R cos(@+a)

Q1

$2 \cos x + 4 \sin x$ can be written in the form

$$R \cos (x - \alpha)$$

where α is acute and R is real.

(i) Find R and α. [4]

(ii) Hence solve the equation

$$2 \cos x + 4 \sin x = 3$$

where $0° \leqslant x \leqslant 360°$ [5]

Q2

(i) Write $3\cos\theta + 4\sin\theta$ in the form $r\cos(\theta - \alpha)$, where r is real and $0° \leqslant \alpha \leqslant 90°$ [4]

(ii) Hence solve the equation

$$3\cos\theta + 4\sin\theta = -2$$

for $0° \leqslant \theta \leqslant 360°$ [5]

Q3

(i) Write $4\cos\theta - \sin\theta$ in the form $r\cos(\theta + \alpha)$, where r is real and $0 \leqslant \alpha \leqslant \frac{\pi}{2}$ [4]

(ii) Hence solve the equation

$$4\cos\theta - \sin\theta = 2$$

for $0 \leqslant \theta \leqslant 2\pi$ [5]

Q4

(i) Express $\cos x + 2 \sin x$ in the form $r \cos(x - \alpha)$, where $r > 0$ and $0° \leqslant \alpha \leqslant 90°$ [4]

(ii) Hence, or otherwise, find the maximum value of

$$\cos x + 2 \sin x$$

and the smallest positive value of x, in degrees, for which it occurs. [3]

Q5

(i) Rewrite $(8 \sin\theta + 6 \cos\theta)$ in the form

$$R \sin(\theta + \alpha)$$

where R is an integer and $0 \leqslant \alpha \leqslant \frac{\pi}{2}$ [3]

(ii) Hence state the maximum and minimum values of

$$8 \sin\theta + 6 \cos\theta$$ [2]

(iii) A mass is suspended from the end of a spring, as shown in **Fig. 1** below.

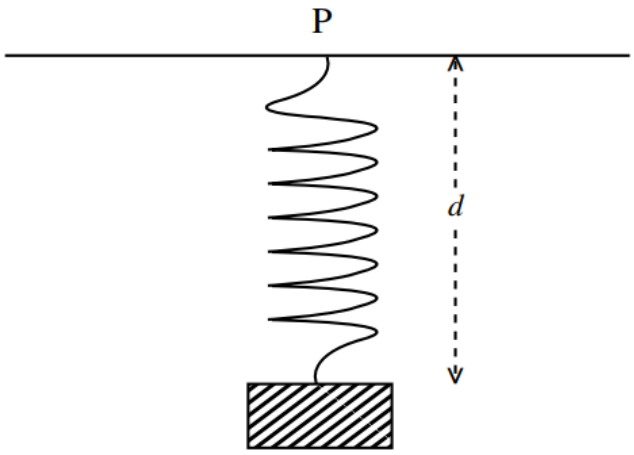

Fig. 1

The mass is oscillating.
After t seconds the distance d (cm) between the fixed point P and the mass is given by

$$d = 15 + 8 \sin 2t + 6 \cos 2t$$

Find the time at which the mass is first at its lowest point. [4]