Exponentials and logarithms – AS Mathematics P2

1. June/2022/Paper_7356/02/No.6

An on-line science website states:

'To find a dog's equivalent human age in years, multiply the natural logarithm of the dog's age in years by 16 then add 31.'

(a) Calculate the equivalent age to the nearest human year of a dog aged 5 years.

[1 mark]

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(b) A dog's equivalent age in human years is 40 years. Find the dog's actual age to the nearest month.

[3 marks]

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(c)   Explain why the behaviour of the natural logarithm for values close to zero means that the formula given on the website cannot be true for very young dogs.

[2 marks]

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2. June/2022/Paper_7356/02/No.10

A bottle of water has a temperature of 6 °C when it is removed from a refrigerator.

It is placed in a room where the temperature is 20 °C

10 minutes later, the temperature of the water is 12 °C

The temperature of the water, T °C, at time t minutes after it is removed from the refrigerator, may be modelled by the equation

$$T = 20 - ae^{-kt}$$

(a) Find the value of a.

[1 mark]

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(b) Calculate the value of k, giving your answer to two significant figures.

[3 marks]

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(c)   Using this model, estimate how long it takes the water to reach a temperature of 18°C after it is taken out of the refrigerator.

[3 marks]

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(d)   Explain why the model may not be appropriate to predict the temperature of the water three hours after it is taken out of the refrigerator.

[1 mark]

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