

13. (a) Express $10 \cos \theta - 3 \sin \theta$ in the form $R \cos (\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90^\circ$.
Give the exact value of R and give the value of α , in degrees, to 2 decimal places.

(3)

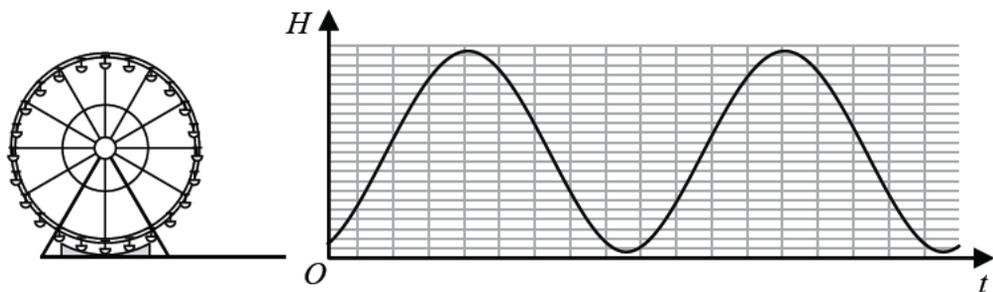


Figure 3

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

$$H = a - 10 \cos (80t)^\circ + 3 \sin (80t)^\circ$$

where a is a constant.

Figure 3 shows the graph of H against t for two complete cycles of the wheel.

Given that the initial height of the passenger above the ground is 1 metre,

- (b) (i) find a complete equation for the model,

(ii) hence find the maximum height of the passenger above the ground.

(2)

- (c) Find the time taken, to the nearest second, for the passenger to reach the maximum height on the second cycle.

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

(3)

It is decided that, to increase profits, the speed of the wheel is to be increased.

- (d) How would you adapt the equation of the model to reflect this increase in speed?

(1)