

6. (a) Express  $\sin x + 2 \cos x$  in the form  $R \sin(x + \alpha)$  where  $R$  and  $\alpha$  are constants,  $R > 0$  and  $0 < \alpha < \frac{\pi}{2}$

Give the exact value of  $R$  and give the value of  $\alpha$  in radians to 3 decimal places.

(3)

The temperature,  $\theta^\circ\text{C}$ , inside a room on a given day is modelled by the equation

$$\theta = 5 + \sin\left(\frac{\pi t}{12} - 3\right) + 2 \cos\left(\frac{\pi t}{12} - 3\right) \quad 0 \leq t < 24$$

where  $t$  is the number of hours after midnight.

Using the equation of the model and your answer to part (a),

- (b) deduce the maximum temperature of the room during this day,

(1)

- (c) find the time of day when the maximum temperature occurs, giving your answer to the nearest minute.

(3)