is $\log_{10} V = 0.05t + 4.8$

(a) Find, to 4 significant figures, the value of $p$ and the value of $q$.

**(4)**

(b) With reference to the model interpret

(i) the value of the constant $p$,

(ii) the value of the constant $q$.

**(2)**

(c) Find the value of the painting, as predicted by the model, on 1st January 2010, giving your answer to the nearest hundred thousand pounds.

**(2)**

**03.**

. The value of a car, £$V$, can be modelled by the equation

$$V = 15\,700\mathrm{e}^{-0.25t} + 2300 \qquad t \in \mathbb{R},\ t \geqslant 0$$

where the age of the car is $t$ years.

Using the model,

(a) find the initial value of the car.

**(1)**

Given the model predicts that the value of the car is decreasing at a rate of £500 per year at the instant when $t = T$,

(b) (i) show that

$$3925\mathrm{e}^{-0.25T} = 500$$

(ii) Hence find the age of the car at this instant, giving your answer in years and months to the nearest month.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

**(6)**

The model predicts that the value of the car approaches, but does not fall below, £$A$.

(c) State the value of $A$.

**(1)**

(d) State a limitation of this model.

**(1)**

**04.**

An advertising agency is monitoring the number of views of an online advert.

The equation

$$\log_{10} V = 0.072t + 2.379 \qquad 1 \leqslant t \leqslant 30,\ t \in \mathbb{N}$$

is used to model the total number of views of the advert, $V$, in the first $t$ days after the advert went live.

(a) Show that $V = ab^t$ where $a$ and $b$ are constants to be found.

Give the value of $a$ to the nearest whole number and give the value of $b$ to 3 significant figures.

**(4)**

(b) Interpret, with reference to the model, the value of $ab$.

**(1)**

Using this model, calculate

(c) the total number of views of the advert in the first 20 days after the advert went live. Give your answer to 2 significant figures.

**(2)**

**05.**

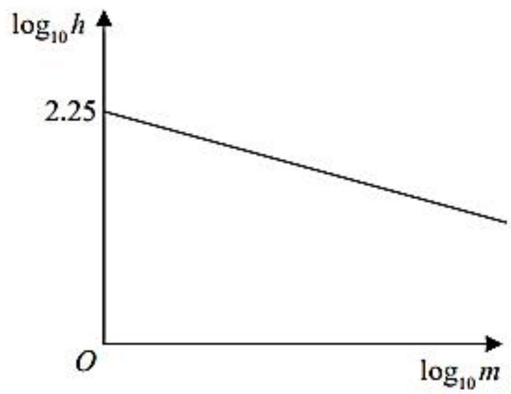


**Figure 2**

The resting heart rate, $h$, of a mammal, measured in beats per minute, is modelled by the equation

$$h = pm^q$$

where $p$ and $q$ are constants and $m$ is the mass of the mammal measured in kg.

Figure 2 illustrates the linear relationship between $\log_{10} h$ and $\log_{10} m$

The line meets the vertical $\log_{10} h$ axis at 2.25 and has a gradient of $-0.235$

(a) Find, to 3 significant figures, the value of $p$ and the value of $q$.

**(3)**

A particular mammal has a mass of 5 kg and a resting heart rate of 119 beats per minute.

(b) Comment on the suitability of the model for this mammal.

**(3)**

(c) With reference to the model, interpret the value of the constant $p$.

**(1)**

**06.** (a) Given that $p = \log_3 x$, where $x > 0$, find in simplest form in terms of $p$,

(i) $\log_3\left(\frac{x}{9}\right)$

(ii) $\log_3\left(\sqrt{x}\right)$

**(2)**

(b) Hence, or otherwise, solve

$$2\log_3\left(\frac{x}{9}\right) + 3\log_3\left(\sqrt{x}\right) = -11$$

giving your answer as a simplified fraction.

**Solutions relying on calculator technology are not acceptable.**

**(4)**

**07.**

. The height, $h$ metres, of a plant, $t$ years after it was first measured, is modelled by the equation

$$h = 2.3 - 1.7e^{-0.2t} \qquad t \in \mathbb{R} \quad t \geqslant 0$$

Using the model,

(a) find the height of the plant when it was first measured,

**(2)**

(b) show that, exactly 4 years after it was first measured, the plant was growing at approximately 15.3 cm per year.

**(3)**

According to the model, there is a limit to the height to which this plant can grow.

(c) Deduce the value of this limit.

**(1)**