



11. The global yearly energy output from onshore wind farms was first measured in 1996. The equation

$$E = ab^t \quad \text{where } a \text{ and } b \text{ are constants}$$

models the global yearly energy output, E gigawatts (GW), from onshore wind farms t years after 1996.

Given that the global yearly energy output from onshore wind farms was

- 74 GW in 2006
- 198 GW in 2010

(a)(i) Given

$$74 = ab^{(2006-1996)} = ab^{10}$$

$$198 = ab^{(2010-1996)} = ab^{14}$$

(a) (i) find the value of b to 3 decimal places,

(ii) find the value of a to one decimal place.

Solving simultaneously,

$$\frac{198}{74} = \frac{ab^{14}}{ab^{10}} = b^4 \quad (4)$$

(b) With reference to the model

- (i) interpret the value of a ,
- (ii) interpret the value of b .

$$b = \left(\frac{198}{74}\right)^{\frac{1}{4}} = 1.2789\dots = 1.279 \text{ 3dp (2marks)}$$

With value for b , $74 = a(1.2789\dots)^{10}$ (2)

$$\Rightarrow a = \frac{74}{(1.2789\dots)^{10}} = 6.318\dots = 6.3 \text{ 1dp (2marks)}$$

Using the model,

(c) find the predicted global yearly energy output from onshore wind farms in 2025. (2)

(b)(i) So, $E = 6.3(1.279)^t$

when $t=0$, $E = 6.3(1.279)^0 = 6.3$, so

a is the energy output in 1996 (1mark)

(b)(ii) when $t=1$, $E = 6.3 \times b$

when $t=2$, $E = 6.3 \times b \times b$, so

b is the factor by which the energy output increases each year (1mark)

(c) In 2025, $t = 2025 - 1996 = 29$

Model predicts $E = 6.3(1.279)^{29}$

$$= 7917.468\dots = 7917 \text{ GW 4sf (2marks)}$$