

Figure 4

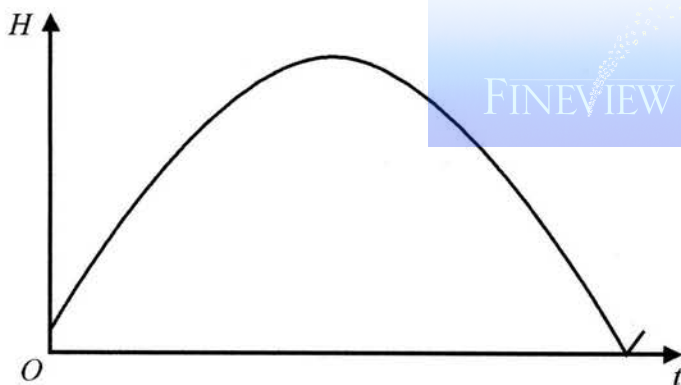


Figure 5

Figure 4 shows a sketch of a Ferris wheel.

The height above the ground, H m, of a passenger on the Ferris wheel, t seconds after the wheel starts turning, is modelled by the equation

$$H = |A \sin(bt + \alpha)|$$

where A , b and α are constants.

Figure 5 shows a sketch of the graph of H against t , for one revolution of the wheel.

Given that

- the maximum height of the passenger above the ground is 50 m
- the passenger is 1 m above the ground when the wheel starts turning
- the wheel takes 720 seconds to complete one revolution

(a) find a complete equation for the model, giving the exact value of A , the exact value of b and the value of α to 3 significant figures.

(b) Explain why an equation of the form $H = |A \sin(bt + \alpha)| + d$ where d is a positive constant, would be a more appropriate model. (4)

(b) H is the height of the passenger above ground, but the passenger never actually touches the ground. The car does not, either. (1 mark)

$$H = |A \sin(bt + \alpha)| + d$$

where d is a positive constant, would be a more appropriate model.

(1)

(a) maximum $|\sin| = 1$, so maximum $H = A(1) = A = 50$ (1 mark) (given)

$|\sin|$ goes from 0 back to 0 in 180° , so $720b = 180 = b = \frac{1}{4}$ (1 mark) (given)

$H = 1$ when $t = 0$, $1 = |50 \sin(0 + \alpha)| \Rightarrow \alpha = \sin^{-1}(\frac{1}{50}) = 1.1459... = 1.15$ 3sf (1 mark)

so,

$$H = |50 \sin(\frac{1}{4}t + 1.15)| \quad (1 \text{ mark})$$