

8.6 Answers

A-Level Pure Mathematics : Year 1 Exponentials and Logarithms

8.6.1 Solution to 8.4 Example

$$\begin{aligned} \text{(i)} \quad a &= 10^{1.380} & b &= 10^{0.0969} \\ &= 24 & &= 1.25 \\ &\therefore n &= 24 \times 1.25^t \end{aligned}$$

[2 marks]

(ii) When $t = 0$, $n = 24$ rabbits.

[1 mark]

$$\begin{aligned} \text{(iii)} \quad \text{When } t = 1, \quad n &= 24 \times 1.25^1 \\ &= 30 \text{ rabbits} \end{aligned}$$

[1 mark]

$$\begin{aligned} \text{(iv)} \quad \text{When } t = 240, \quad n &= 24 \times 1.25^{240} \\ &= 4.35 \times 10^{24} \\ &= 4\,350\,000\,000\,000\,000\,000\,000\,000 \text{ rabbits} \end{aligned}$$

[2 marks]

(v) The rabbits are likely to run out of food and space well before their population reaches such a substantive size on Ensay which was described as being a small island.

[2 marks]

8.6.2 Solution to 8.5 Exercise

Answer 1

$$\begin{array}{lll} \text{(i)} & 200 & \text{(ii)} \quad 54.6 \\ \text{(iv)} & 0.580 & \text{(v)} \quad 0.631 \end{array} \quad \begin{array}{l} \text{(iii)} \quad -0.916 \\ \text{(vi)} \quad 2.18 \end{array}$$

[6 marks]

Answer 2

$$\begin{aligned} B &= \frac{\Delta Y}{\Delta X} \\ &= \frac{7.3 - 4.8}{1.4 - 0} \\ &= 1.786 \\ \therefore Y &= 4.8 + 1.786X \end{aligned}$$

$$\begin{aligned} a &= 10^{4.8} & b &= 10^{1.786} \\ &= 63000 & &= 61.1 \\ \therefore y &= 63000 \times 61.1^x \end{aligned}$$

[3 marks]

Answer 3

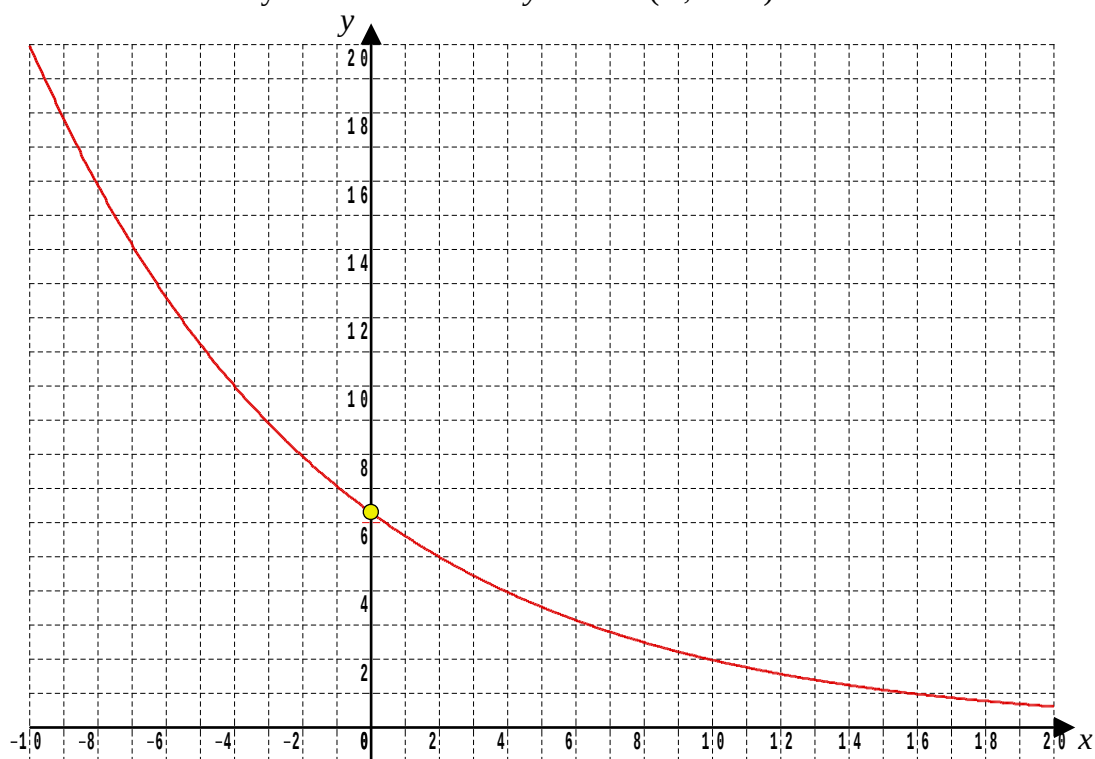
(i) $a = 10^{0.8} = 6.31$ $b = 10^{-0.05} = 0.891$
 $\therefore y = 6.31 \times 0.891^x$

[2 marks]**(ii)**

x	0	1	2	3
y	6.31	5.62	5.01	4.46

[2 marks]

(iii) Here is the graph of $y = 6.31 \times 0.891^x$
The only axis crossed is the y-axis at (0, 6.31)

**[2 marks]**

Answer 4

$$\begin{aligned}
 \text{(i)} \quad a &= e^{0.208} & b &= e^{0.113} \\
 &= 1.23 & &= 1.12 \\
 \therefore g &= 1.23 \times 1.12^t
 \end{aligned}$$

[2 marks]**(ii)** b is the rate of change of the growth rate.**[1 mark]****(iii)** 8.45**[1 mark]****(iv)** a is the predicted rate of growth when $t = 0^\circ \text{C}$ This temperature is below the known data domain of $13 \leq t \leq 28$

Possibly, if the larvae become frozen they might die, for example.

[2 marks]**Answer 5**

$$\begin{aligned}
 \text{(i)} \quad a &= 10^{2.58} & b &= 10^{-0.148} \\
 &= 380 & &= 0.711 \\
 \therefore L &= 380 \times 0.711^n
 \end{aligned}$$

[3 marks]**(ii)** b is the probability of NOT rolling a '6'**[1 mark]****(iii)**

Roll number, n	0	1	2	3	4	5	6	7	8
N° of <i>live</i> dice, L	400	272	186	130	95	69	51	34	25
Prediction of L	380	270	192	137	97	69	49	35	25

[3 marks]**(iv)** 0.289 because $1 - 0.711 = 0.289$ **[2 marks]**